



DATA & TECHNOLOGY DRIVEN TRAFFIC ASSET MANAGEMENT IN VIRGINIA

2023 VASITE Annual Meeting

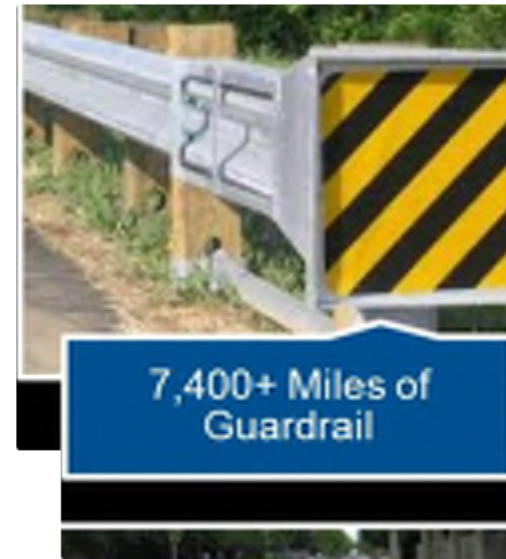
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VDOT Traffic Operations Division

June 15, 2023

Critical to the Safety and Operation of Highway System



Traffic Assets Uniqueness and Challenges

What is Unique About Traffic Operation Assets?

- Touch every one's life every day
- Dynamic, diverse, electrical-powered, technology-driven
- Diverse geographical locations

Challenges for Managing Traffic Assets

- Large quantities and relatively low unit value
- Not required in FHWA Transportation Asset Management Plan
- Significant efforts to keep inventory up to date due to large quantities
- No or limited information on inventory and condition for traffic assets

Challenge is a Catalyst for Innovation

ADA Challenge in 2014:

- 80,000 curb ramps and 4,100 miles of sidewalks
- DOJ mandate on improvements in alteration projects
- **No inventory and condition**
- ADA Transition Plan past due
- High litigation risk
- Quality of life for vulnerable users

How Would You Bring VDOT to Compliance?

Guardrail Challenge in 2016:

- 7,400 miles of rail, 150k terminals
- **No inventory and condition**
- New MASH design standard
- High Congressional, public & media interest in outcome
- High litigation risk
- Keep Virginians safe
- Limited funding for GR improvement

How Would You Improve Management of the Asset?

Traffic Asset Program Innovations

Virtual Inventory and Condition Collection

System-wide high-definition imagery from pavement assessments



Guardrail field identification manual to guide product identification



GIS tool to integration location and product information

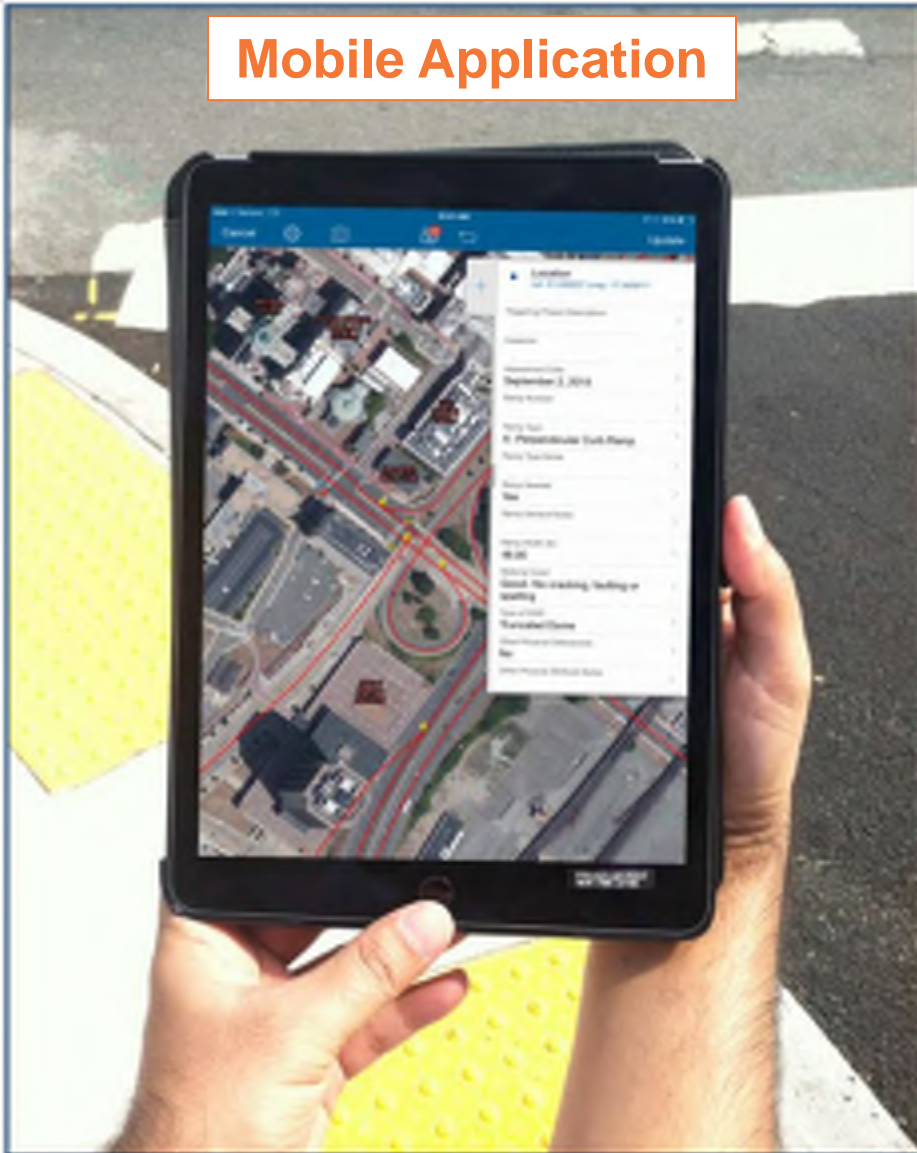


- Boots-on-the-ground data collection takes years and millions of dollars
- Virtual collection takes a few months and a small fraction of the cost



New ADA Curb Ramp Program Innovations

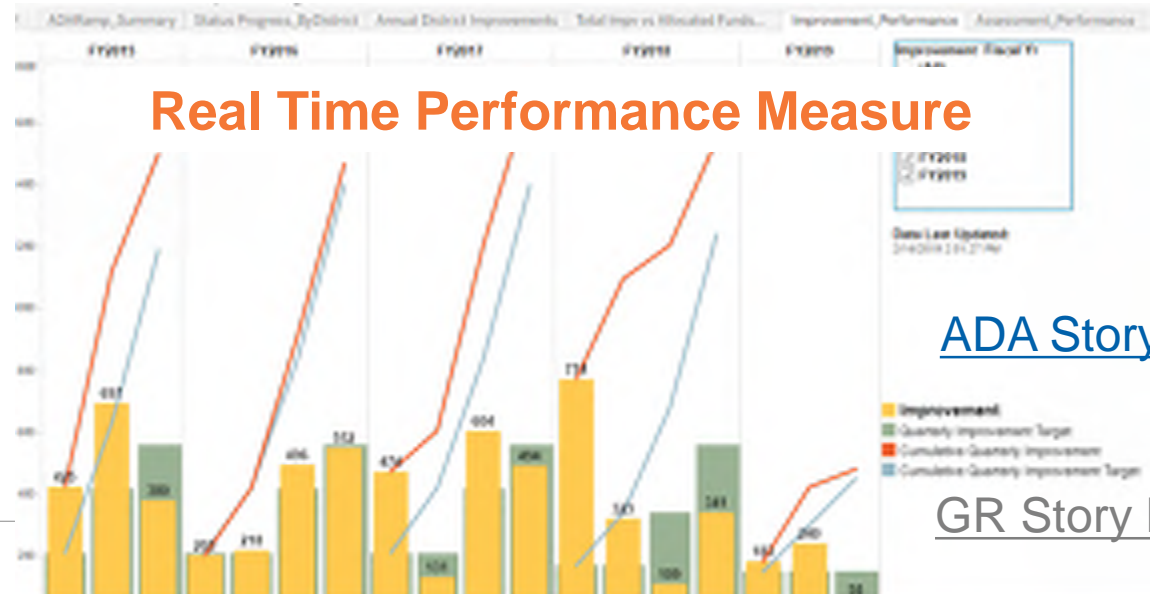
Mobile Application



ArcGIS Online Applications



Real Time Performance Measure



[ADA Story Map](#)

[GR Story Map](#)

ADA Curb Ramp Program Progress

BEFORE

	With Traditional Method
Improvement	Sporadic through isolated projects
Performance & Tracking	No tracking to prove compliance
Inventory & Condition	No inventory and condition of Barriers
Information Sharing	No Improvement information shared to general public
Efficiency & Oversight	Manual, inaccurate, and inconsistent reporting with very limited oversights
Litigation Risk	High Risk- not demonstrating commitment to ADA/DOJ requirements

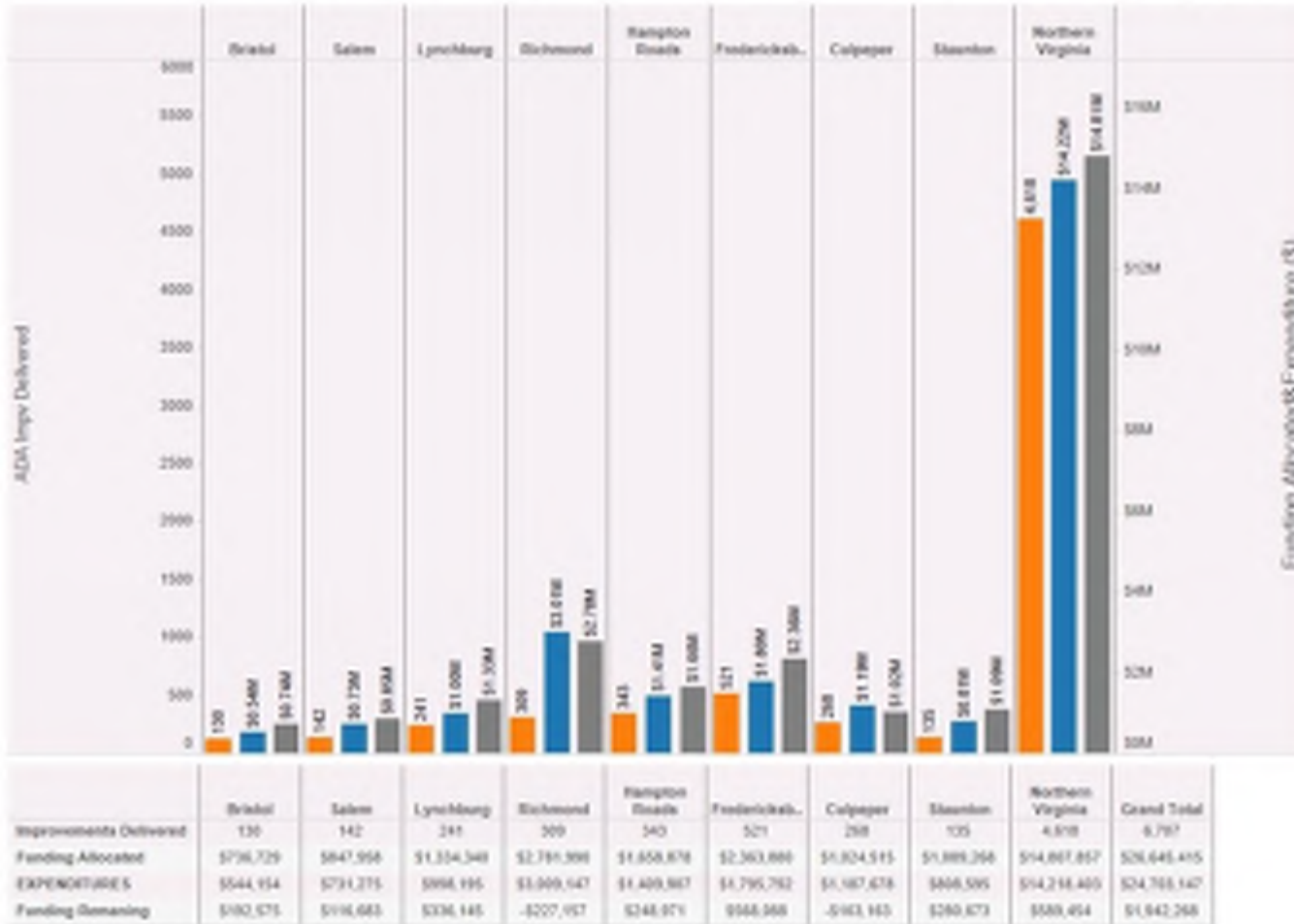


AFTER

	With Innovation & Technology
	Systematic with dedicated funding
	Real time tracking with performance measure, starting from CR SharePoint DB
	Complete statewide Inventory of Barriers map in the cloud
	Proactive public outreach and stakeholder engagements
	Real Time Mobile & Cloud ; 50%+ staff hours reduction; Enhanced program quality and oversight; QAQC
	Low Risk- Solid program in place to ensure compliance

Enhanced Program Management Through Data & Technology

FY 2015-FY2019 ADA Cumulative Improvements vs. Allocated Funding & Expenditure



- **Efficiency Improvement**
 - One cloud based statewide inventory
 - Reduced 5 FTE staff to 2 (NOVA)
- **Enhanced Oversight on Program schedule, cost and quality**
 - When and where money was spent
 - Before & After Photographs
 - Real Time Monitoring
 - Identify issues early and intervention
 - Effective Planning

Program Mission

To Support the Asset Management and Field Project Delivery of the Department's Various Traffic Assets through

- Financial Needs Assessment
- Policy and Technical Guidance
- Process Improvement and Technology Solution and
- Data Driven Decision Making

Major Program Areas



American Disabilities Act (ADA) Compliance



Strategic Guardrail Management



Highway Maintenance Management System (HMMS) – Traffic Asset



Traffic Needs Based Budgeting (NBB)



Data Analytics for Asset Management



Asset Technical Guidance & Project Delivery Support

Program Background

New Limited Scope GR Terminal Maintenance Inspection Program



- Roadway Departure (RD) Crashes cause over half of traffic deaths in Virginia
- Guardrails are a critical roadside safety asset to reduce the severity of RD crashes when designed and installed correctly.
- Research shows GR could reduce about 50% of RD crash fatalities and severe injuries on freeways.
- GR is itself a hazard. When incorrectly installed, deteriorated, or damaged, GR may become a more severe hazard.
- Effective management of GR inspection, repair, replacement, and upgrade is critical to the safety of the traveling public.

New Limited Scope Guardrail Terminal Maintenance Inspection Program

Objective

Implement a limited scope, maintenance inspection program, providing "boots-on-the-ground" inventory and condition assessment for existing guardrail terminals.

What is a Limited Scope Maintenance Inspection?

A focused assessment of existing guardrail terminals (excludes rail assessment) to identify key known maintenance issues.

- NOT an acceptance inspection for new or replacement guardrail terminal installations
- NOT expected to identify ALL issues of GR terminals given the time constraint
- Majority of inspections will NOT need maintenance of traffic

Targeted Issues

- Rusted terminals
- Mix and match hardware
- ET-Plus 4" vs. 5" verification
- Obvious damage, loose bolts or cables, other known issues

Challenges of Guardrail Maintenance Inspection

- **Over 30 GR Terminal Types and Standards**
 - Each with its own unique design and components
 - Significant field experience required to identify manufacture type and model
- **Lack of Industry Technical Guidance**
 - Previously no business need to identify detailed GR terminal manufacture and type
 - No VDOT or national standards for maintenance inspection or identify GR terminal type
- **Safety and Access**
 - Dangerous to inspect existing GR with traffic exposure at every location
 - Difficult to access some GR locations with limited shoulder and right of way
- **Limited Pool of Qualified Inspectors**
 - GRIT certification does not cover terminal identification and maintenance inspection
 - Dedicated GR maintenance inspection training and certification needed

Over 30 Guardrail Terminal Types Currently in Service

Steel Tube on top

Road Systems SKT350

ALL have Square Impact Heads

Trinity ET2000

Road Systems FLEAT SP

Ground Strut

Identifying Terminal Type and Manufacturer Using

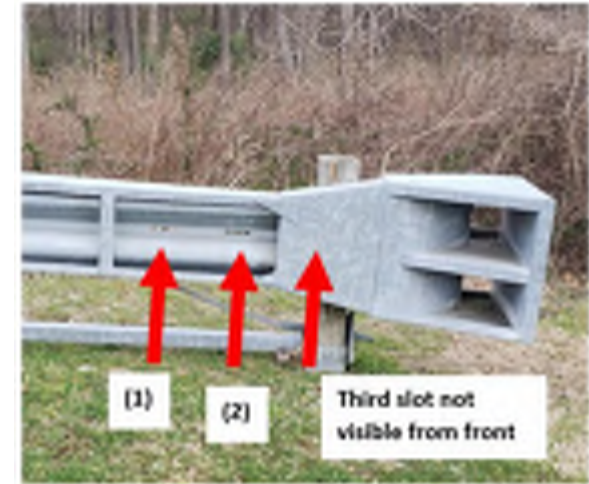
- **VDOT Field ID Manual**
- **VDOT Terminal Pocket Guide**

[Traffic Asset Program - Home \(sharepoint.com\)](https://sharepoint.com)

Tapers at the top

Improper "Mix and Match" Components

SKT350 Impact Head used with SRT350 Rail Panel



Three (3) short slots seen on Road Systems SKT-350 GR-9 Terminal (front)



Six (6) long slots seen on Trinity SRT-350 GR-7 Terminal

[Traffic Asset Program - Home \(sharepoint.com\)](https://sharepoint.com)

Tools: Limited Scope Guardrail Terminal Maintenance Inspection Pocket Guide ^{NEW!}

- **Quick Reference Guide**
 - **Data collection < 15 minutes per terminal site**
 - **Worker Safety overview**
 - **Terminal Identification summary**
 - **17-point, step by step inspection summary**



INSPECTION CHECKLIST

The inspector shall observe the following items as detailed on the following pages:

- 1. Identification
- 2. Reflective sheeting
- 3. Damage
- 4. Is the guardrail needed?
- 5. Photos
- 6. Ground strut
- 7. Height
- 8. Rail slots
- 9. Posts
- 10. Corrosion (rust)
- 11. Cable tension
- 12. Cable anchor connections
- 13. Cable bearing plate
- 14. Post #1 attachment
- 15. Impact head rail insertion
- 16. Impact attenuator size
- 17. General notes

Tools: Guardrail Hardware Field Identification Manual (2018), updated May 2023

Distinguishing Characteristics	Product Description Detailed Image
<ul style="list-style-type: none"> Visually similar SKT-350 and SKT-SP Products Front of feeder chute is enclosed with "SKT" lettering cutout (unlike other SKT products) See through hollows in extruder head Has ground strut (like SKT-350, unlike SKT-SP) Extruder head flat on top and with feeder chute 	
Use <ul style="list-style-type: none"> MGS-2 Installation – Run-On W-Beare Terminal 	<p>MSKT - Front View</p>
<p>MSKT - Shoulder Side View</p>	<p>MSKT - Traffic Side Front View</p>



Guardrail Hardware Field Identification Manual Version 1.4

May 2023



Virginia Department of Transportation
Traffic Operations Division

ATSSA Guardrail Identification & Repair Guidelines (2022)

AMERICAN TRAFFIC SAFETY SERVICES ASSOCIATION

W-Beam Guardrail Identification & Repair Guidelines

2022 EDITION



END TREATMENTS NCHRP 350 TESTED

SKT

Manufacturer: Road Systems, Inc.
Manufacturer Website:
www.roadsystems.com

Description: The SKT-SP is a tangent terminal that meets NCHRP 350 standards. It was available at 28" and 31" (MGS) rail heights. The SKT was available in a steel post or wood post system.

Identification: The SKT is 50' long and has 8 posts.

Operation: During design condition head-on impacts, the SKT impact head slides over the W-beam guardrail. The rail is sequentially kinked or bent as it moves through the head. The kinked guardrail exits the head and the vehicle is brought to a controlled stop. When impacted along the side within the length-of-head, the SKT functions like guardrail. The errant vehicle is redirected back toward its original travel path.

Testing: TL-2 and TL-3. Tested to NCHRP 350 TL-3 at 62 mph (100 km/hr). The TL-2 system was tested at 44 mph (70 km/hr).



ET Plus

Manufacturer: Trinity Highway
Manufacturer Website:
www.trinityhighway.com

Description: The ET Plus System is a cable anchored, energy absorbing guardrail end treatment that may be used on the termination of W-beam barriers on the shoulder of a roadway. The ET Plus was available in a steel post or wood post system. Note the ET Plus was discontinued in the USA as of November 23, 2021.

Identification: Rectangular Strike Plate (2' 4" x 1' 3")

Operation: The end treatment cap absorbs the impact of a crash. The wooden posts fracture or the steel posts yield, and the guardrail is extruded out the non-traffic side of the unit in a ribbon as the impact head slides over the rail.

Testing: TL-2 and TL-3. Tested to NCHRP 350 TL-3 at 62 mph (100 km/hr). The TL-2 system was tested at 44 mph (70 km/hr).



END TREATMENTS - MASH TESTED

MSKT

Manufacturer: Road Systems, Inc.
Manufacturer Website:
www.roadsystems.com

Description: The MSKT was designed to meet MASH 2016 standards. It is only available for 31" rail height. There is a wood post option for post #3 and beyond. MSKT (MASH-Compliant Sequential Kinking Terminal) is an energy absorbing terminal using many of the same NCHRP 350 SKT components.

Identification: Large impact head with SKT letters cut out.

Operation: During design condition head-on impacts, the MSKT head slides over the W-beam guardrail. The rail is sequentially kinked as it moves through the impact head. The kinked guardrail exits the head and the vehicle is brought to a controlled stop.

Testing: MASH TL-3 and MASH TL-2. Tested to MASH TL-3 at 62 mph (100 km/hr). The TL-2 system was tested at 44 mph (70 km/hr).



SoftStop

Manufacturer: Trinity Highway
Manufacturer Website:
www.trinityhighway.com

Description: The SoftStop System is a tangent, single-sided, energy absorbing, red-nerve and galing end treatment. Installation height of 31"

Identification: Impact head with an upstream facing chute and utilizes the anchor guardrail to attach to an upstream anchor post providing tension.

Operation: During head-on impacts within MASH criteria, the SoftStop System is designed to dissipate energy by the head traveling down the anchored W-beam panels. During length of head side impacts within MASH criteria, the SoftStop System is designed to contain and redirect the impacting vehicle.

Testing: The SoftStop System is tested to MASH 2016 Test Level 3 criteria and may be used in Test Level 1, Test Level 2, and Test Level 3 applications. Tested to MASH TL-3 at 62 mph (100 km/hr). The TL-2 system was tested at 44 mph (70 km/hr) and has a length of 38' 3 1/2". TL-3 has a length of 50' 8 1/2".



Guardrail Maintenance Inspection Worker Safety Guidance

- Safety is the **top priority**
- Guidance summarizes best practices in support of Limited Scope Guardrail Terminal Maintenance Inspection program
- Does **not** replace or supersede the Virginia Work Area Protection Manual



New Inspection Program Messages

- **Business need to conduct boots-on-the-ground maintenance inspection of statewide GR terminals in the next new years**
- **Limited number of qualified GR terminal inspectors**
- **New Program Inspector Training Requirements:**
 - **Limited Scope GR Terminal Maintenance Inspection Training (Required)**
 - Multiple training workshops will be held in the next few months with some offered to consultant community
 - **Basic Work Zone Safety Training Certification (Required)**
 - **Guardrail Installer Training (GRIT) (Preferred)**

A BIG THANK YOU for our team and consultant partners!

- **Traffic Asset Team**
 - [Ning Li, PhD, PTOE, PMP](#)
 - [Matt Barret](#)
 - [Jihong Cao, PE](#)
 - [Mia Li, PE](#)
- **Consultant Partners**
 - [Timmons Group](#)
 - [Spy Pond Partners](#)
 - [VHB and subs](#)
 - [JMT](#)

Thank you!
Questions?

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