



Joseph J. Szczur, PE
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Impactful Resilient Infrastructure Science &
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District Executive – Pennsylvania Department of
Transportation , Engineering District 12 , 2004 –
2020, retired

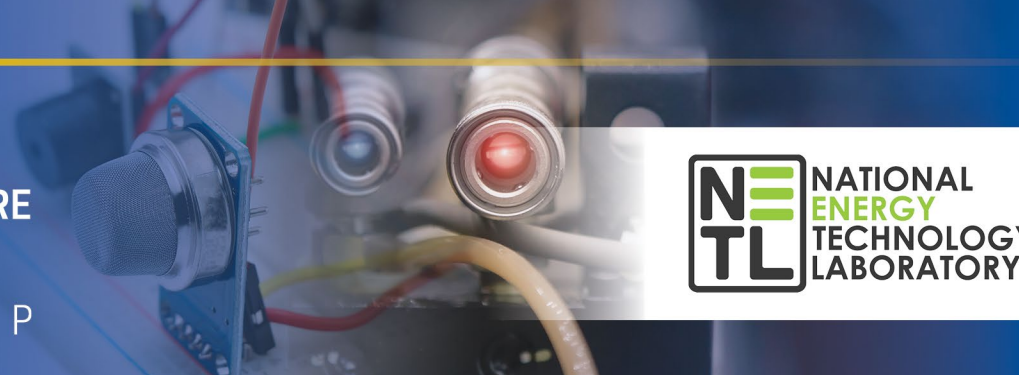
Distinguished Alumni Award recipient , 2014
Swanson School of Engineering, Department of
Civil and Environmental Engineering

Overview of Pitt Transportation Infrastructure Research

Impactful Resilient Infrastructure Science and Engineering (IRISE) Consortium

Joseph Szczur – Director of IRISE

November 8, 2023



University of Pittsburgh | Swanson School of Engineering

Thank You!



Bridges

Ongoing Pitt Research

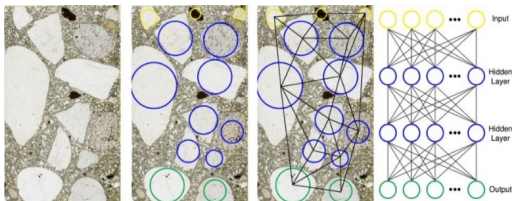
- Integrating Additive Manufacturing with Accelerated Bridge Construction Techniques, **Dr. Alavi** PITT|IRISE
- A Novel Methodology for Structural Optimization of Bridge Decks Against Corrosion, **Dr. Brigham** PITT|IRISE



Pavements

Ongoing Pitt Research

- Faulting Models for JPCP and BOCA, ***Drs. Khazanovich (JPCP) Vandenbossche (BOCA)***
- Three-dimensional Micro-mechanical Characterization of the Effect of Vibration and Compaction in Concrete Pavements, ***Drs. Fascetti and Vandenbossche*** PITT|IRISE
- Joint Performance Optimization for JPCP, ***Dr. Vandenbossche*** PITT|IRISE
- Prediction of Dowel Corrosion and Effect on Performance of Concrete Pavements, ***Dr. Vandenbossche*** PITT|IRISE
- Design and Construction of Two-lift Concrete Pavements for Pennsylvania, ***Dr. Khazanovich*** PITT|IRISE



Geotechnical

Ongoing Pitt Research

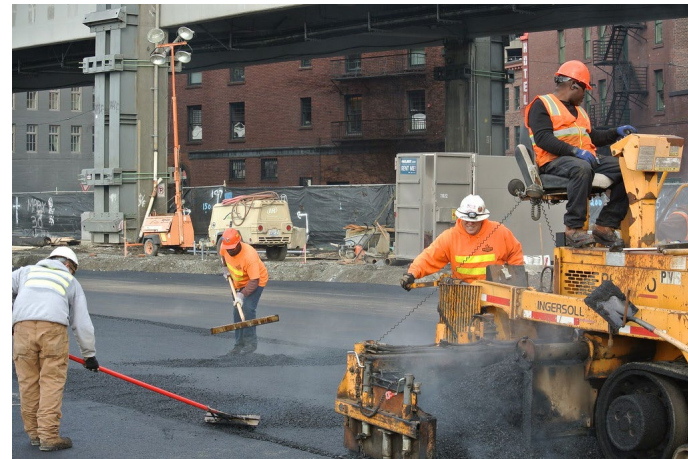
- Development of a Roadway Landslide Inventory and Analytical Tool for Southwestern Pennsylvania, ***Drs. Bain, Iannacchione and Shelef*** PITT|IRISE
- Development of a Regional Landslide Inventory to Advance Hazard and Risk Estimates for Southwestern Pennsylvania, ***Dr. Bain*** PITT|IRISE



Worker Safety

Ongoing Pitt Research

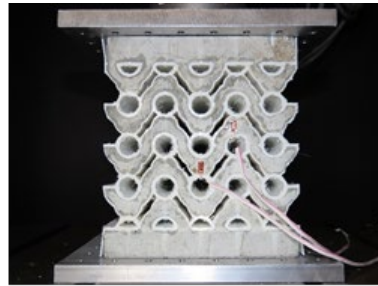
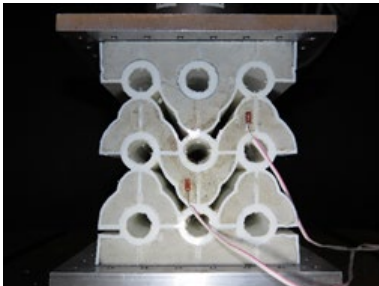
- A Novel Immersive VR Platform for H&S Training of Construction Workers, **Dr. Fascetti** PITT|IRISE
- Identifying Major Causes of Construction Accidents for the Paving Industry in Pennsylvania, **Dr. Khazanovich** PITT|IRISE



Materials

Ongoing Pitt Research

- Material Compatible Repairs Evaluation, ***Drs. Sachs, Khazanovich and Vandembossche*** PITT|IRISE
- Carbon Nanotube Additives for Structural and Highway Concrete (*Continuation*), ***Drs. Sachs and Gilbertson***
- Microbial Concrete Sealer (*Continuation*), ***Drs. Sachs and Haig***
- Developing Light-Weight and High-Performance Metamaterial Concrete, ***Dr. Alavi*** PITT|IRISE



Other

Ongoing Pitt Research

- Developing Methodologies to Predict and Quantify the Benefits of IRISE Research, **Dr. Magalotti** PITT|IRISE
- Tactical Urbanism/Demonstration Projects Guide, **Dr. Stevanovic**
- A Seminar Series on Innovative and Comprehensive Stormwater Management, **Dr. Bain** PITT|IRISE

COST BENEFIT ANALYSIS



PittRigid ME Could Save Millions in Concrete Pavement Costs

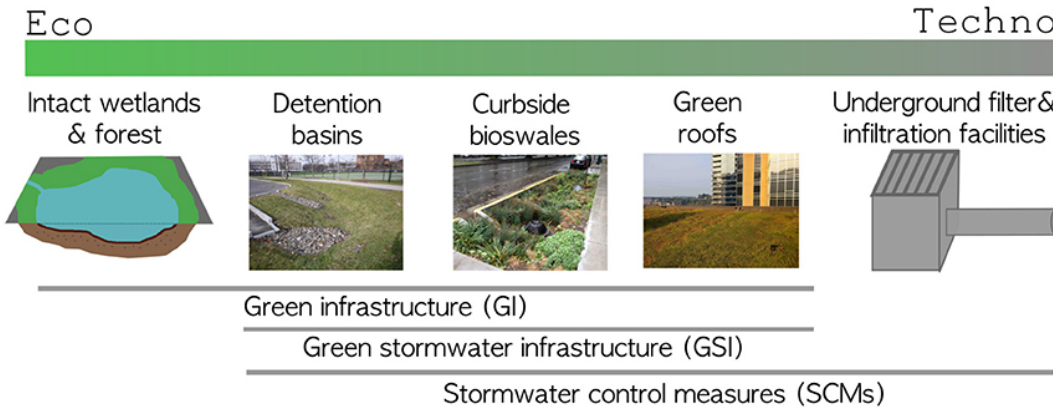
PittRigid ME gives highway designers a practical tool to select the optimal design parameters in Pennsylvania for concrete pavement sections. The PittRigid ME tool is based upon the Multivariate Empirical Pavement Design Guide (MEPDG) and AASHTOWare Pavement ME Design software. The MEPDG method has been shown to produce more efficient and equally durable pavement designs than the AASHTO method currently used in Pennsylvania. Use of the Pavement ME software is currently recommended by AASHTO and FHWA. PittRigid ME produces similar results to Pavement ME for Pennsylvania conditions.

Case study projects were selected from the Pennsylvania Turnpike Commission, PennDOT and Allegheny County of Pennsylvania to demonstrate the benefit of using the methodology for more efficient pavement designs. These case studies represent a variety of conditions in order to illustrate how the application of the ME (Guide) through use of PittRigid ME tool could reduce costs. However, other factors are considered when selecting a pavement design method for a wide variety of conditions.

Potential cost reductions were determined by performing an alternative design using the MEPDG/PittRigid ME design method and calculating the resulting cost reductions based on the project quantities. The results of the analysis revealed these potential cost reductions.

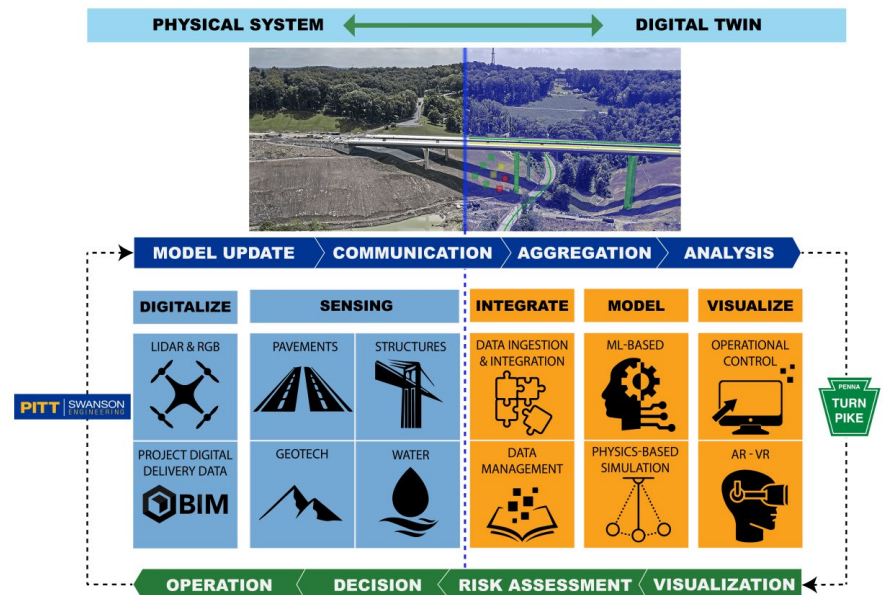
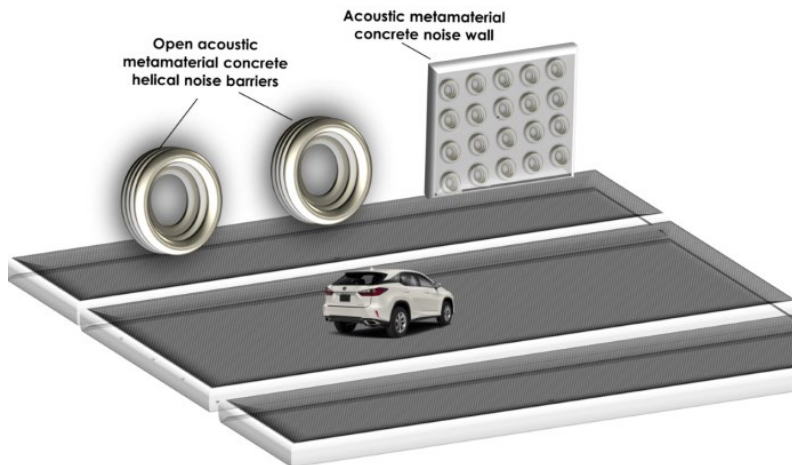
Project	Original Design Total Costs/Depth of Pavement	PittRigid ME Design Total Costs/Depth of Pavement	Cost Reduction
Southwest Bypass	\$44,035,866	\$37,422,089	\$6,613,777
Plan: Concrete			
Pavement RFS	12 inches	8 inches	
IS-119	\$10,646,213	\$8,944,232	\$1,701,981
Plan: Concrete			
Pavement RFS	12 inches	8 inches	
Key Avenue	\$210,375	\$178,819	\$31,556
Plan: Concrete			
Pavement RFS	10 inches	8 inches	
Total			\$8,357,314

This benefit analysis reveals that if the PittRigid ME Design for the three case studies had been used total pavement construction costs would have been reduced by a total of \$8,357,314. As shown, the benefits were significant for all three case studies representing different project scales but not all pavement design scenarios.



Mon Fayette Expressway Test Bed

- Absorptive Sound Walls: **Dr. Alavi**
- Digital Twin Technology: **Dr. Fascetti**
- Electrified Roadway Strategic Plan: **Dr. Alavi**
- Energy Harvesting: **Dr. Alavi**



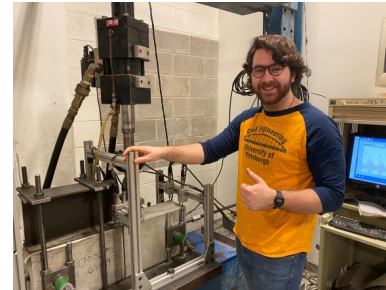
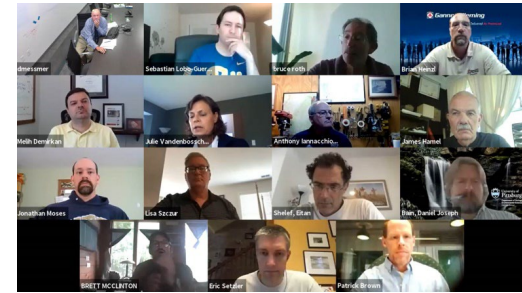
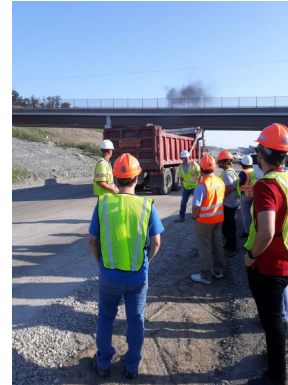
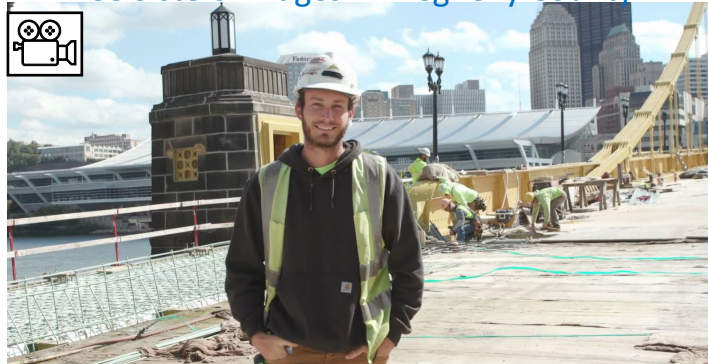
IRISE Year 6 Projects Being Initiated

1. *Bridge*: Bridge Load Ratings, **Dr. Rizzo**
2. *Geotechnical*: Why do they keep sliding? Analysis of Reoccurring Landslides in SWPA to Advance Hazard and Risk Estimates, **Dr. Bain**
3. *Pavement*: Adaptation of a Large Language Model for Facilitating Pavement-Related Information Retrieval and Knowledge Discovery, **Dr. Khazanovich**
4. *Materials*: Self-Heating Concrete Pavement Systems with Surface-Mounted Heating Elements, **Dr. Alavi**
5. *Other*: Supervised Learning for Classification of High-Resolution LiDAR Point Clouds, **Dr. Fascetti**
6. *Other*: Developing and Applying Methodologies to Quantify the Benefits of IRISE Projects, **Dr. Magalotti**

Other Activities

- Student involvement
- Workshops/seminars
- Demonstration projects
- Tech days
- Presentations to help tech deployment
- Other ideas ????

Three Sisters Bridges – Allegheny County



<https://www.engineering.pitt.edu/irise>