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WELCOME!
IRISE 2025 Annual Meeting
May 22nd, 2025

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IRISE 2025 Annual Report

Dana Vidic, IRISE Associate Director

IRISE Annual Meeting

May 22nd, 2025

Impactful Resilient Infrastructure Science and Engineering (IRISE)

- Developing sustainable, resilient engineering solutions
- Improving worker safety
- Areas of Research
  - Bridges
  - Pavements
  - Worker Safety
  - Geotechnical
  - Stormwater Management
  - Materials
  - Other

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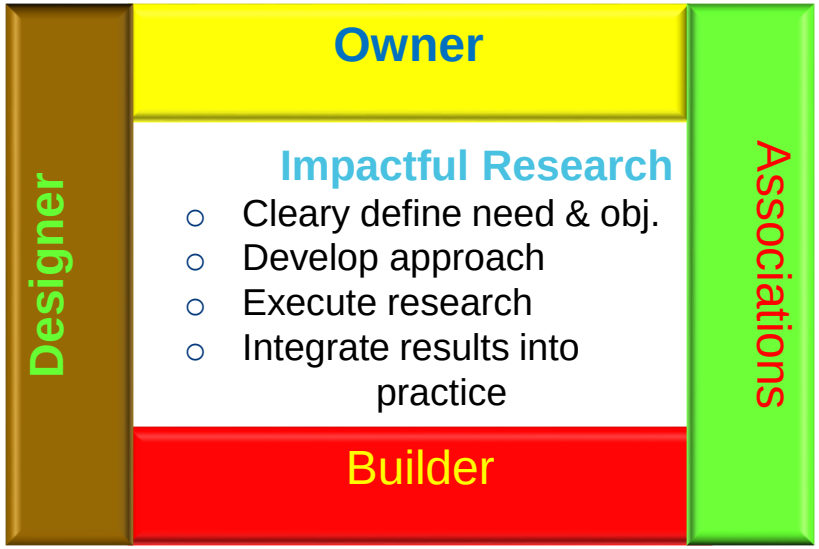
Unique Approach

MISSION: Implementable Solutions

- Identify a deficiency/challenging issue
- Develop Impactful technology
- Benefit seen by all parties (buy-in)

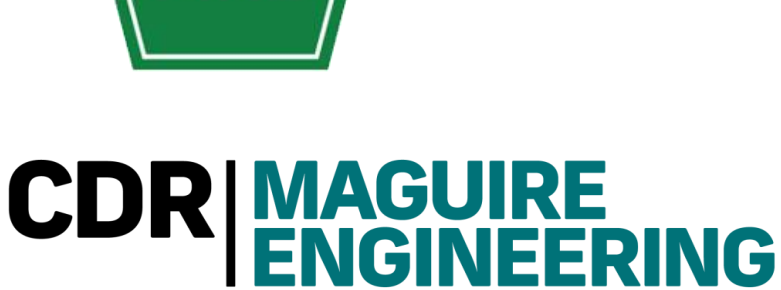
APPROACH…

- Get all parties involved early in the process
- Maintain their involvement throughout the process



WE ARE INDEBTED TO OUR MEMBERS

PITT | IRISE - Denotes Founding Members



*Ex-officio member

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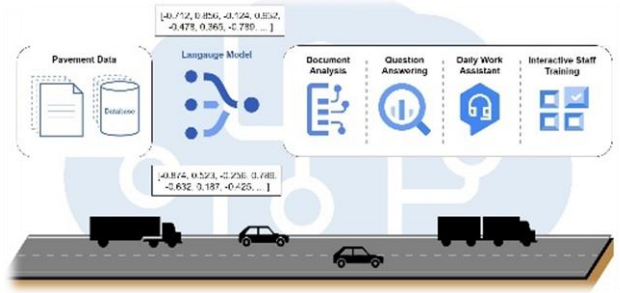
Ongoing Research

- 15 On-going Projects During 2024/25, 6 Completed

- **Bridges**
  - Bridge Deck Corrosion
  - Bridge Load Ratings
- **Geotech/Stormwater**
  - Reoccurring Landslide Analysis
  - Common Sense Compaction
  - Regional Stormwater Management
  - Earthwork Quantities Utilizing LiDAR
- **Worker Safety**
  - AI Safety Assistant
- **Pavements and Materials**
  - Pavement LLM
  - Material Compatible Repairs
  - Self-Heating Pavements
  - Two-Lift Pavement Construction
  - Low Carbon Concrete
  - Pavement LCA
- **Other**
  - Benefits Analysis
  - LiDAR Point Clouds



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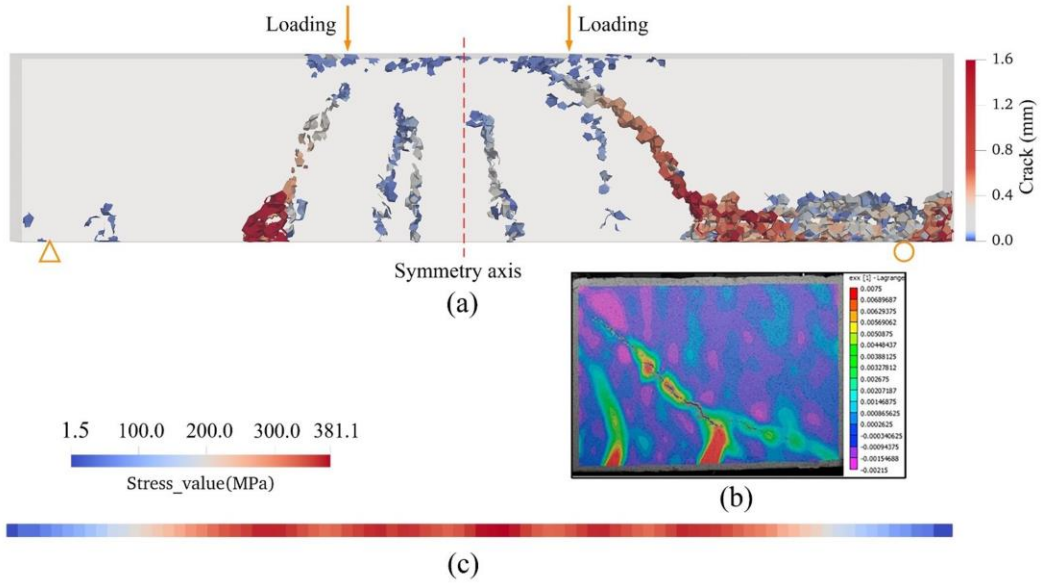
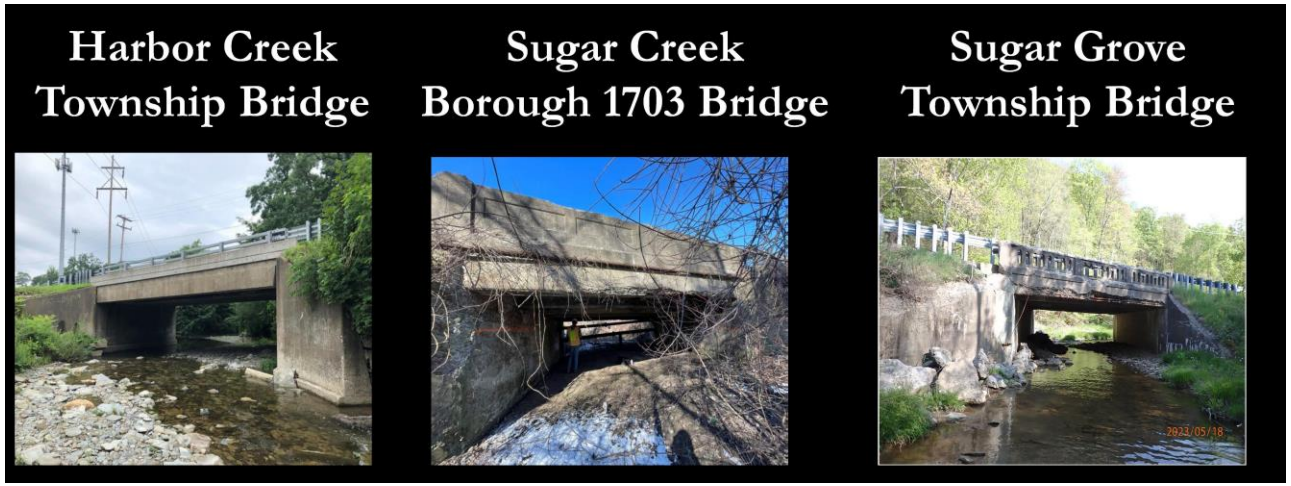
Bridges

On-Going Research Projects

- A Novel Methodology for Structural Optimization of Bridge Decks Against Corrosion, ***Dr. Brigham***
- Bridge Load Ratings, ***Dr. Rizzo***





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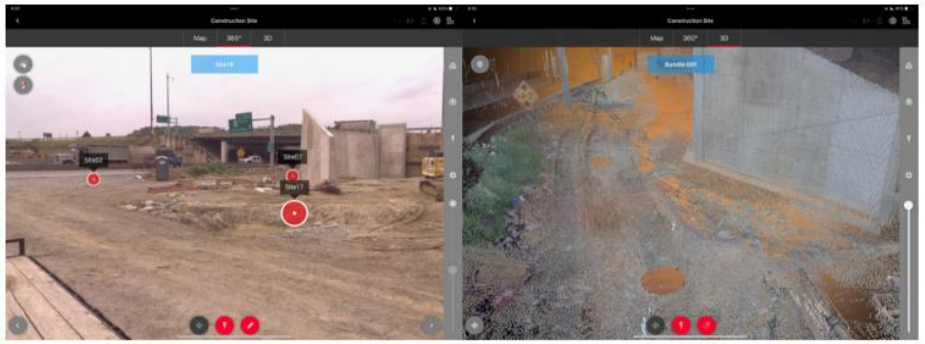
Geotechnical/ Stormwater

On-Going Research Projects

- Analysis of Reoccurring Landslides in SWPA to Advance Hazard and Risk Estimates, ***Dr. Bain***
- Common Sense Compaction for Soils/Embankments, ***Dr. Salles de Salles***
- Improved Collection of Earthwork Quantities Utilizing UAV-Based LiDAR, ***Dr. Fascetti***
- Advancing Regional Comprehensive Stormwater Management through Cross-Jurisdictional Coordination and Cooperation, ***Dr. Bain***



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Materials

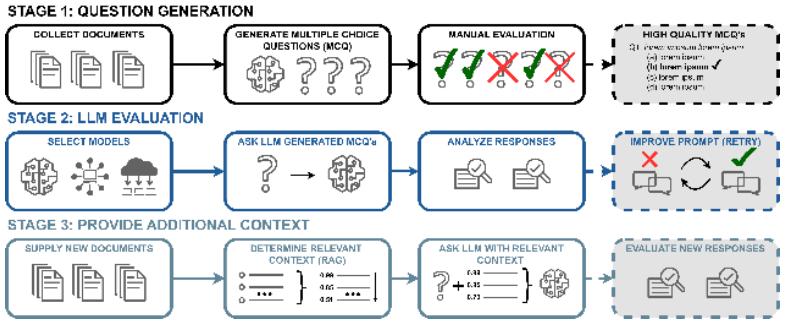
On-Going Research Projects

- Material Compatible Repairs Evaluation – Field Implementation, ***Drs. Sachs, Khazanovich and Vandenbossche***
- Concrete Mixtures with Half the Carbon Footprint, ***Dr. Vandenbossche***

Pavements

On-Going Research Projects

- Design and Construction of Two-lift Concrete Pavements for Pennsylvania, ***Dr. Khazanovich***
- Adaptation of a Large Language Model for Generation of Responses to Pavement Related Questions, ***Dr. Khazanovich***
- Self Heating Concrete Pavement Systems with Surface-Mounted Heating Elements, ***Dr. Alavi***
- Concrete Pavements Life Cycle Assessment Tool, ***Dr. Bilec & Dr. Khazanovich***



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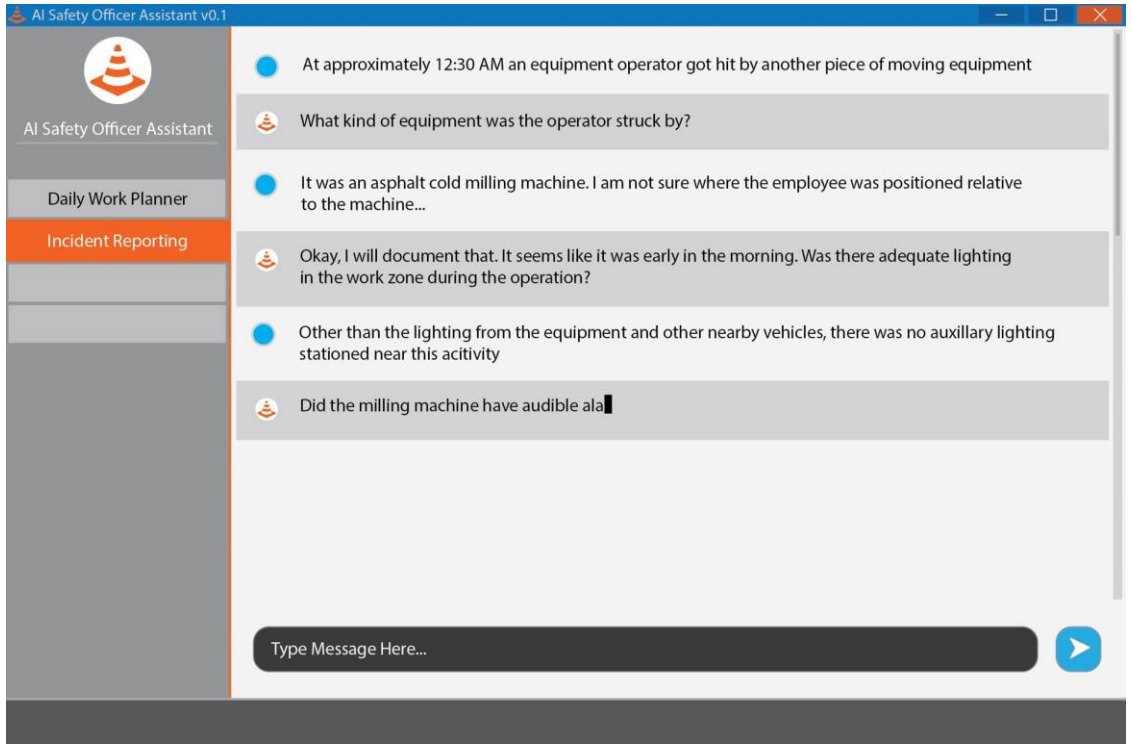
Worker Safety

On-Going Research Projects

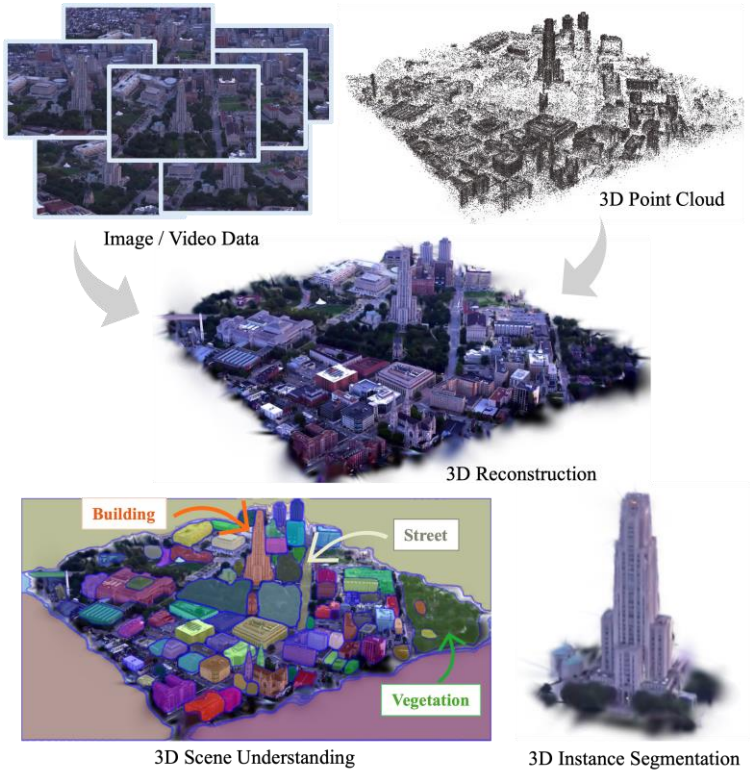
- AI Safety Assistant, ***Dr. Khazanovich***



Other

On-Going Research Projects

- Developing and Applying Methodologies to Quantify the Benefits of IRISE Projects, ***Dr. Magalotti***
- Supervised Learning for the Classification of High-Resolution LiDAR Point Clouds, ***Dr. Fascetti***



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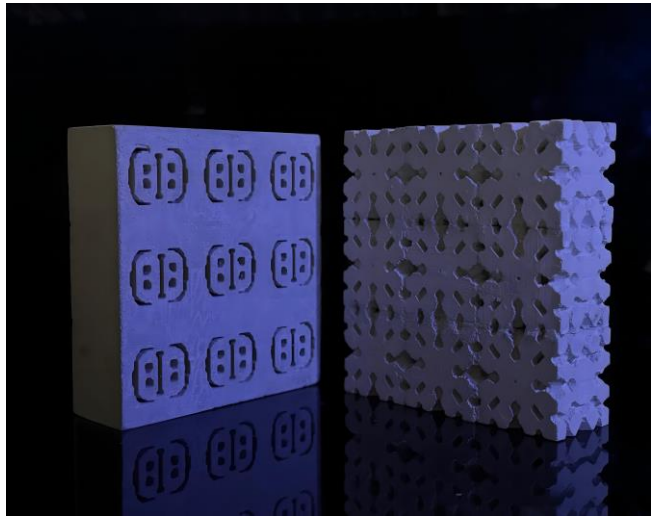
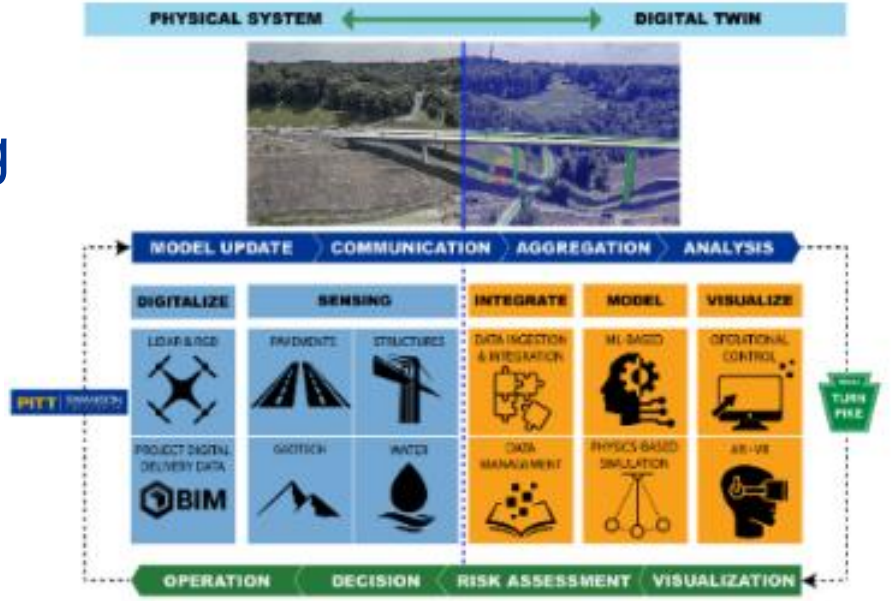
PA Turnpike Mon Fayette Test Bed

1. Digital Twin
2. Metamaterial Noise Walls
3. Electrified Roadways Strategic Plan
4. Multifunctional Geogrids for Energy Harvesting





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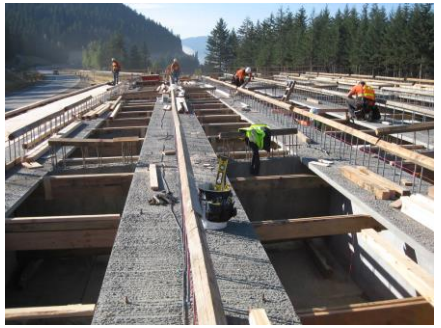
IRISE Year 8 Projects





1. Efficacy of One-Step Reinforced Concrete Bridge Deck Repairs
2. Joint Activation in Concrete Pavements
3. Advancing Ground Penetrating Radar (GPR) for Pavement Inspection
4. Geothermal Pavement Deicing
5. Virtual Reality Based Training for Work Zones Around Live Traffic

Efficacy of One-Step Reinforced Concrete Bridge Deck Repairs



Research Problem:

- Determine if durable overlay materials (e.g., Latex-Modified Concrete [LMC], Polyester Polymer Concrete [PPC], Hybrid Composite Synthetic Concrete [HCSC]) can structurally replace traditional two-step repair methods.
- Evaluate structural adequacy of one-step repairs, potentially reducing repair time, preserving original deck elevation, and maintaining structural integrity.

Research Objectives:

1. Assess structural performance of one-step concrete deck repairs without additional overlay application.
2. Analyze compatibility and performance (modulus, bond strength, thermal) of selected repair materials with existing deck structures.
3. Develop recommendations for using one-step methods for Type 2 and Type 3 repairs, including possible future research directions.

Joint Activation in Concrete Pavements

Research Problem:

- Proper joint activation in concrete pavements prevents uncontrolled cracking and related distresses.
- Current practices for joint activation (e.g., saw-cutting) do not always ensure crack formation, leading to excessive slab movements and increased cracking risks.
- Difficulty detecting joint activation delays can result in premature pavement failures.

Research Objectives:

1. Develop an analytical tool to predict joint activation timing.
2. Evaluate the impacts of construction practices and site conditions on pavement performance.
3. Recommend optimal saw-cut timing and alternative joint activation methods to reduce failure risks.

Advancing Ground Penetrating Radar (GPR) for Pavement Inspection

Research Problem:

- Traditional pavement inspection methods (records, as-built plans, core samples) often provide incomplete or inaccurate data.
- Ground Penetrating Radar (GPR) shows promise as a Non-Destructive Evaluation tool but lacks uniform adoption across DOTs.
- Greater understanding is required of GPR's full capabilities, limitations, and best implementation practices.

Research Objectives:

1. Evaluate current DOT applications and the effectiveness of GPR technology in pavement assessments.
2. Provide clear guidelines for optimal implementation strategies for transportation agencies.
3. Conduct two webinars to disseminate findings, demonstrate successful GPR use cases, and recommend best practices for network-level and project-level pavement inspections.

Geothermal Pavement Deicing

Research Problem:

- Geothermal heat offers a sustainable alternative to chemical deicing, enhancing winter road safety.
- Roadways can serve as multifunctional assets by storing solar heat in summer for winter use.
- Current designs focus on pavement systems but overlook geothermal interactions with soil or rock, resulting in knowledge gaps in system efficiency and scalability.

Research Objectives:

1. Develop and laboratory-validate a scalable geothermal pavement heating module adaptable to diverse climates, soil types, and pavement conditions.
2. Assess potential pilot locations to prepare for future field implementation in Pennsylvania.

Virtual-Reality Based Training for Work Zones Around Live Traffic

Research Problem:

- Highway construction workers face high injury/fatality risks from live traffic, visibility issues, and unpredictable drivers.
- Traditional training (lectures/presentations) inadequately prepares workers for dynamic, hazardous environments.

Research Objectives:

1. Develop immersive Virtual Reality (VR)-based training targeting critical hazard recognition and response skills.
2. Use Mixed Reality (MR) technology to simulate realistic, interactive scenarios involving real construction equipment and live traffic conditions.
3. Enhance safety training through realistic simulations, reinforcing best practices and increasing trainee engagement and knowledge retention.

Student Involvement

- 11 Undergraduate Students
- 22 Graduate Students
- 1 Post-Doc

Conferences

- ACPA, TRB, Society of Engineering Annual Conference

Site Visits

IRISE TRI-PRO Competition

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Other Activities

Transportation Forum

- In conjunction with Pittsburgh Chapters of ASHE and WTS
- 155 Attendees

ACPA/PA Concrete Conference

Hosted PennDOT ELDP

5th Advanced International Workshop on Concrete Pavements

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Thank you!

Additional details can be found at…

https://www.engineering.pitt.edu/Irise/
Or Google "Pitt IRISE"

Thank you for all your contributions this past year!

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