

# IN MOTION

*A semi-annual update on research and innovation at VTRC.*

Q3-Q4 Newsletter  
Virginia Transportation Research Council  
January 2026



## A Note from Our Director



This issue of our newsletter marks an important moment of transition for VDOT and for VTRC. After more than 30 years of public service, Chief Deputy Commissioner Cathy McGhee will soon be concluding her career with the Department. While Cathy's impact on VDOT is well known, her connection to VTRC is especially meaningful. Her professional journey began here, and through her own work, and that of her husband and father-in-law, both accomplished researchers, her family has been part of VTRC's story for decades. With her departure, a notable chapter in that history comes to a close.

That sense of continuity and change is reflected throughout this newsletter. We are honored to have VTRC designated as a Virginia Historic Civil Engineering Landmark, a recognition that speaks not just to a facility or a moment in time, but to generations of people whose work has shaped transportation practice in Virginia. From our origins in the 1940s to today's broad research portfolio, VTRC has consistently focused on translating research into solutions that matter to the Department.

At the same time, the transportation landscape continues to change. Artificial intelligence, advanced data sources and new analytical tools are increasingly part of how transportation agencies operate. As these technologies gain traction, VTRC's role is to help distinguish promise from practice, ensuring that innovation is grounded in engineering judgment and informed by real-world conditions.

The research highlighted in this issue, from pavements and bridges to safety, operations, climate resilience and emerging technologies, reflects that commitment. As we continue to move forward, we do so with an appreciation for those who built the foundation on which we stand. Cathy McGhee and her family represent that legacy of service, curiosity and dedication to applied research. While priorities, tools and people will change over time, VTRC will always remain mindful of the contributions that came before us and grateful for the lasting impact they continue to have on our work.

Please enjoy.

**Mike Fitch**  
Director, VTRC

## New Happenings

In recognition of more than seven decades of leadership in transportation research and innovation, the Virginia Transportation Research Council (VTRC) was designated a Virginia Historic Civil Engineering Landmark by the Virginia Section of the American Society of Civil Engineers (ASCE) in October 2025. The designation celebrates VTRC's enduring contributions to the way transportation systems are constructed, operated and maintained in Virginia and across the nation.

The honor was commemorated during a landmark celebration at VTRC, featuring remarks from leaders representing VTRC, the University of Virginia (UVA), ASCE and the Virginia Department of Transportation (VDOT). VTRC Director Mike Fitch welcomed guests and reflected on the organization's history and impact. Dr. Devin Harris, Chair of UVA's Civil and Environmental Engineering Department, highlighted the importance of the long-standing partnership between UVA and VDOT, while Lindsay Swain, President of the ASCE Virginia Section, provided an overview of the Historic Civil Engineering Landmark program and the significance of VTRC's selection. The landmark plaque was unveiled by Chief Deputy Commissioner Cathy McGhee and Swain and formally accepted on behalf of VTRC by McGhee. Following the event held at VTRC, Deputy Commissioner McGhee and former Director Gary Allen spoke at the associated ASCE dinner held in the UVA Rotunda.



*L-R: Cathy McGhee, P.E., VDOT Chief Deputy Commissioner, and Lindsay Swain, President, ASCE Virginia Section, unveil the landmark designation plaque.*

VTRC's story began in 1944 as a small research section within the Virginia Department of Highways and took shape in 1949 with the establishment of a formal cooperative research program with UVA. This collaboration made VTRC the first state DOT-funded research facility dedicated to transportation research and one of the earliest DOT-university partnerships in the nation. From early studies of highway materials to nationally influential work in pavement design, safety, bridge engineering, environmental analysis and emerging technologies, VTRC has consistently translated research into practical solutions.

The Historic Landmark designation recognizes not only a building or a moment in time, but the collective efforts of generations of researchers, partners, and leaders whose work continues to improve transportation for the Commonwealth and beyond.

# Research Updates

## VTRC PUBLICATIONS

### [Incident Management in Interstate Work Zones](#)

*Cottrell Jr., B., P.E.*

This project identified best practices for incident management in interstate work zones, including strategies to provide for the detection, response, and clearance of incidents. The researcher reviewed the literature, surveyed other state departments of transportation and VDOT staff, reviewed transportation management plans for selected interstate work zones, and reviewed incident management after-action reports. Concise draft guidelines or best practices for incident management in interstate work zones were developed.

### [Phase II: High Resolution Digital Elevation Models \(DEMs\) and Street-Level Imagery for Rock Cut Slope Inventory and Rockfall Hazard Rating](#)

*Admassu Y., Ph.D., P.G.*

This publication presents a pilot study aimed at helping transportation agencies monitor and maintain rockfall-prone rock cut slopes. It explores two key activities: rock cut slope inventory, which identifies slopes and collects basic geologic data, and rockfall hazard rating, which involves detailed risk assessment. Traditionally, these tasks require time-intensive fieldwork, but the study investigated the use of high-resolution LiDAR-derived digital elevation models (DEMs) and street-level imagery from Mapillary.com as a more efficient, desktop-based alternative for collecting geometric and geologic data.

### [Modified Fiber Reinforced Concrete Repairs for Corroded Steel Beam Ends](#)

*Provines, J. T.; Sharifi, M.; Ozyildirim, H. C., Ph.D., P.E. and Sharp, S.R., Ph.D., P.E.*

One common form of costly bridge maintenance is repairing corroded steel beam ends under leaking joints. The purpose of this project was to evaluate how UHPC repairs on steel beam ends can be modified to make the beam ends easier to construct in the field, either by VDOT work crews or by contractors. The two modifications that this project focused on included using other types of fiber reinforced concretes (FRCs) in place of UHPC and using threaded rods instead of shear studs to transfer load from the steel beam to the FRC panels.

### [A Follow-up Evaluation of the Concrete Pavements \(U.S. 58\) Rehabilitated in 2012](#)

*Hossain, M.S., Ph.D., P.E.; Ozyildirim, H. C., Ph.D., P.E. and Nair, H., Ph.D., P.E.*

In 2012, VDOT tried new ways to rehabilitate old concrete pavement on U.S. Route 58 in Southampton County. Traditionally, these pavements receive an asphalt overlay, creating a composite surface. For this project, westbound lanes were treated with two alternatives: a bonded concrete overlay and an unbonded concrete overlay, while eastbound lanes received the usual asphalt overlay. After 12 years of traffic, VTRC evaluated how each section performed. The review looked at surface conditions, maintenance records, ride quality, skid resistance, and structural health using specialized testing.

### [Evaluating the Potential Use of Traffic Speed Deflection Device-Based Pavement Structural Data for Asphalt Pavements in VDOT's Pavement Management Processes](#)

*Katicha, S.W., Ph.D.; Flintsch, G.W., Ph.D., P.E.; Murekye, A.; Perrone, E., Amarh, E., Ph.D.; and Diefenderfer, B.K., Ph.D, P.E.*

This report describes the evaluation of a proposed approach to incorporate structural condition information obtained from a traffic speed deflection device into the VDOT Pavement Management System's pavement treatment selection process for asphalt pavement sections, which are denoted within the VDOT pavement management system as BIT for bituminous. This study analyzed a subset of the more than 7,000 lane miles tested in Virginia. The subset of data includes the structural condition data on approximately 4,250 lane miles (approximately 1,690 and 2,560 lane miles on the interstate and primary networks, respectively) of the VDOT network. The proposed approach calculates the pavement effective structural number and uses this number to determine the remaining structural life (RSTL). Researchers used RSTL thresholds to determine a structural modified recommended treatment category, that is, the recommended pavement rehabilitation category based on currently used surface condition and adding in the structural condition.

### [Interstate 64 Pavement Recycling Instrumentation and Monitoring](#)

*Ruiz, C.B.; Flintsch, G.W., Ph.D., P.E.; Diefenderfer, B.K., Ph.D., P.E.; Tong, B., Ph.D.; Amarh, E., Ph.D.; Katicha, S., Ph.D. and Boz, I., Ph.D., P.E.*

During the past two decades, the implementation of pavement recycling techniques, such as cold central plant recycling

and full-depth reclamation, for pavement rehabilitation and construction in the United States has been driven by positive performance and the opportunity for significant cost and environmental savings. However, these recycling techniques are not commonly implemented because of the need for long-term performance information and a better understanding of the interactions between material properties, traffic configuration, and environmental conditions. This report presents the measured pavement responses (strains and stresses) of two recycled pavement sections on Interstate 64 in Virginia, incorporating cold central plant recycling and full-depth reclamation, which were subjected to real-world environmental and traffic-loading conditions. This work was completed to improve the understanding of the structural performance of pavements with recycled materials.

### [Night Versus Day Work—Balancing Safety, Operations, and Constructability for Short-Term Operations on Two-Lane Roads](#)

*Robartes, E.M., Ph.D*

Allowable work hours (AWH), dictate which hours of the day construction and maintenance activities may occur and are known to affect operations, constructability, and safety. This project assessed VDOT's current AWH practices on two-lane roads for short-term projects, the level of variability among practices, and opportunities to improve statewide consistency. Researchers developed and distributed a statewide survey on AWH, conducted interviews with representatives from other state departments of transportation, and analyzed data from Virginia's pavement management scheduling system. The results identified benefits to setting AWH at the district level rather than

implementing statewide AWH. The work also identified specific areas that may benefit from statewide consistency without overly affecting local flexibility on decision making. The report recommends developing a framework for decision making and conducting outreach in regard to the existing decision-making tools.

#### [Evaluation of Combining Heat Induction and Laser Ablation for the Removal of Potentially Hazardous Bridge Coatings](#)

*Sharp, S.R., Ph.D., P.E.; Provines, J. T., P.E.; Gillespie, J.S.; Moffat, W.P., Ph.D.; Wilson, D.L., Rickard-Passaro, R., CIH; Fitz-Gerald, J. M., Ph.D. and Agnew, S. R., Ph.D.*

This project aimed to evaluate whether induction coating removal (ICR) and laser ablation coating removal (LACR) could be combined to remove hazardous bridge coatings at practical rates. It included evaluations of the coating removal rates, surface cleanliness, surface profile, steel substrate mechanical properties, recoating adhesion performance, field demonstrations, and environmental and industrial hygiene evaluations of ICR, LACR, and ICR first plus LACR afterward (ICR+LACR). Coating removal data showed that using ICR+LACR could result in a coating removal rate approximately ten times faster than using LACR alone. ICR can quickly remove the bulk coating layers but leave the residual primer on the steel surface. LACR can then quickly remove the remaining primer layer to provide a clean surface ready to be recoated.

#### [Historical Streamflow Discharge Trends Considering Climate Change and Application](#)

*Rossetti, M.S., Ph.D.*

Bridges and large culverts are designed using historical streamflow data. However, historical streamflow data are static and do not account

for changes in precipitation, temperature, and watershed characteristics such as the percentage covered by impervious surface. This report details efforts to determine if streamflow peak discharges in Virginia have changed or remained constant for roughly the past century (1916–2015), the extent to which changes are related to physiographic factors and watershed characteristics, and efforts to develop a watershed index that identifies watersheds that may be particularly vulnerable to climate change.

#### [Evaluation of Structural Fillers for “Steel Grouting” in Steel Bridge Preventive Maintenance and Repairs](#)

*Provines, J. T., P.E.; Starr, J. and Ozbulut, O., Ph.D.*

This study investigated the performance of “steel grouting,” which is structural fillers for filling gaps in steel bridges, through laboratory testing and field evaluations. First, the research team developed a list of potential structural fillers and their key properties. Three fluid (injectable) and three putty structural fillers were selected for experimental testing of material and structural properties. Material tests of selected structural fillers included compressive strength testing at different curing temperatures and creep testing under sustained compressive loads at elevated curing temperatures. Results from these tests were used to narrow down the selection of structural fillers for structural component testing with slip-critical bolted connections.

#### [Field Validation of Balanced Mix Design Initial Criteria](#)

*Diefenderfer, S. D., Ph.D., P.E.; Boz, I., Ph.D., P.E.*

The purpose of this study was to validate the suitability of the initial Balanced Mix

Design (BMD) cracking test criteria for design and reheated production specimens determined from the laboratory benchmark testing of 11 surface mixtures placed in 2015. Pavement condition surveys, falling weight deflectometer testing, field visits, and core testing were conducted to assess the mixture properties and pavement conditions after 8 years in service. Results were analyzed relative to the initial mixture properties and results of BMD benchmark testing to validate VDOT’s initial BMD cracking criteria.

#### [Extending Full Depth Reclamation \(FDR\) Service Lives](#)

*Amarh, E.A., Ph.D.; Tong, B., Ph.D., Katicha, S.W., Ph.D., Flintsch, G. W., Ph.D., P.E., Diefenderfer, B. K., Ph.D., P.E.*

Despite its advantages, cement-stabilized FDR may be prone to shrinkage cracking, which remains a critical concern for pavement longevity. To mitigate shrinkage-related issues, microcracking may be employed to reduce the severity of shrinkage-induced cracking in cement-treated layers by introducing a network of fine cracks to relieve initial stresses within the first 24 to 72 hours after construction. In this study, cement-stabilized FDR test cells were constructed at Virginia’s Accelerated Pavement Testing Facility to assess the differences in performance between microcracked and nonmicrocracked FDR test cells having two different cement contents. A relatively thin hot mix asphalt surfacing was placed over the FDR layer. The study found that although microcracking resulted in higher deflections, higher vertical stresses, and similar tensile strains than nonmicrocracked test cells, microcracking led to reduced transverse crack development at the pavement surface and within the FDR layer.

#### [Ruggedness Study of Specimen Preparation and Fine-Tuning of Test Methods for IDT-CT and IDT-HT Test](#)

*Boz, I., Ph.D., P.E.; Habbouche, J., Ph.D., P.E.; Taylor, A., P.E. and Moore, N., P.E.*

VDOT utilizes the indirect tensile cracking test (IDT-CT) and the indirect tensile at high temperature (IDT-HT) test as part of its balanced mix design framework to evaluate asphalt mixture performance and support performance-based acceptance decisions. This study was undertaken to systematically evaluate the influence of key specimen preparation factors on IDT-CT and IDT-HT test results and to establish clear, data-driven guidelines to standardize preparation practices. The results highlighted that inconsistent preparation practices can introduce practical and sometimes statistically significant variability, potentially leading to false positive or false negative performance assessments, particularly when comparing with specification thresholds such as the cracking tolerance index. Based on the study findings, a draft Virginia Test Method was developed to guide standardized preparation practices and improve the reliability, repeatability, and interpretability of IDT-CT and IDT-HT test results.

#### [Modeling Travel Time Reliability for Non-Interstate National Highway System Routes](#)

*Zhao, M., Ph.D., P.E. and Lan, C., Ph.D.*

Under the Moving Ahead for Progress in the 21st Century Act, state departments of transportation are required to report travel time reliability and set performance targets for interstate and non-interstate National Highway System facilities. Although several past studies have analyzed and predicted travel time reliability on interstates, a gap still exists in studies modeling travel time reliability on arterial roads. The researchers used 4

years of probe data from different sources to conduct a segment-level comparative analysis of travel time distributions and the Level of Travel Time Reliability (LOTR) on arterials. In addition, this study developed planning-level models to predict the 50th, 80th, and 95th percentile travel times on arterial segments statewide.

#### [Evaluating the Virginia Department of Transportation's Potential Use of Electric Pickup Trucks Using Field Test Data](#)

*Goodall, N. and Robartes, E.*

This project evaluated the Ford F-150 Lighting electric pickup truck by (1) field testing the range, charging, and general capabilities of the electric truck and its associated charging infrastructure and (2) capturing the experiences of VDOT field staff when using the vehicle. Field testing revealed that the electric truck performed consistently with manufacturer estimates under standard driving conditions but experienced significant range reductions during towing operations (50–70% decrease) and cold weather conditions. The vehicle demonstrated good suitability for local maintenance operations, with accurate range estimation and effective performance during low-speed work zone operations. Based on these findings, the study recommends that VDOT's Maintenance Division initiate a pilot electric vehicle deployment that prioritizes electric sport utility vehicles and sedans at selected facilities. The operational limitations observed during towing and cold weather operations indicate that electric sport utility vehicles and sedans can provide similar fuel and maintenance cost benefits without these constraints because they are typically not required for heavy towing or 24-hour, around-the-clock emergency operations that characterize many pickup truck applications.

#### [A Management Plan for Historic Bridges In Virginia: The 2024 Update](#)

*Miller, A.*

This study identifies practices to manage and treat Virginia historic bridges, addressing technical elements such as eyebar deterioration, coatings for metal truss bridges, masonry stabilization, compatible mortar, dismantling pin-connected truss bridges for rehabilitation, and truss bridge capacity. VDOT is actively using the management concepts presented herein. For example, six of the 33 historic bridges have been repaired or rehabilitated during the past 7 years, and another three historic bridges (through trusses in Brunswick and Wythe counties and a deck truss in Bedford County) are expected to be rehabilitated soon. The Management Plan provides essential information for maintaining historic bridges. The stringent standards for defining which bridges are historic, supported by this Plan and the affiliated Historic Structures Task Group, yield a relatively small group of historic bridges, saving VDOT roughly \$40,000 to \$160,000 annually.

## EXTERNAL PUBLICATIONS

**Sensitivity of the Ideal Rutting Test to Variations in Conditioning and Testing Parameters for Assessing Asphalt Mixture Rutting Potential**, *Journal of Testing and Evaluation*  
*Boz, I., Ph.D., P.E. and Diefenderfer, S., Ph.D., P.E.*

**Assessing the Impact of Test Conditions on Indirect Tensile Test Results for Evaluating Rutting Potential in Asphalt Mixtures**, *Transportation Research Record*  
*Boz, I., Ph.D., P.E. and Diefenderfer, S., Ph.D., P.E.*

**Practical Laboratory Aging Protocol for Cracking Evaluation of Asphalt Surface Mixtures in Virginia**, *Transportation Research Record*  
*Boz, I., Ph.D., P.E. and Diefenderfer, S., Ph.D., P.E.*

## INITIATED VTRC RESEARCH

#### [Advancing Forensic Investigation of Concrete Distresses at VTRC with Focus on Alkali-Ailica Reaction \(ASR\)](#)

*Behravan, A., Ph.D., P.E. and Garg, N. (UIUC)*

#### [Concrete Removal Limits for the Rehabilitation of Bridge Piers](#)

*Harris, D. and Bernard, K.L., Ph.D., P.E.*

#### [Evaluation of Polymer Concrete for Bridge Deck Overlay Applications in Virginia: Phase I](#)

*Arce, G., Ph.D., P.E.*

#### [Improving Holiday Congestion Forecasting on Interstate Highways](#)

*Appiah, J., Ph.D., P.E.*

#### [Identifying Opportunities to Improve Temporary Sediment Basins](#)

*Lloyd, L.N., P.E. and Rossetti, M., Ph.D.*

#### [Evaluation of Alternative Materials for Timber Bridge Deck Plank Replacement](#)

*Kassner, B. L., Ph.D., P.E.; Provines, J. T., P.E. and Osbulut, O.*

#### [Patch Mixtures for Bridge Structures and Pavements](#)

*Ozyildirim, H. C., Ph.D., P.E.; Sharifi, M. and Hossain, M. S., Ph.D., P.E.*

#### [Ultra-High Performance Concrete Overlays in Virginia](#)

*Ozyildirim, H. C., Ph.D., P.E. and Sharifi, M.*

#### [Overlays with Rapid Setting Cement and a Liquid Low P Admixture](#)

*Ozyildirim, H. C., Ph.D., P.E. and Sharifi, M.*

#### [Test Methods for Joint Fabrics Used in Precast Concrete Adjacent Member Beam Connections](#)

*Kassner, B. L., Ph.D., P.E.*

#### [Assessing Bat Use of Culverts in Virginia and Identifying Opportunities for Streamlining the Consultation Process for VDOT Projects: Phase I Study](#)

*Donaldson, B. M. and Luu, J.*

#### [Incident Management Coordinator Vehicle Red Lights Completion Project](#)

*Mollenhauer, M. (VTTI)*

#### [Developing Guidance for Calculating the Downstream Functional Area of an Intersection](#)

*Dougald, L. E.*

[Bridging Research, Innovation, and Practice: Partnership for the Advancement of Pavement Engineering and Asset Management in Virginia](#)

Nair, H., Ph.D., P.E. and Flintsch, G., Ph.D., P.E.

[Evaluating the Impact of Volumetric Properties and Reheating on the Balanced Mix Design Test Results - Phase II](#)

Kuchiishi, K., Ph.D and Boz, I., Ph.D., P.E.

## Other News

### VTRC Attends 105th TRB Annual Meeting

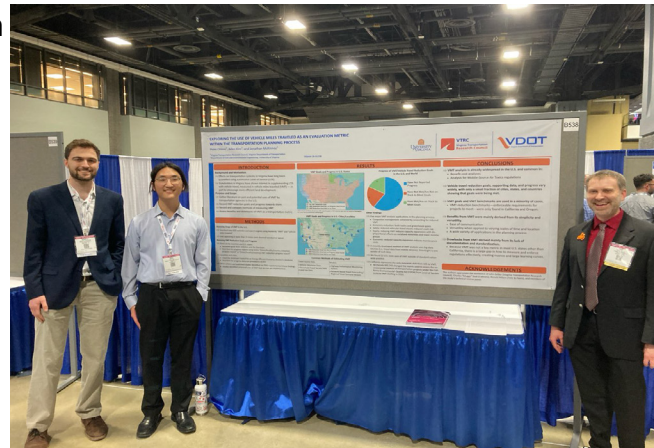
VTRC participated in the 105th Annual Transportation Research Board (TRB) meeting in Washington, D.C. in January, where each VTRC team was represented and exchanged knowledge with industry partners, and showcased collaborative research efforts through seminars, meetings and presentations.

### Day of Caring

VTRC staff formed a volunteer team to assist a local nonprofit organization with development and outreach efforts to help connect more youth to mentoring and STEAM learning. This was part of the annual Day of Caring in the Charlottesville area, coordinated by the United Way. VTRC participants included John Miller, Janna Brown, Maria Rossetti, Gabriel Arce, Stacey Diefenderfer, Peter Ohlms, and Lance Dougald.

### Virtual Reality Enhances Public Involvement Processes

Office of Strategic Innovation (OSI) in collaboration with the University of Virginia completed a demo of wearable virtual reality technology at a Bristol District public hearing. The tool allowed citizens to immerse themselves in the location and design plans from cyclist and pedestrian perspectives of the two proposed roundabouts.



L-R: Peter B. Ohlms, AICP, Aden Kim, Jonathan McKinney present poster at 105th Annual Transportation Research Board meeting.

### Virginia Section of the Institute of Transportation Engineers Traffic Bowl

The Traffic Bowl is a Jeopardy-style competition for universities focused on transportation engineering. VTRC Associate Directors John Miller and Mike Fontaine served as coaches for the UVA student team, which included VTRC Graduate Research Assistant Afrida Raida and VTRC undergraduate intern Aden Kim. The team competed against Virginia Tech and Liberty University at Lane Stadium during the VASITE Fall Meeting, with Virginia Tech ultimately winning in final Jeopardy and UVA finishing 2nd.



L-R: Mike Fontaine, Daniel Vtipil, Aden Kim, Mari Bocaner and Afrida Raida at the Virginia Section of the Institute of Transportation Engineers Bowl.

### OSI Hosts Central Office Innovation Day

In September, OSI in partnership with Business Integrated Solutions (BISD) as part of the DRIVERS PMO hosted the first ever Central Office Innovation Day. More than 25 divisions participated in the event, displaying their projects and solutions that are improving the way VDOT does business. Innovations and tools such as VTRC's Laser Ablation, Maintenance's Mobile Advanced Road Weather Information Sensor and Stockpile Reports, Location and Design's use of Terrestrial LiDAR Scanning and many others were showcased. View all showcased innovations [here](#).

## Appointments

Associate Principal Research Scientist **Stacey Diefenderfer** was appointed as chair of the National Cooperative Highway Research Program (NCHRP) Project Panel, *NCHRP 09-77 Silo Storage Impact on Asphalt Mixture Performance*.

Associate Principal Research Scientist **Stacey Diefenderfer** is the 2025-2026 President of the Association of Asphalt Paving Technologists.

Senior Research Scientist **Ilker Boz** was appointed as a member of the project panel for *NCHRP 09-74: Developing a Friction Performance Index for Asphalt Concrete Mixtures to Promote Safety, Sustainability and Longevity*.

Research Scientist **Gabriel Arce** was appointed as a voting member of the newly formed American Concrete Institute (ACI) Subcommittee 240-0A on Calcined Clays.

Research Scientist **Ilker Boz** was appointed as the new chair of the Research Roadmap Subcommittee of the Consortium for Asphalt Pavement Research and Implementation (CAPRI).

Research Scientist **Amir Behravan** was promoted to voting member of ACI Committee 228, Nondestructive Testing.

## Awards

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OSI Director **Hari Sripathi** received the “Best Technical Meeting of the Year” award from the American Society of Civil Engineers Richmond Branch for his presentation on AI implementation within VDOT.

VTRC Graduate Research Assistant **Afrida Raida** received the Judges’ Award for her presentation entitled “Understanding pedestrian street crossing decisions in day and night scenarios: A user-centric approach” at the University of Virginia Civil and Environmental Engineering Fall Graduate Research Symposium.

## VTRC Leadership Team

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**Michael Fitch**  
Director, VTRC

**Hari Sripathi**  
Director, Office of Strategic Innovation

**Michael Fontaine**  
Associate Director, Safety, Operations and Traffic Engineering

**John Miller**  
Associate Director, Environment, Planning and Economics

**Steve Sharp**  
Associate Director, Structures

**Hari Nair**  
Associate Director, Pavements

**Kevin Wright**  
Implementation Coordinator

**Donna Cognata**  
Business Manager