MEETING NOTES: ***CTB Innovation Subcommittee***

DATE: Tuesday, July 16, 2024

TIME: 9:00 AM

The meeting of the Commonwealth Transportation Board (CTB) Innovation Subcommittee was held at the Virginia Department of Transportation Central Office Old Highway Building Computer Lab, 1221 East Broad Street, Richmond, VA 23219. The meeting was called to order at 9:00 a.m.

Approval of September 2023 minutes – *The minutes from the September meeting were approved without comment.*

ITTF Program Update – Paul Szatkowski, Traffic Operations Division, provided an overview of the ITTF program, focusing on projects added in 2024 as part of the SYIP. Mr. Kasprowicz requested that we return to presenting the proposed projects to the committee prior to adoption of the SYIP. Comments were also made regarding the continued investment of ITTF funds for fiber to support the technology components of the Operations Program. The members present requested more input on project selection going forward. The presentation included for reference.

I-95 Variable Speed Limit Evaluation Update – Michael Fontaine, Associate Director, Virginia Transportation Research Council provided an update on the evaluation of the VSL system installed on I-95 NB in the Fredericksburg area. Committee members asked about additional deployments. A network screening is ongoing to identify sites where a similar system would be beneficial. Alternative, less expensive approaches (e.g. queue warning) are also being evaluated. The presentation is included for reference.

VDOT and VTTI Work Zone Safety and Automation Research – Mike Mollenhauer, Virginia Tech Transportation Institute provided and overview of the research that VTTI and VDOT are collaborating on to improve work zone safety. The presentation is included for reference.

Starlink Pilot Update – Hari Sripathi, Office of Strategic Innovation. Due to time constraints, this presentation was postponed until a later date.

ADJOURNMENT: The meeting adjourned at 10:25 a.m.

DRAFT


VDOT
Virginia Department of Transportation

ITTF PROGRAM UPDATE

July 2024 Innovation Subcommittee Briefing

Paul Szatkowski

July 16, 2024

Agenda

- 2023 Report
- 2024 New Projects
- 2025 Program Changes

Innovation & Technology Transportation Fund

Funds pilot programs and fully developed high-tech infrastructure improvements with a focus on:

1. Reducing congestion
2. Improving mobility
3. Improving safety
4. Providing up-to-date travel data
5. Improving emergency response

ITTF 2023 Reporting – General Assembly Report



Posted at https://rga.lis.virginia.gov

I-95 Variable Speed Limit (VSL) System

ITTF PURPOSES

Project Purpose

VDOT has installed variable speed limits on the I-95 northbound corridor between mile markers 115 and 130 in Caroline and Spotsylvania counties. This is to address crashes caused by unexpected speed differentials when encountering congestion or lane impacting events. LED signs displaying variable speed limits between 35 mph and 65-70 mph, along with dynamic message boards, provide real-time information to drivers. The speed limits are reduced only when necessary based on traffic speed and volume data collected by vehicle detectors. Enforcement authorities have access to real-time changes in the posted speed limits.

Description (ITTF Funded Portion for I-95 VSL)

- Develop the algorithms for the I-95 Variable Speed Limit technology.
- From 115 to 130 (15 miles), VSL is located on I-95 NB. It includes:
  - Algorithm Enhancements for Work Zones
  - Automated Detector Monitoring and Alerts
  - Active System Management
  - System Evaluation Support

Description (Other Funding Sources for I-95 VSL)

- System integration
- I-95 VSL Infrastructure (detectors, signs, cameras)

Overview

Location	I-95 in Spotsylvania County/City of Fredericksburg
VDOT District	Fredericksburg
Route	I-95
City/County	Fredericksburg, Spotsylvania, Caroline
Category	Advanced Roadway Technology
Project Cost	$2,404,000 (ITTF Funding for the I-95 VSL Algorithm)
2023 Milestones	Construction complete. System operational, June 2022. Evaluations completed, 2023.

Roadway Characteristics

Metric	2021 Pre-Implementation	2023 Post-Implementation
Annual Vehicle Hours of Delay	775K	764K
Annual Vehicle Hours Cost of Delay	$29.9M	$29.5M
All Crashes	291	286
Fatal+Injury Crashes	67	58
Daily Traffic Volumes	47K – 57K (2021)	49K – 57K (2022) 2023 data not available
Weekend Days with Speeds Below 20 MPH	63	51

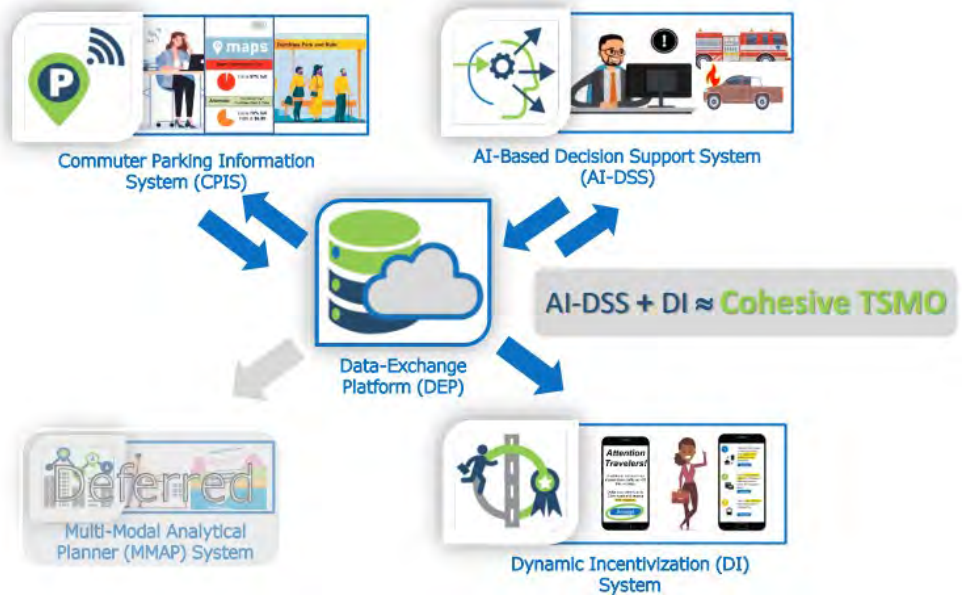
Benefits

Focus	Metrics	Results
Safety	Reduction in crashes	Fatal + Injury Crashes: 13.6% Reduction Rear-End Crashes: 10.7% Reduction Sideswipe Crashes: 2.7% Reduction
Mobility	Travel Time Index	Sunday travel times declined by 8.2% and reliability improved by 14.4%
Congestion	Vehicle Hours of Delay (VHD)	Continuing evaluation

ITTF 2023 Reporting Examples

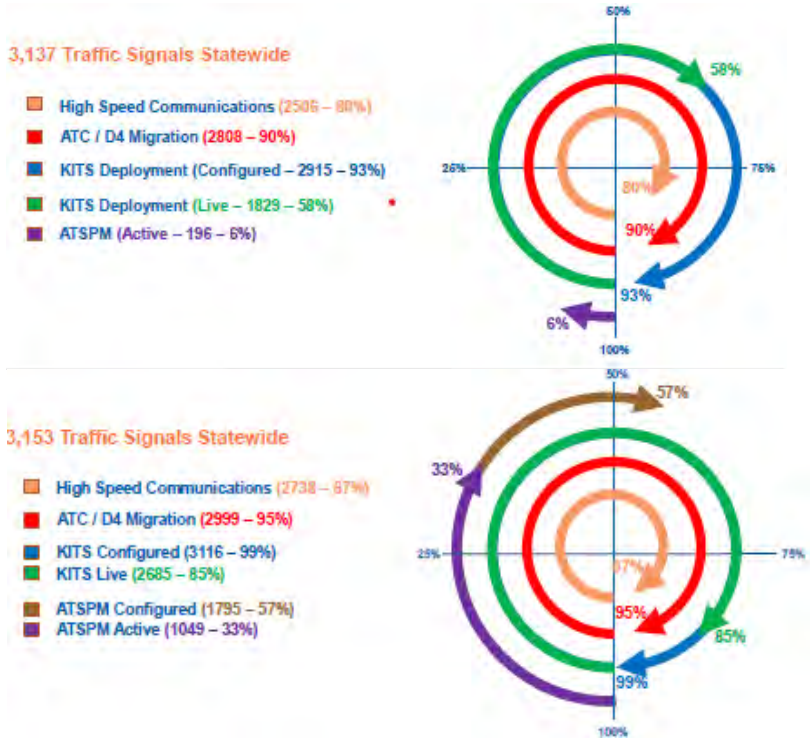
RM3P Data Exchange Platform

(completed)



Advancing Automated Traffic Signal Performance Measures - ATSPM

(8 completed projects to advance the effort)



ITTF 2024 New Projects

Eighteen new projects have been included in the SYP**.** These projects include a focus on:

- Advanced Tunnel Operations tools to improve mobility and safety
- Traffic Operations systems advancement including Integrated Corridor Management & ATSPM to reduce congestion and improve safety
- Advanced Technology/Strategy Development for real time data collection and monitoring

ITTF 2024 New Projects

#	District	UPC	Description	Location	Total Cost
1	Bristol	126100	Tunnel Work Zone/ Automated Lane Closure Technology	Big Walker Mtn Tunnel	$2,250,000
2	Bristol	125207	Traffic Queue Detection w/ Automated Messaging	I-77, I-81	$1,700,000
3	Bristol	125208	Tunnel Thermal Detection (Cameras & Sensors)	Big Walker Mtn Tunnel	$875,000
4	Bristol	125206	Tunnel Hazmat Placard Readers	Big Walker Mtn Tunnel	$875,000
5	CO-TMPD	T29378	Sidewalk & Crosswalk Management Tool	Statewide	$350,000
6	CO-TOD	T29376	Transportation Technology Fiber Communication **(17 Breakout Projects)**	Statewide	$25,000,000
7	CO-TOD	T29379	Signal Controllers & CPU Enhancements for ATSPM advancement	Northern Virginia	$2,000,000
8	Culpeper	125829	ATSPM projects with LIDAR detection/data collection	Culpeper: US 29, US 250, VA 3 (~9 locations)	$873,000
9	Staunton/ Salem/Bristol	125726	I-81 Advanced Monitoring Display Tool	Staunton & Salem Traffic Operation Centers	$1,000,000
10	Hampton Rds	125029	Hampton Roads Signal Preemption for Emergency Response	Districtwide (9 total)	$175,000
11	Hampton Rds	125032	Crash Notification System (advanced portable camera trailers) @ work zones & tunnels	Districtwide	$500,000

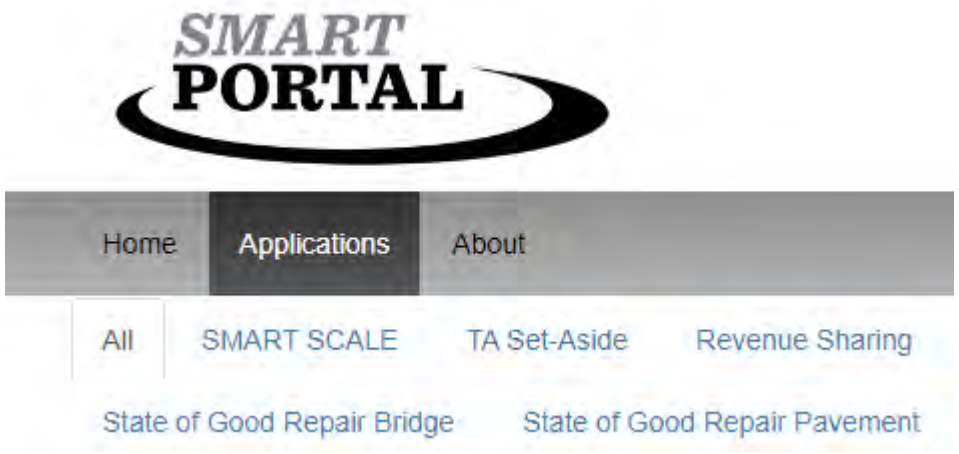
ITTF 2024 New Projects

#	District	UPC	Description	Location	Total Cost
12	Hampton Rds	125031	Hampton Roads District Annex – Communication Connectivity to access traffic signal and the ATMS network.	Suffolk: Portsmouth Bvld, Nansemond Pwky	$420,000
13	Hampton Rds	125048	Integrated Corridor Management (traffic routing between MMMBT and the James River Bridge)	Newport News, Suffolk, Isle of Wight	$4,840,000
14	Lynchburg	126015	High Speed Communications for Traffic Signals	11 locations	$1,400,000
15	Lynchburg	126014	ATSPM Upgrades & Corridor Retiming Enhancements	US 221, 460, 501, 29 ~20 potential locations	$1,070,000
16	Richmond	125376	Ramp Preemption System (prevent backup on main line routes)	15 potential locations	$750,000
17	Richmond	125374	Red Light Extend on High Speed/Volume Truck Routes	50+ potential locations	$500,000
18	Salem	T29336	Portable ITS Cameras for Incident Monitoring	Districtwide	$100,000
Total:					**$44,678,000**

ITTF 2025 Program Changes

Accept Applications via the **Smart Portal**

(Tentative Open Date = October 2024)





VTRC

Virginia Transportation
Research Council

VDOT

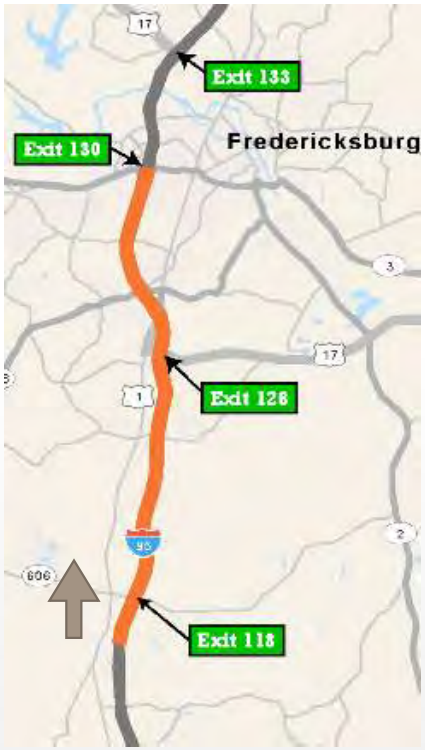
I-95 Fredericksburg Variable Speed Limit Evaluation

Michael D. Fontaine, P.E., Ph.D.
Associate Director
Virginia Transportation Research Council

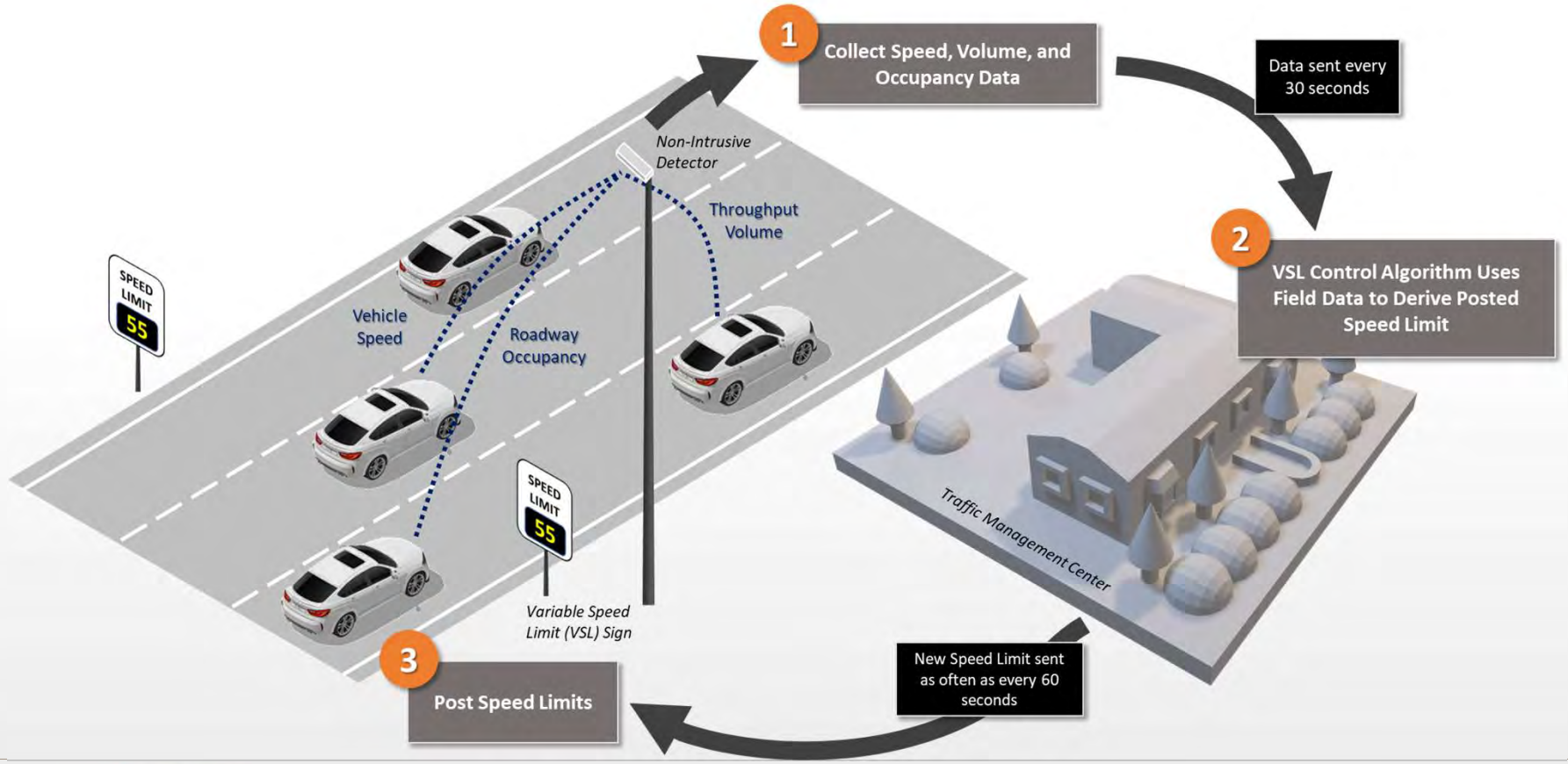
July 16, 2024

Project Background

- I-95 NB between MP 115-130, south of Fredericksburg experiences significant recurring and non-recurring congestion, especially in the summer.
- Speed variations are present, along with higher crash rates
- In June 2022, VDOT activated an ITTF funded VSL system on the corridor with a goal of improving traffic flow and safety.
- Results from initial 3 months of deployment were presented to the CTB in October 2022



How the System Works



Field Imagery



Corridor Video



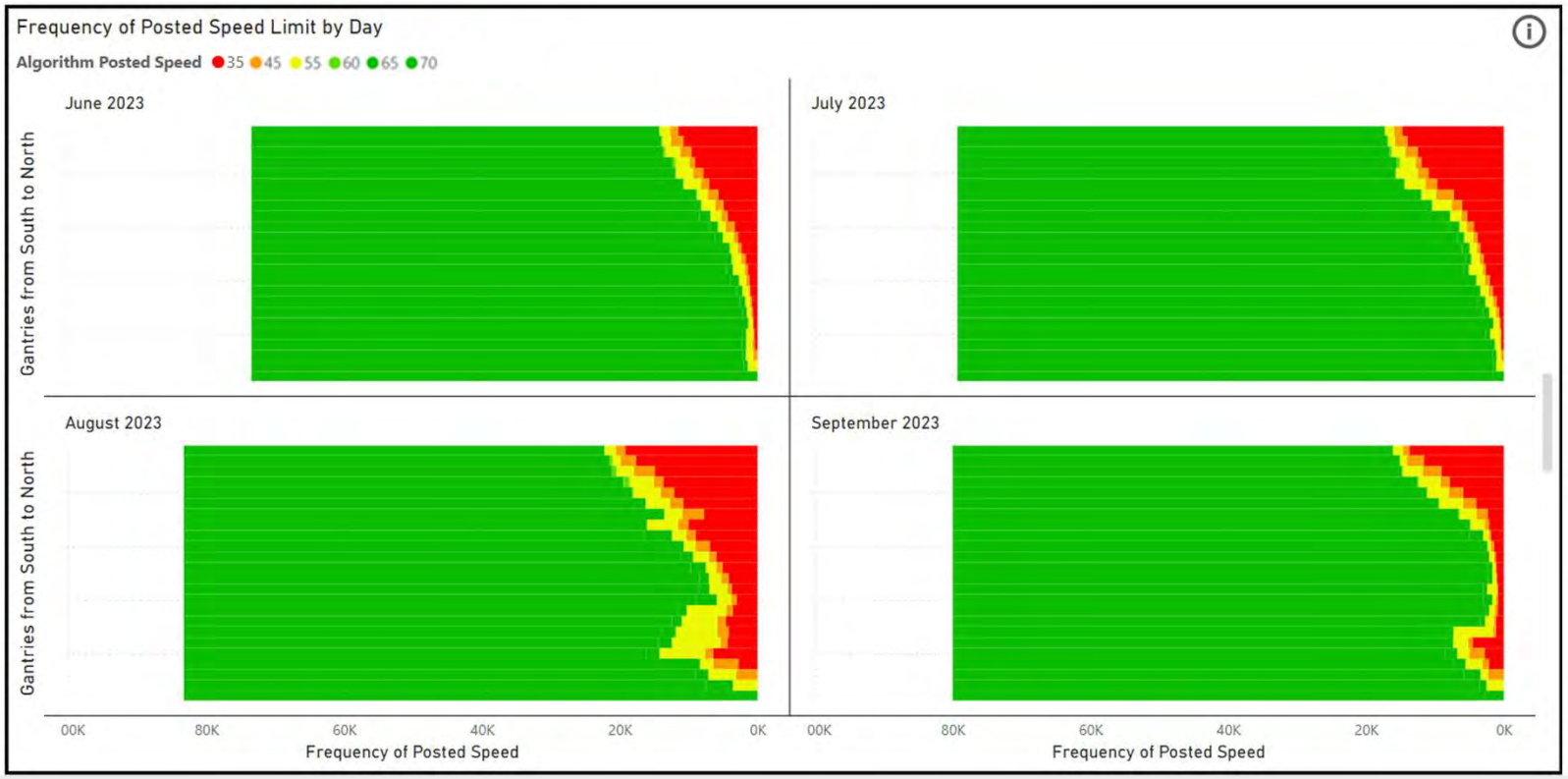
System Utilization (June 2022-June 2024)

- **Reduced speeds were posted most often:**
  - In the spring and summer
  - On Friday, Saturday, and Sunday
  - Between 11 AM and 8 PM

Day of Week	System Activation
Sunday	17%
Monday	5%
Tuesday	3%
Wednesday	4%
Thursday	5%
Friday	9%
Saturday	9%



Patterns of VSL Postings (Summer 2023)



Direction of Traffic

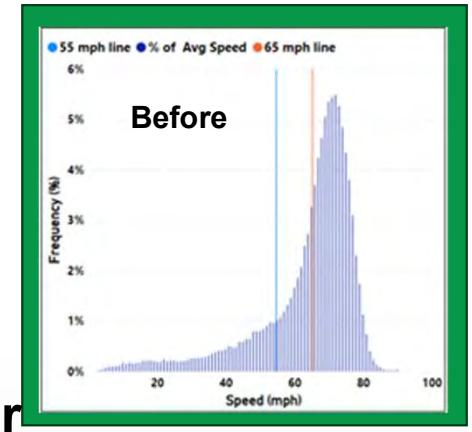
System Evaluation - Driver Behavior

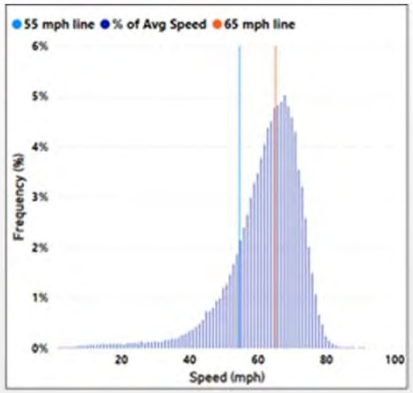
- Speeds remained the same during free flow and congestion
- Improved uniformity during transitional flow (45-60 mph) with 1.5-4 mph speed reductions

Posted Speed	Mean Speed (mph)		% > 5 mph Over Limit		% > 10 mph Over Limit	
	Before	After	Before	After	Before	After
65,70	72.2	71.6	28.7	26.3	4.8	4.4
60	64.3	62.6	52.5	39.0	24.6	11.2
55	64.0	62.3	74.5	68.0	62.1	47.2
45	53.8	50.0	61.3	56.4	53.4	46.0
35	28.0	28.6	20.7	23.1	13.9	12.6

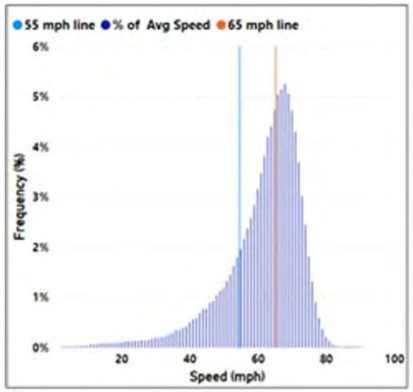
Speed Distributions - 55 MPH

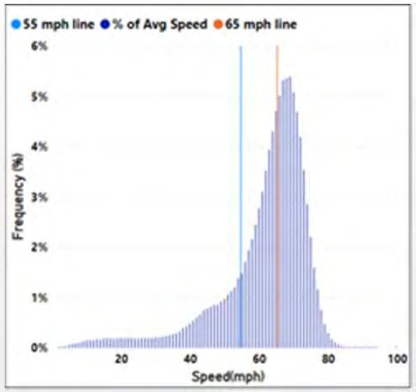
Winter



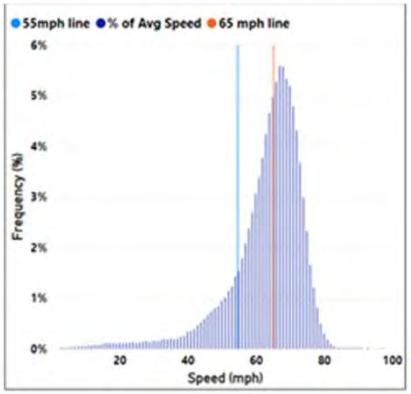


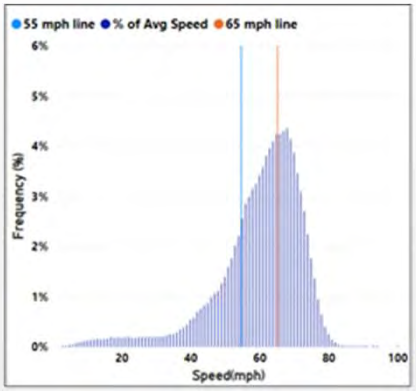
Summer





Fall

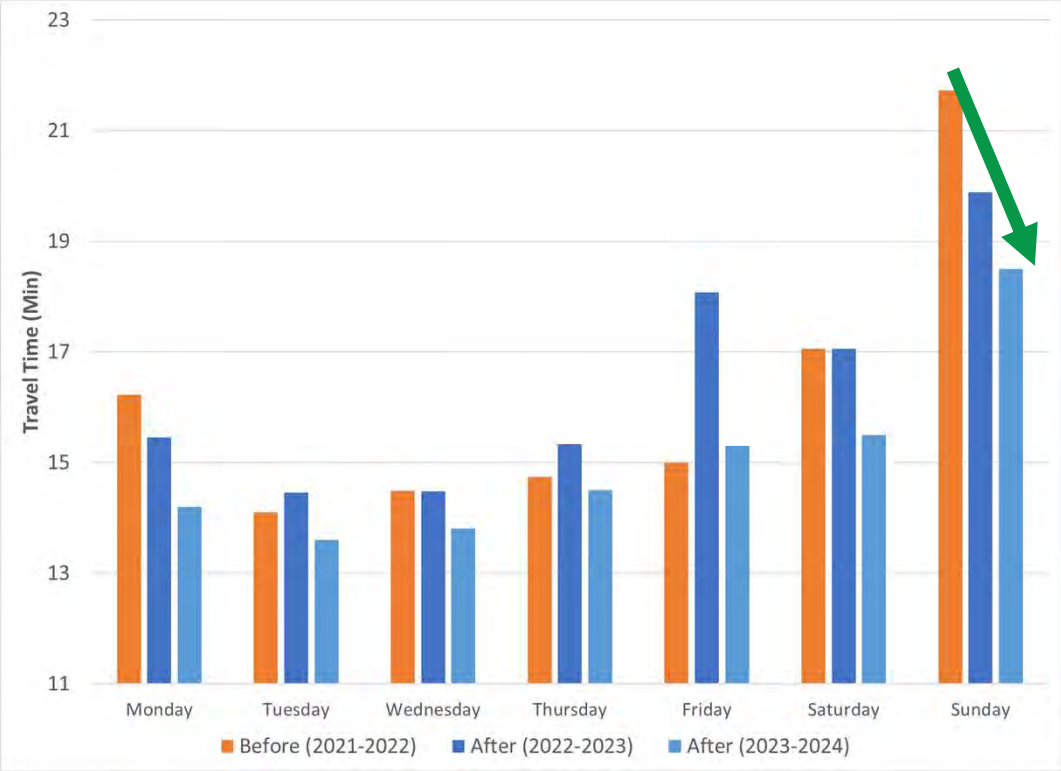




2022

2023

Travel Time
(Year over year comparison, 6 AM-8 PM)



- **June 2023 – June 2024 average travel times are down from the year prior to VSL activation for all days except Friday.**
  - Average reduction of 6.3%
  - Sundays down 14.8%
- **Reliability has also improved for all days except Friday**
  - Average improvement of 17.5%

System Evaluation – Safety

- **Crashes were compared between milepost 115 and 130 from system activation using 1 year before/after data**
  - Trends at comparison sites were also examined.
- **Crashes are rare and random events. Trends from 1 year of VSL activation data are a small sample and should be viewed with caution.**

During the same period, similar sections of I-95 experienced a 20% increase in crashes and a 41% increase in fatal/injury crashes.

Measure	6/22/22-6/21/23 Crashes	Change from 1 Year Before
All Crashes	286	-2%
Fatal/Injury Crashes	57	-14%
Rear Ends	159	-11%
Sideswipe – Same Direction	36	-3%

Summary

- Activations of reduced speed limits (less than 65 mph) are most highly concentrated in northern sections of the corridor on summer weekends.
- The VSL system was able to produce reductions in mean speeds when transitional speed limits (45 or 55 mph) were posted.
- Following VSL activation travel times and reliability generally improved from the year prior to activation, especially on Sundays.
- Safety data from the first year after VSL deployment shows positive initial results, however more data needs to accumulate before firm safety conclusions can be made.

Next Steps

- **Continue to monitor and evaluate the VSL system.**

- **Currently exploring opportunities to enhance effectiveness of VSL system through an ITTF project that will leverage connected vehicle technology.**

Smart Work Zone Safety Initiatives

Mike Mollenhauer

Director, Division of Technology Implementation

7/16/2024



VIRGINIA TECH TRANSPORTATION INSTITUTE
VIRGINIA TECH

Partnering for Work Zone Safety

- VTTI and VDOT have been working together to improve work zone safety for over 15 years
- Initial motivations in connected and automated vehicle support
- Practical safety solutions are needed
- Easy to use tools are needed to create accurate work zone data to distribute to 3rd parties
- New commercial products are often siloed and typically not part of an integrated system



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SMART WORK ZONE

INTEGRATED COMPONENTS

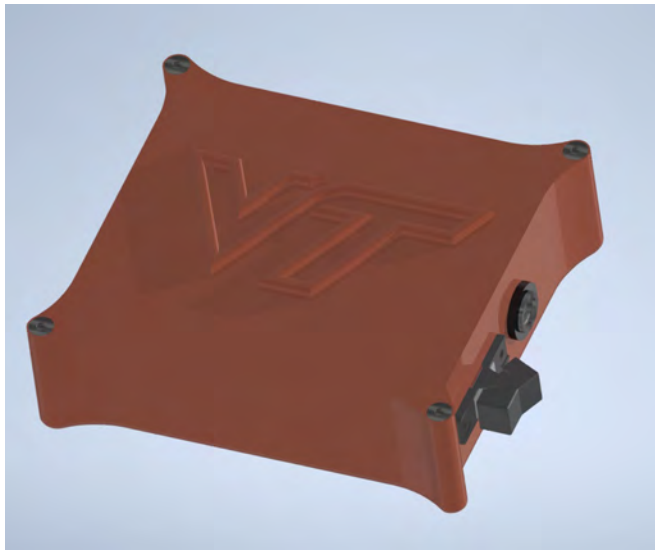
- Smart Work Zone Field System
  - Smart Vest
  - Smart Helmet
  - Equipment Unit
  - Base Station and Traffic Evaluation System
- Work Zone Builder Application
- Automated Truck Mounted Attenuator (ATMA)

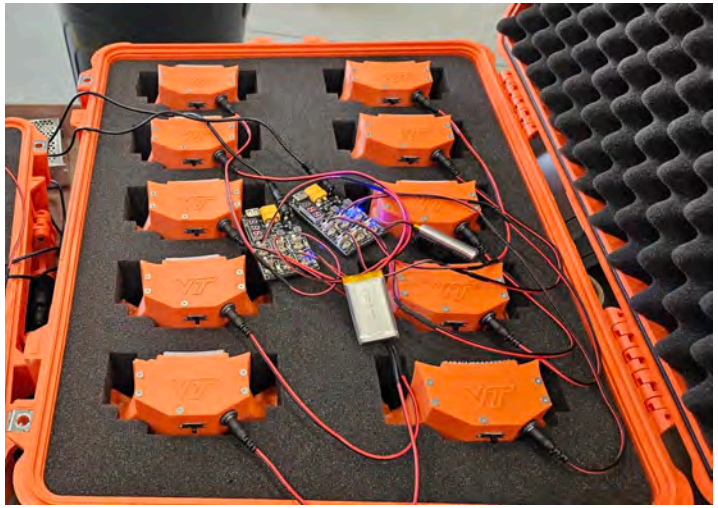


Smart Helmet / Vest

- Wearable system that integrates with Kask helmet accessory mounts
- Does not interfere with other accessories
- Wireless mesh network integrates to base station
- GPS+RTK module
- Redundant modes of warning
  - Vibrating motors
  - Chirping buzzer
  - LED halo illumination over visor
- 6 oz, 20 hours battery life











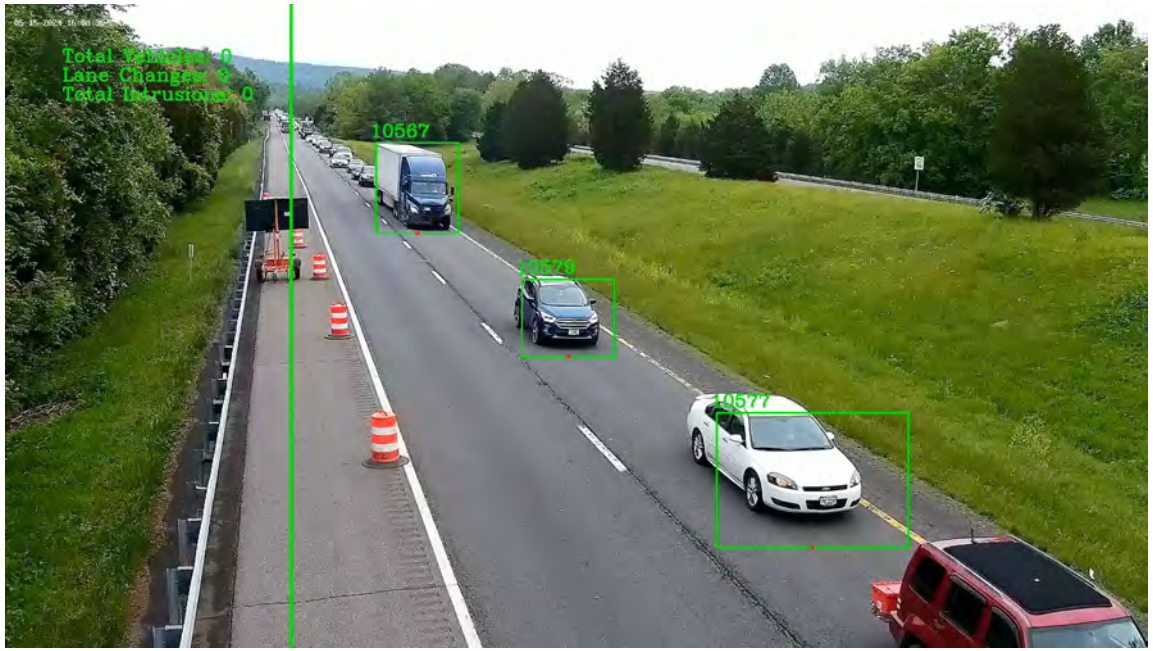
Equipment Unit

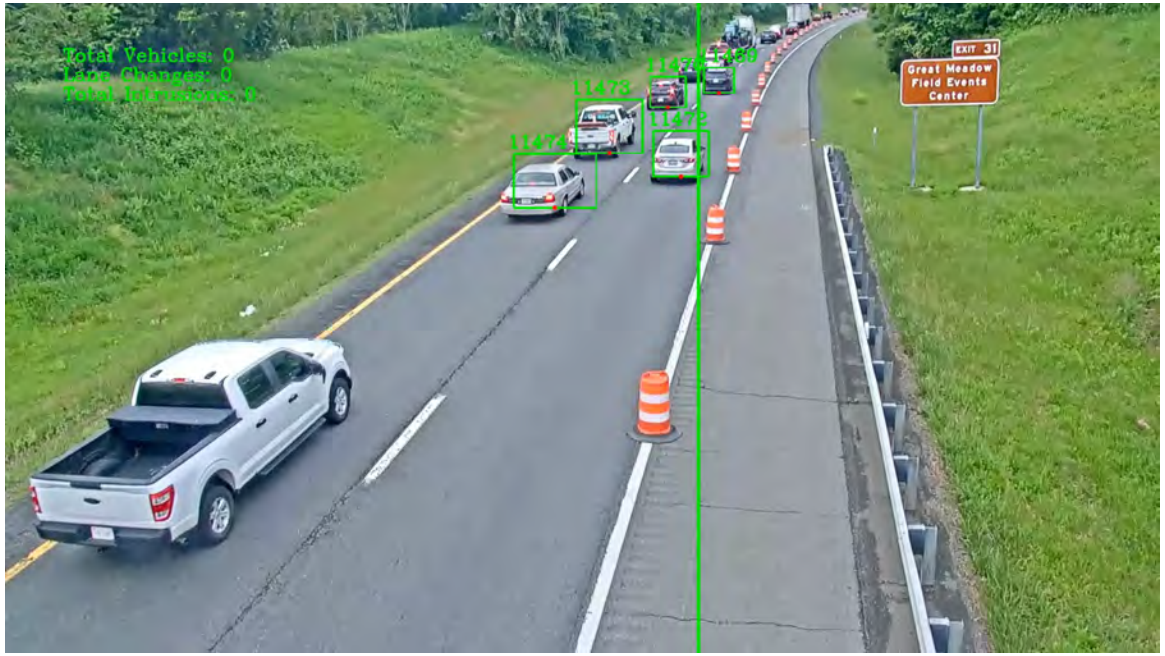
- Magnetic base attaches quickly to equipment
- Wireless mesh network integrates with base station
- GPS+RTK module
- Inertial measurement unit
- Provides warnings to workers when they are close and equipment starts moving

Traffic Evaluation System

- Developed a machine-vision based system that can be mounted on roadside
- Initially used to assess compliance with Move Over Law
- Developed into warning solution for roadside workers based on trajectory of approaching vehicles
- Integration into fixed work zone warning systems and scenarios







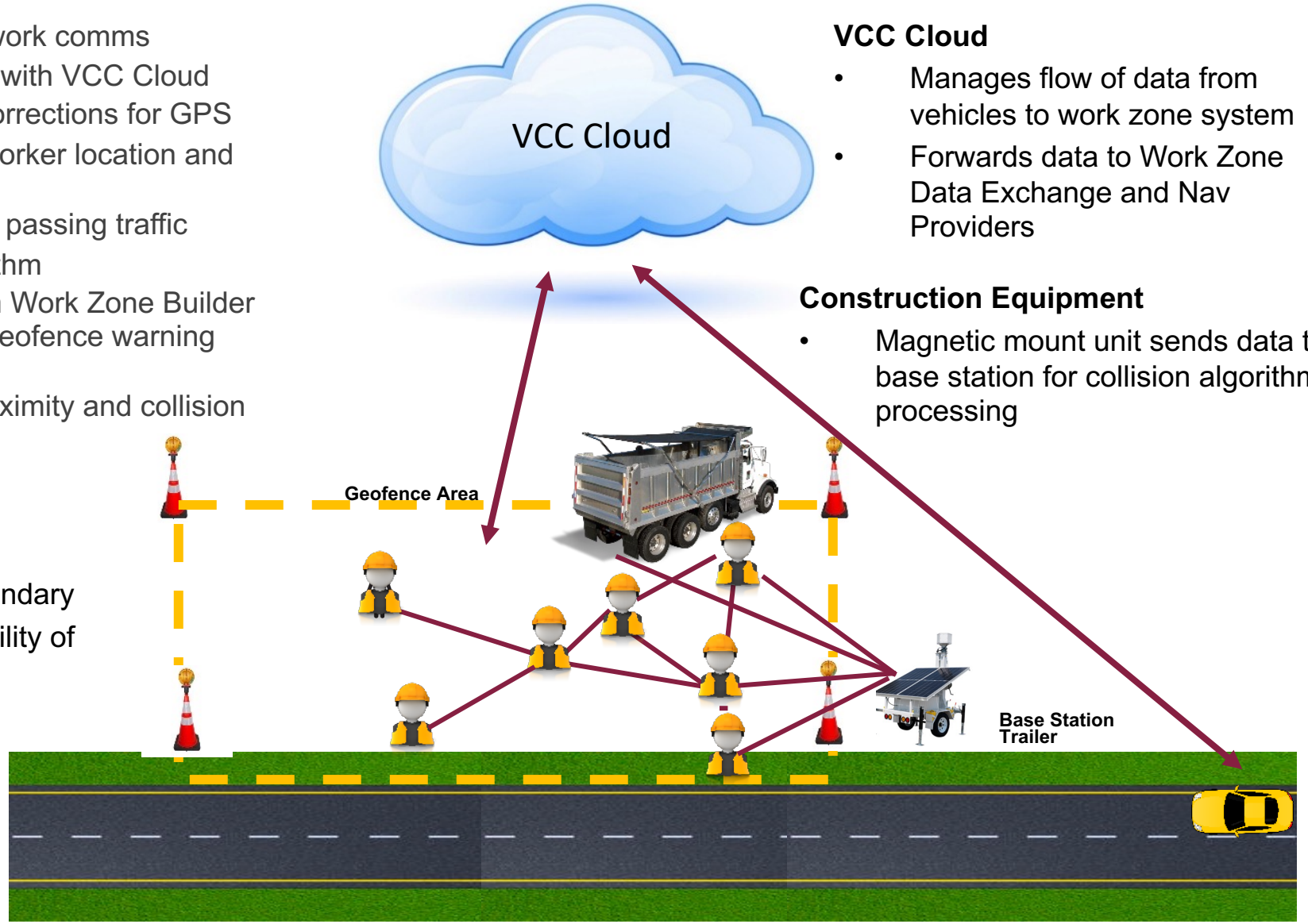
Smart Work Zone Configuration

Base Station Trailer

- Manages wireless mesh network comms
- Manages 4G cellular comms with VCC Cloud
- Receives and applies RTK corrections for GPS
- Processes and aggregates worker location and movement data
- Machine vision processing of passing traffic
- Runs collision warning algorithm
- Receives geofence data from Work Zone Builder and/or geo-plotter and runs geofence warning algorithm
- Sends vests and helmets proximity and collision warnings

Smart Cones

- Auto-define geofence boundary
- Expands range and reliability of mesh network

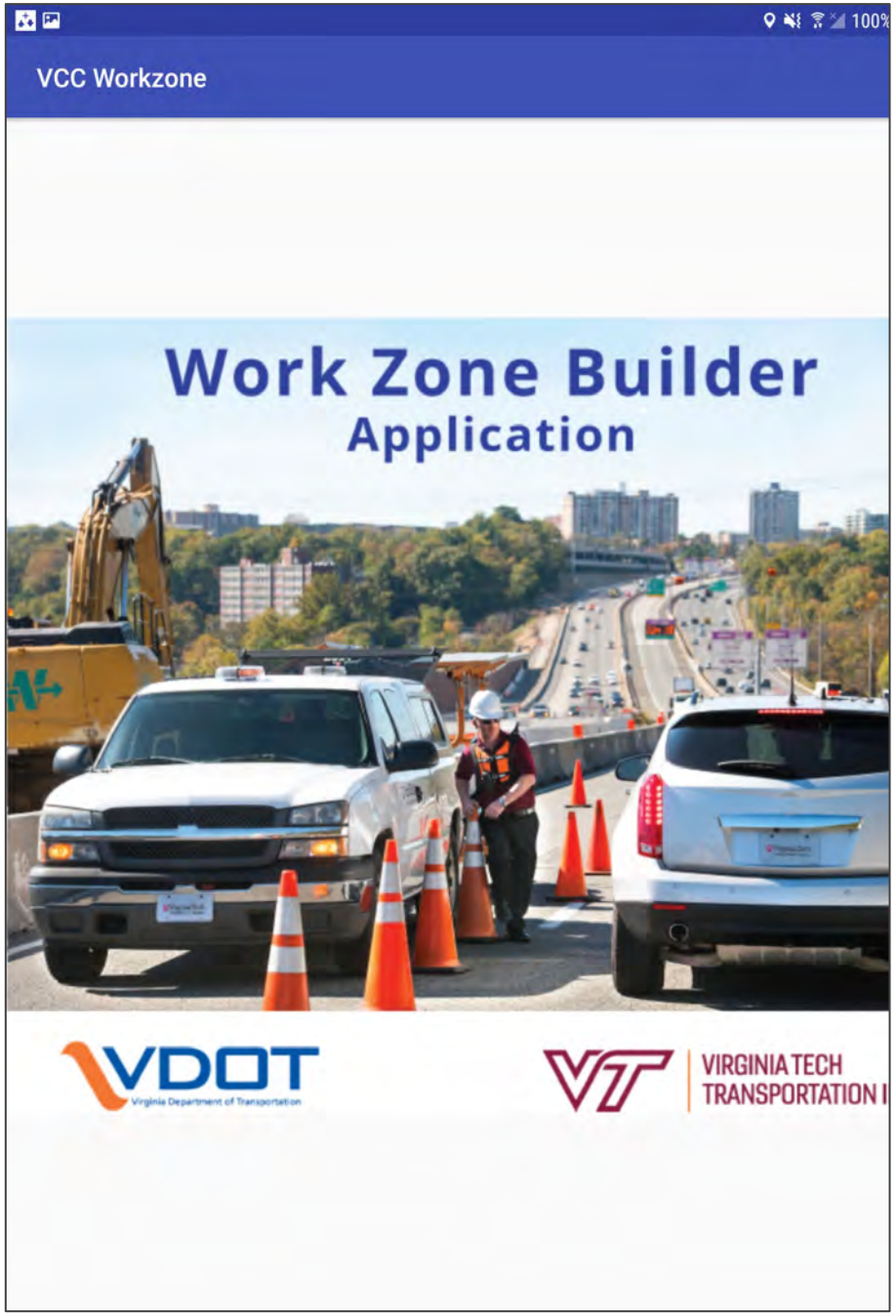


VCC Cloud

- Manages flow of data from vehicles to work zone system
- Forwards data to Work Zone Data Exchange and Nav Providers

Construction Equipment

- Magnetic mount unit sends data to base station for collision algorithm processing

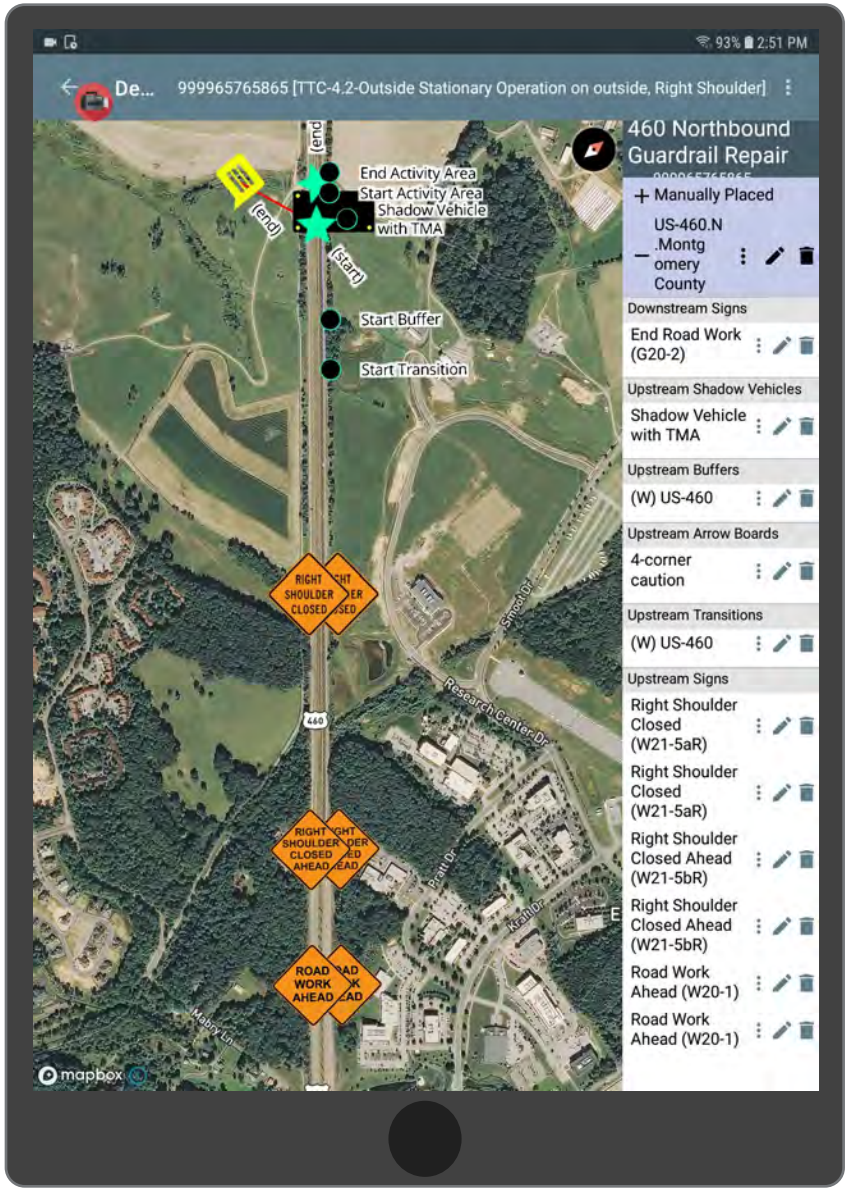


Work Zone Builder Application

- Tablet-based application to create and manage work zone plans
- Produce data that connected and automated vehicles will need to safely navigate work zones
- Streamline submission, review, and approval processes
- Provide a means to source work zone data for **maintenance** activities
- Create an app that work zone managers want to use
- Provide a means to source data for Work Zone Data Exchange and 3rd party navigation applications

Design Mode

- Select activity area and apply TTC template
- Adjust positions of existing features
- Add new features from palette
- Mirror inside / outside templates
- Clone bi-directional templates
- Add notes to features
- Automatically add geofenced areas that will integrate with Smart Vest system





Field Mode

- Use GPS to navigate to, position, and validate work zone features
- Update plans to reflect field adjustments made to address site conditions
- Communicate status electronically to TOC
- Capture imagery to further document the design

Automated TMA Program

- Consortia formed to co-fund development of automated TMA prototype
- Freeway operations, HMI, robust safety features
- Multi-phase program
  - Phase 1: Design, build, and demo leader-follower ATMA System (complete)
  - Phase 2: GPS-Denied operations and reduced BOM (complete)
  - **Phase 3: Testing on public roadways in live work zone operations (current)**
- Targeted Outcome
  - IP package suitable for commercialization



VDOT Virginia Department of Transportation

Transurban

DCS DeANGELO CONTRACTING SERVICES

SAFE-D SAFETY THROUGH DISRUPTION

Current Functionality

- Lead-follower operation with portable lead package
- Transferrable lead vehicle package
- Lateral offsets +/- 12 ft, longitudinal offsets of 50 to 400 ft
- GPS-denied operating capability
- Speeds tested up to 40mph, suggested operation 15mph or less
- Manually initiated holds and releases
- Static and dynamic forward object detection and response
- Remote driving capability to circumvent challenges





Most Recent Developments



- Incorporate a machine vision lane line tracking solutions to supplement GPS
- Add safety features to support transition to on-road testing
- Integration with a remote monitoring and operation system
- Reduced BOM and system costs, simplified lead package
- Successful tests completed on US460, I-64, I-564 Tunnel, and with Iowa DOT

Integration into Mainstream Operations

- The big step!
- Building the case for safety
  - Safety by design
  - Safety by consensus
  - Legal and regulatory review
  - Safety through performance
  - Safety in deployment
- **Remove the driver and safety driver** from the most vulnerable TMA position
- Monitor performance and adherence to Operational Design Domain limitations



Next Steps

- Apply learnings from testing with Iowa, Pennsylvania, Virginia on NCHRP Project
- Robust and resilient
- Simple, plug-and-play deployment
- Integration with VDOTs business processes
- Finalize commercialization





Questions?

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(970)227-3373

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