

IRISE

ANNUAL REPORT 2021

IRISE Consortium

Impactful Resilient Infrastructure
Science and Engineering







COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION



Friends and Colleagues of IRISE:

The Pennsylvania Department of Transportation is happy to recognize the accomplishments of the IRISE consortium during its first four years of existence. We are looking forward to continuing our active participation in the consortium during the fifth year and into the future. We are facing challenging times as a profession and as an industry. Aging infrastructure, global warming and changes and opportunities arising from rapidly advancing technology all pose new issues and problems that we must address, at a time when funding remains inadequate even after the passage of the Infrastructure Investment and Jobs Act.

Addressing these challenges requires innovation, something PennDOT has recognized through inclusion of Innovation as one of its seven Strategic Themes and Values in its Strategic Plan and through mechanisms such as our State Transportation Innovation Council. One of my favorite quotes is from Margaret Wheatley "The thing we fear most in organizations-fluctuations, disturbances, imbalances - are the primary sources of creativity." As a key part of its organizational culture, PennDOT strives to encourage its employees to be imaginative and innovative.

Our investment in research and development reflects our focus on innovation. And our participation in the IRISE consortium is an important component of our research program. Bill Gates said "Innovation requires the ability to collaborate and share ideas with other people, and to sit down and talk with customers and get their feedback and understand their needs." IRISE certainly exemplifies that thought, providing opportunities for our staff to interact with colleagues from the academic, association, construction and design sectors to identify problems and research needs, help shape the research as it is being planned and conducted and then realizing the benefits resulting from implementing the innovations produce by the research.

It is an exciting time to be an engineer and we are looking forward to an even more exciting future. We eagerly anticipate the innovations that IRISE will be producing to address the infrastructure durability and sustainability challenges we collectively face. I stand ready to support your important work.

Melissa J. Batula, P.E.

Executive Deputy Secretary
Pennsylvania Department of Transportation

Office of the Executive Deputy Secretary
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Greetings

I am pleased to report that the Impactful Resilient Infrastructure Science and Engineering (IRISE) research consortium had a successful fourth year of operation.

As always, we very much appreciate the active participation from our consortium members: Allegheny County, the Constructors Association of Western Pennsylvania, Golden Triangle Construction, Michael Baker International, the Pennsylvania Department of Transportation, the Pennsylvania Turnpike and the Federal Highway Administration as an ex officio member.



Multiple representatives from all of our members provide invaluable contributions in many ways. They help identify relevant highway infrastructure durability and sustainability issues such as corrosion prevention; pavement design, construction and maintenance; development and application of new materials; and landslide and stormwater management. They then participate on project panels and help define the scope of each project and make sure that the research is conducted in a manner that will provide relevant and implementable results. All of their efforts are much appreciated.

This fourth annual report provides information on what we accomplished together this past year, and what we hope to accomplish in the future. We strive to develop research products that help current professionals perform their jobs more safely and effectively. At the same time, we strive to contribute to the knowledge base of emerging professionals by integrating these products into the civil and environmental engineering curriculum.

We are pleased with the variety of projects that we've undertaken as summarized in this report. Additional information on these is available on our website (engineering.pitt.edu/irise). And we are looking forward to getting our fifth year program started this fall.

With the increasing recognition of the poor state of much of our highway infrastructure and how that negatively affects the economy and quality of life, and with the continuing importance of investing available funds wisely to account for durability and sustainability, we remain excited about applying our expertise in partnership with our members to produce practical, innovative solutions to these problems.

We are very proud of the history and tradition of civil and environmental engineering education and research at Pitt. We invite your continuing active participation and look forward to working with you to make our future work even better.

Julie M. Vandebossche, PhD, PE
Director, IRISE

PITT | IRISE

CENTER FOR IMPACTFUL RESILIENT
INFRASTRUCTURE SCIENCE & ENGINEERING

Why IRISE

The Impactful Resilient Infrastructure Science and Engineering (IRISE) Consortium was established in the Civil and Environmental Engineering Department in the University of Pittsburgh's Swanson School of Engineering in the Fall of 2018 to develop innovative solutions that address the durability and resiliency challenges associated with aging highway infrastructure.

IRISE is guided by two main principles:

- Innovative solutions to highway infrastructure problems are best achieved through a collaboration between the public agencies that own and operate the infrastructure and the private companies that design and build it.
- Highway infrastructure research must aim to provide implementable solutions that meet the needs of these agencies and companies.



Over its life, IRISE has produced research products addressing member needs in areas such as bridge corrosion and condition assessment, landslide risks, and concrete pavement design, materials and strength evaluation. As described in this report, ongoing efforts are exploring issues related to research benefits analysis, landslide best practices and data analysis, highway construction worker safety, and pavement construction, materials and performance.

Through their participation throughout the whole research cycle, beginning with the generation of ideas through project development and execution and implementation of results, members are acquiring knowledge to solve problems they face and improve their services.





IRISE Partnerships

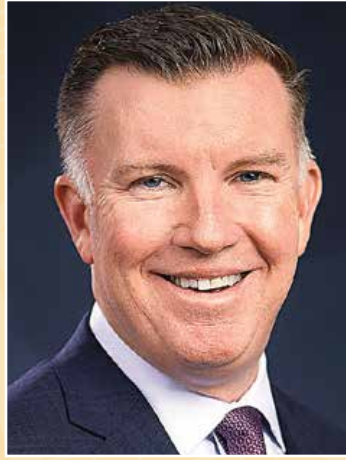
The University of Pittsburgh is joined by three public, two private and one association organizations that comprise the IRISE consortium partnership. The Federal Highway Administration also serves as an ex-officio member.

Each organization is represented on the IRISE Steering Committee. The individuals shown contribute towards defining each year's research program and appoint representatives from their organizations to individual project panels to help define each project's detailed scope, to keep the research relevant as it proceeds, and to build interest in implementing the innovations that result.





Rich Barcaskey
Executive Director
Constructors Association
of Western Pennsylvania



Mark Compton
Chief Executive Officer
Pennsylvania Turnpike Commission

"The Pennsylvania Turnpike appreciates IRISE's focus on research products that address real problems. The solutions developed by IRISE add tremendous value for us as we strive to continually innovate and be the leader in transportation and customer services."

– Mark Compton



Chuck Niederriter
Chief Operating Officer
Golden Triangle Construction



Michael Schultz
*Strategic Planning and
Program Manager*
Pennsylvania Turnpike Commission



Steve Shanley
Director
Allegheny County
Department of Public Works



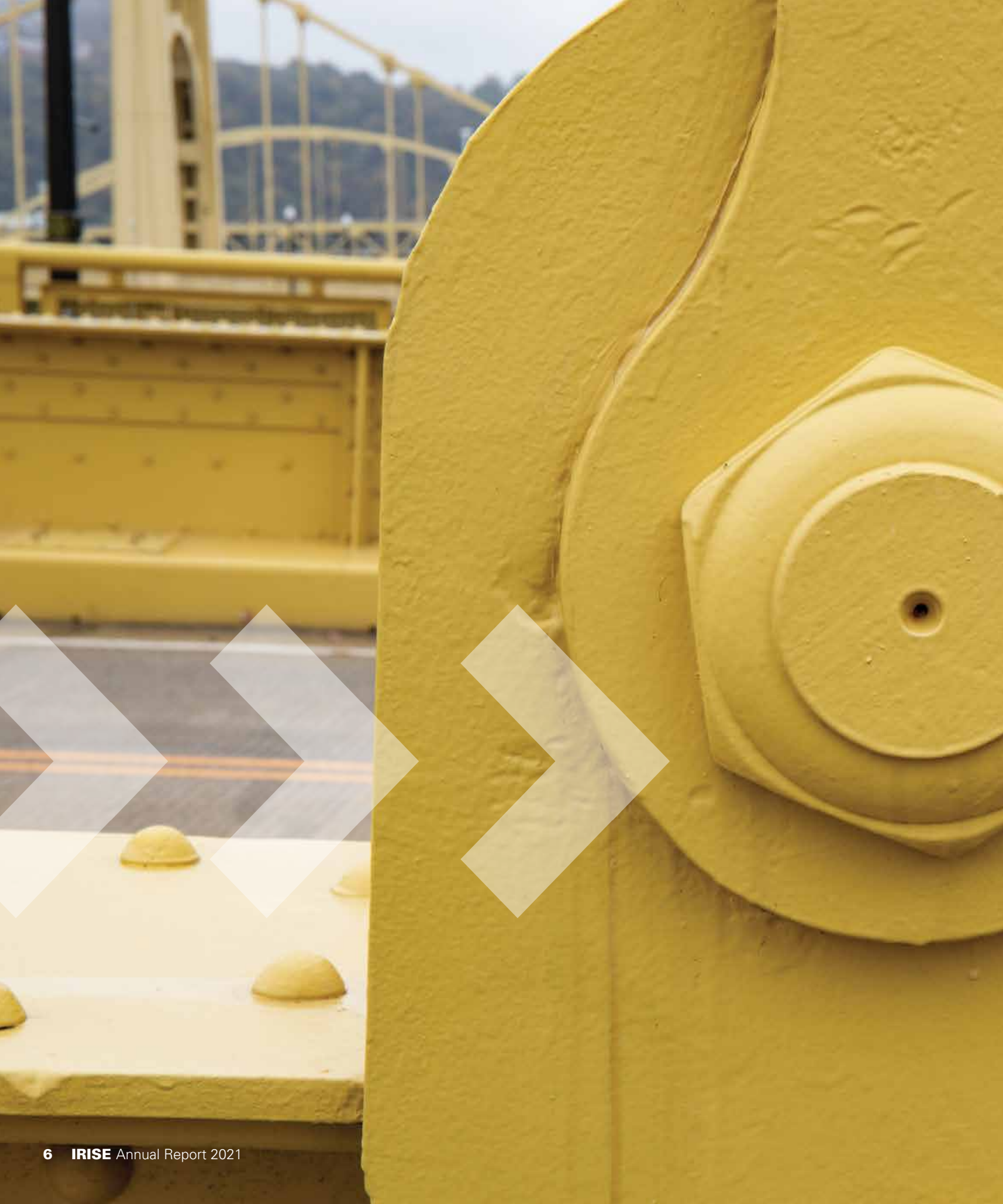
Brian Wall
Research Division Manager
Pennsylvania Department
of Transportation



Tom Zagorski
Senior Vice President
Construction Services
Michael Baker International

"At Michael Baker, we strive to continuously innovate in order to be the best professional services company in the industry. Our IRISE membership helps us achieve that, while at the same time, enabling us to engage with the other members in order to better serve the community."

– Tom Zagorski





Activities

The following sections contain capsule descriptions of the individual projects that IRISE has completed, are ongoing or being initiated in 2022. The graphic below depicts how each of the projects fit into the IRISE research framework. More information on each project can be found on the IRISE website: engineering.pitt.edu/irise





Projects Completed this Past Year

Improving Bridge Assessment through the Integration of Conventional Visual Inspection, Non-Destructive Evaluation and Structural Health Monitoring Data

This project established a framework for integrating traditional non-destructive evaluation (NDE) and emerging automated unmanned aerial vehicle (UAV)-based techniques to provide improved performance assessment of bridges. The framework focuses on addressing the principal challenges associated with studying the service life of bridge structures: (a) the long time scales (which requires accelerated aging), (b) the diverse outputs related to bridge condition (in terms of data collected through UAV, NDE, and visual inspection), and (c) an advanced data interpretation and fusion framework for automated detection and quantification of bridge surface and subsurface defects. Data processing frameworks based on deep learning and a systematic UAV data collection strategy were developed to automatically detect the surface defects from High Definition (HD) images and subsurface defects from Infrared thermography (IR) images.

Final Report: https://issuu.com/pittswanson/docs/bridge_assessment_final_report_irise

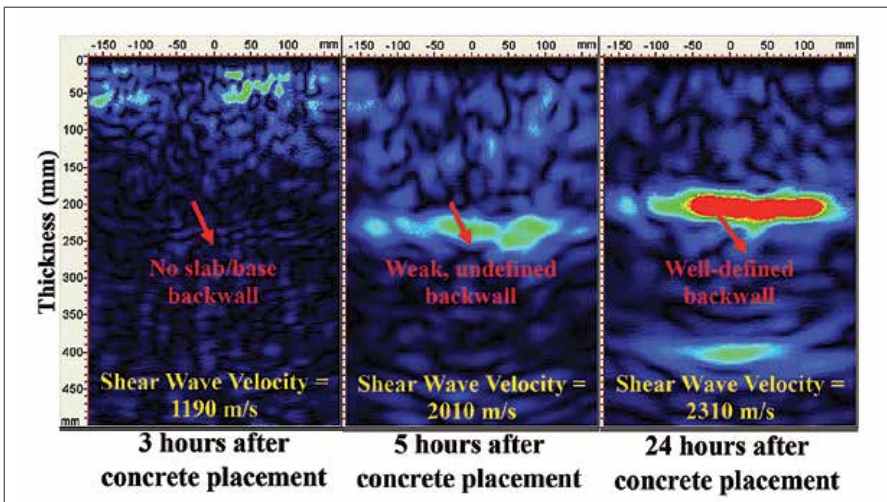
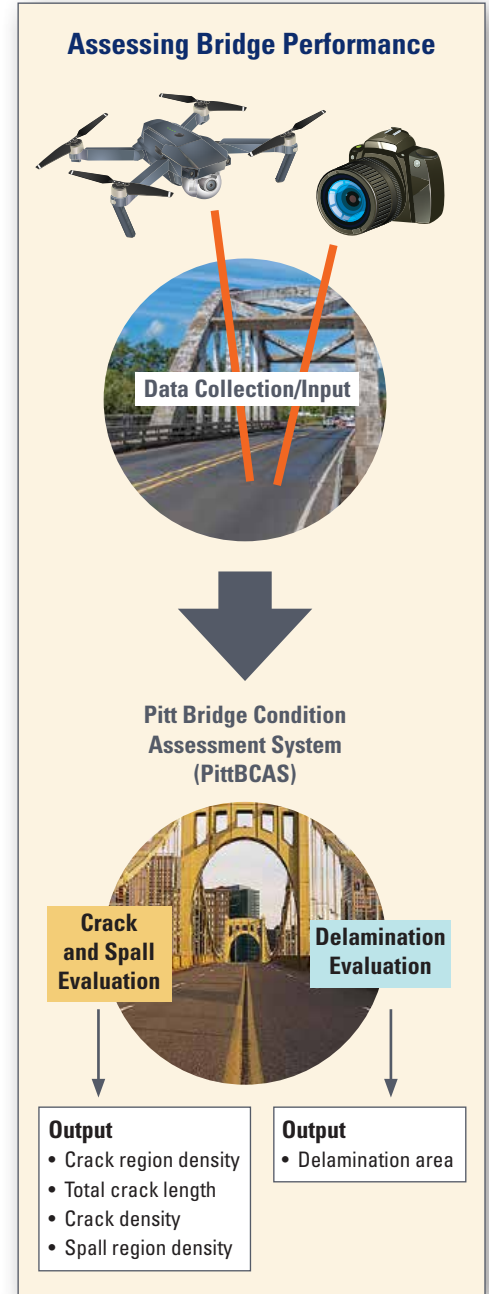
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Early Opening of Concrete Pavements to Traffic

Under this project, laboratory and field studies were conducted and established that both the maturity method and ultrasonic tomography are efficient and produce reasonable in-situ concrete strength estimations for pavements. A strength gain prediction model was created using both nondestructive methods that combined the benefits of ultrasonic tomography for strength estimation with the predictive ability of the maturity method for future strength development prediction. A mechanistic-based early opening damage analysis procedure was developed to predict the effect of early loading on transverse cracking and dowel bar performance for Pennsylvania climatic conditions. A web-based tool was created to facilitate the implementation of this procedure for determining the optimal time when paving projects can be opened to traffic without significant damage. User cost analysis showed that early opening a pavement to traffic would have significant benefits on urban arterial roadways and a minor effect on freeways.

Final Report: https://issuu.com/pittswanson/docs/early_opening_final_report_irise_cover

Tool: <https://pittearlyopenpcc.azurewebsites.net/>



Ongoing Projects

Developing Methodologies to Predict and Quantify the Benefits of IRISE Research

Methodologies are being developed and applied to estimate the benefits associated with implementation of the research products for six IRISE projects, based on data obtained from IRISE agency members and other public information.

1. Development of a Simplified Rigid Pavement ME Design Tool for Pennsylvania (completed)
2. Joint Design Optimization
3. Landslide Best Practices
4. Material Compatible Partial Depth Concrete Repair
5. Pavement Asphalt Surface Distress Associated with Pavement Markings
6. Remote-Controlled Technology Assessment for Safer Pavement Construction and QA/QC

After each analysis is completed, a one page summary is being prepared and made available to members and will be posted under the project pages on the IRISE website.

Development of a Roadway Landslide Inventory and Analytical Tool for Southwestern Pennsylvania

This project will develop a unified inventory of landslide data incorporating extensive geophysical information providing interested parties with access to a comprehensive and consistent database. Reflecting cumulative experience from across the region, data from the inventory could be used to guide mitigation efforts, help identify the most important causes for slope failure and/or locations that are most likely to fail and advance an effective proactive approach to landslide monitoring and mitigation. Specifically, the project will:

- Design a structure for a unified landslide inventory that addresses the needs of stakeholders in Southwestern Pennsylvania
- Initiate a data collection effort to establish a working database to serve as a platform to enhance investigations of this important regional topic
- Document workflows that will enable the collection, sharing, and analysis of new data across agencies
- Demonstrate the power of a comprehensive landslide inventory database through evaluations of data collected to assist in risk assessment and prioritization of landslide locations.





Identifying Major Causes of Highway Construction Accidents

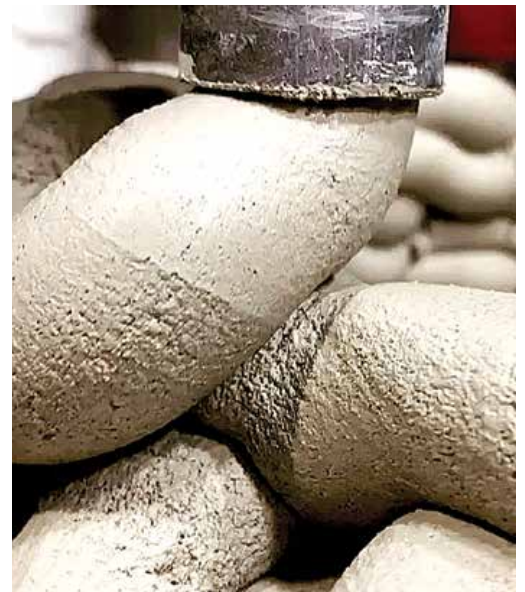
According to the National Institute for Occupational Safety and Health (NIOSH), half of all accidents in the highway and street construction industry result from the movement of construction equipment and other construction-related activities. Using historical data related to road construction accidents in Pennsylvania, this project will identify and rank dangerous scenarios, taking into consideration near-misses, in highway and street construction in Pennsylvania. The project will develop recommendations for avoiding or minimizing dangerous scenarios in the future and provide qualitative information for the improvement of safety training and development of safety-related equipment.

Integrating Additive Manufacturing and Accelerated Bridge Construction Techniques

This project is exploring the feasibility of integrating additive manufacturing with Accelerated Bridge Construction (ABC) techniques in Pennsylvania. It is focusing on identifying, fabricating and mechanically testing a range of 3D printable prefabricated bridge elements currently used in the ABC projects. The main goal is to address the major challenges associated with the reinforcement of 3D printed prefabricated concrete elements. Concrete beams will be 3D printed and tested to identify efficient reinforcement strategies and concrete mixtures. A range of small-scale prefabricated bridge elements commonly used in ABC practice will then be 3D printed.

Investigating New Underground Utility Location Technologies and Novel Methods to Improve the Safety and Efficiency of Highway Construction

Under this project, current and emerging technologies that could more accurately determine lateral position and depth of known and unknown utilities will be investigated. The types and locations of utilities, and the accuracy, complexity, and duration of data analyses of conventional testing methods will first be evaluated. Next, current DOT methods and technologies used across the US as well as new and emerging technologies will be evaluated and promising technologies identified. Field test sites with verified location of underground utilities where detection might be a challenging problem will be identified and a testing program developed to assess the ability of these new methods to identify utility location. Recommendations for the selection of equipment and test protocols will be developed.





Joint Design Optimization

Joint performance is dependent on the interaction between the individual elements of the pavement structure, such as load transfer, drainage and joint reservoir/sealant design. For example, the selection of the joint sealant type and the design of the sealant reservoir must consider the pavement structure (base type, slab length, and dimensional stability of the concrete), the anticipated level of traffic and the expected opportunities for maintenance. Yet traditionally, most of these individual elements are designed without regards to these interactions. The type, reservoir design, construction practices and performance of joint sealants in Pennsylvania will be explored and guidance on strategies for optimizing joint performance will be developed. The work on this project is being coordinated with the activities being performed in this area by the Concrete Paving Quality Initiative group.



Landslide Best Practices

The project will produce a Southwestern Pennsylvania region-specific best practices document for practicing geotechnical engineers and geologists engaged in mitigating adverse impacts from active landslides or reducing the risk of landslide movements for infrastructure. The project is identifying and characterizing how landslides can be mitigated under a range of initiating conditions and identifying improvements needed in current design and permitting procedures and procurement practices. The first part of the manual focuses on landslide characteristics (slope movement and failure prone mechanisms), landslide investigation, instrumentation and monitoring and slope maintenance, while the latter portion will focus on stabilization methods (design, economical and construction aspects) and slope management practices.



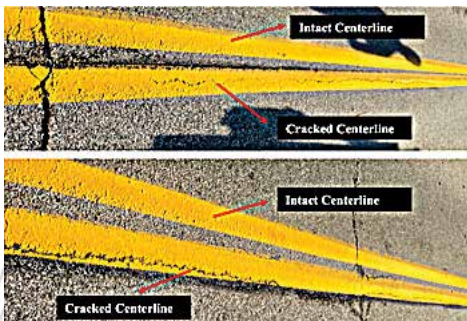
Material Compatible Repairs Evaluation

To address the incompatibility between in-situ concrete and repair material, a research project entitled "Material Compatible Repairs (MCR) for Concrete Pavements and Bridge Decks" was conducted as part of IRISE's first year program. Based on laboratory studies, the research shed light on the importance of using MCRs and best practices to develop a performance engineered repair material to be used for the MCR. This project will assess the performance of actual partial depth repairs made using the recommendations in the research report in comparison with partial depth repairs made using standard PennDOT mixtures in similar settings. Concurrently, for the same repairs, the ability of ultrasonic tomography testing to provide reliable information for required partial depth repair dimensions and evaluate bond condition after repair placement will be investigated.



Preliminary Evaluation of Pavement Surface Distresses Related to Pavement Markings

This project is investigating whether pavement markings are causing pavement surface deterioration in Pennsylvania and, if so, the project will develop approaches for mitigating the problem. Visual surveys were performed on several pavement sections to identify if the surface distresses are located directly below or in the vicinity of the markings. Nondestructive testing will be performed to estimate asphalt concrete density under the markings, and finite element simulations will be used to evaluate the effect of temperature differences between the pavement markings and the surrounding pavement surface.



Remote-Controlled Technology Assessment for Safer Construction

New and emerging processes that can be deployed for safer construction practices are being explored. Three technologies will be the subject of technology transfer workshops that will brief participants on these technologies and implementation experiences, and provide perspectives on future trends.

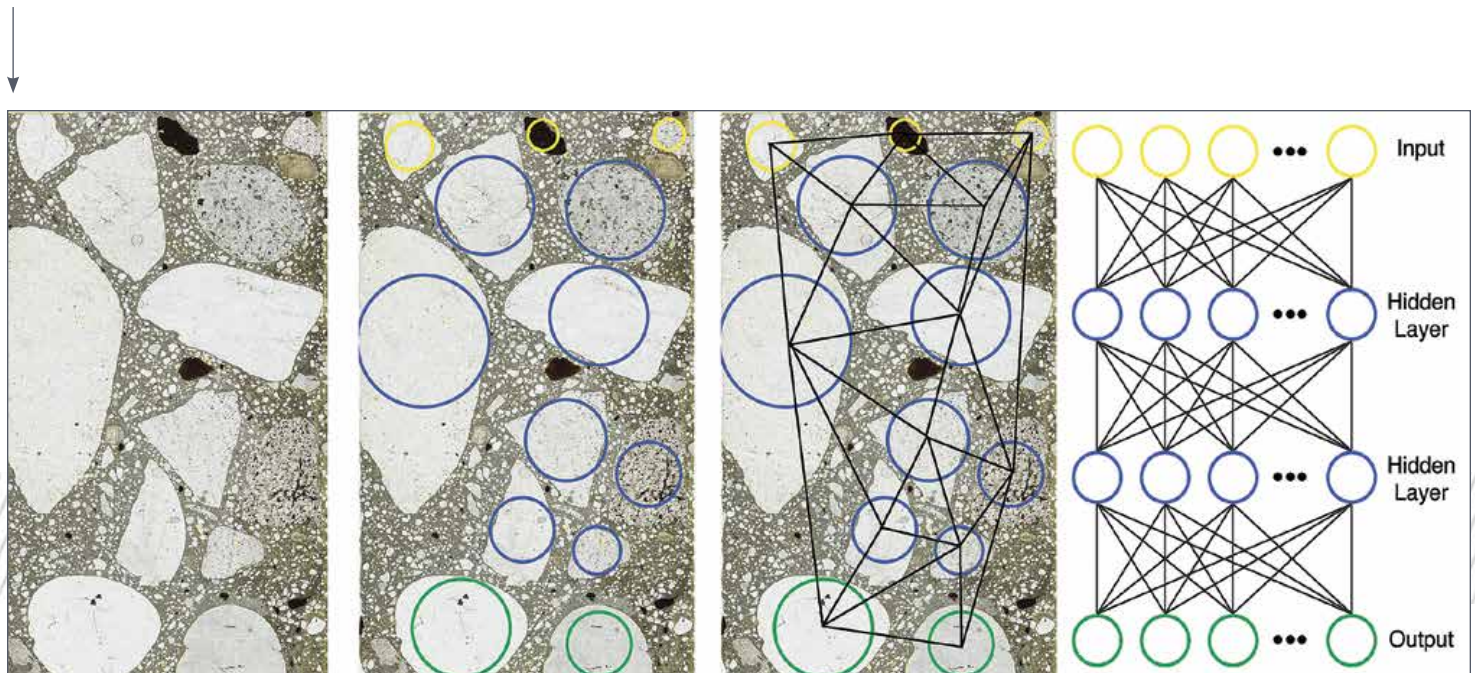
- Automated Real-Time Thermal Profiling for Asphalt Paving using Infrared Cameras in order to determine the asphalt material temperatures continuously during paving.
- Remote-Controlled Roller Density Meter to provide quick and comprehensive density data for the asphalt layer during and after compaction.
- Autonomous Impact Protection Vehicle for its potential for safety improvement of any activity directly related to work zone safety.

Recommendations will be developed providing information on the potential benefits and associated cost, as well as possible specification limits.



Three-dimensional Micro-Mechanical Characterization of the Effect of Vibration and Compaction in Concrete Pavements

This project is investigating the effects of vibration and compaction operations in slipform paving under variable environmental conditions. First, it will identify the effects of different vibration and compaction strategies, as a function of the mix design and the ambient temperature and humidity. Based on these results, this research will build and validate novel computational tools to parameterize the solution space and identify best practices for optimal results. Findings will serve as the basis for the definition of guidelines to allow for the optimized construction of concrete pavements under different conditions.





Planned Program

The IRISE annual work program planning process commences in the fall with a brainstorming session, held on December 2, 2021. Research ideas were gathered in advance through discussions with representatives of IRISE member organizations. These were discussed during the brainstorming session, and IRISE staff subsequently identified the ideas that generated the most interest. Short problem statements for these topics were prepared and discussed with the IRISE Steering Committee. The Steering Committee approved development of detailed scopes of work for a subset of these problem statements and these were distributed to and discussed with member technical representatives.

The project ideas below emerged from that process. If approved by the IRISE Steering Committee, work on these projects is expected to be initiated in the fall of 2022.

A Novel Immersive Virtual Reality (VR) Platform for H&S Training of Construction Workers

This project would create and deploy an immersive VR testbed to provide advanced training to construction workers and quantify the benefits of the adoption of VR in construction health and safety.



A Seminar Series on Innovative and Comprehensive Stormwater Management to Produce Multiple-Benefits in the Appalachian Plateau

A series of seminars would be conducted to share knowledge about storm water control technologies, particularly green infrastructural approaches, effective cross-jurisdictional strategies, and scenarios of climate and regulatory strategy.



A Novel Methodology for Structural Optimization of Bridge Decks Against Corrosion

The goal of this research is to identify the complex interrelationships between the temporal and spatial frequency of salt application and corrosion mitigation strategies.



Design and Construction of Two-Lift Concrete Pavements for Pennsylvania

This project would develop design and construction recommendations for two-lift concrete pavements for Pennsylvania conditions, including testing of appropriate concrete mixes for both top and bottom layers, with focus on the former's high-performance needs and the latter's economical and sustainable aspects.

Developing Light-Weight and High-Performance Metamaterial Concrete

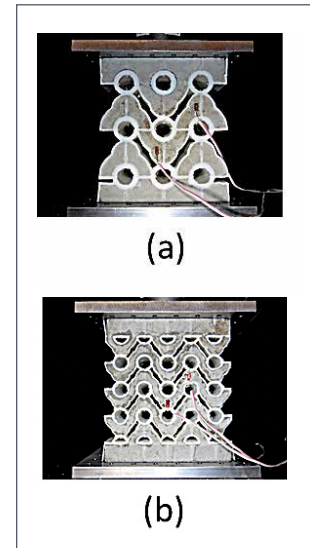
Under this project, metamaterial designs for concrete-based beams and slabs would be investigated, with focus on metamaterial design, determination of mechanical properties, fabrication and experimental testing of large-scale metamaterial slabs and cost-benefit analysis.

Prediction of Dowel Corrosion and Effect on Performance of Concrete Pavements

The goal of this research is to quantify the corrosion development of dowel bars and correlate corrosion to loss of joint performance. The outcome would be a predictive model that accounts for key parameters including dowel type and exposure to deicing materials.

Seal Coat for Asphalt Pavements: Best Practices and Experience

This project would develop design, construction and inspection guidelines for successful and uniform use of seal coats in Pennsylvania, based on both positive and negative experiences with seal coating from different parts of the US contrasted with experience with current Pennsylvania practices.

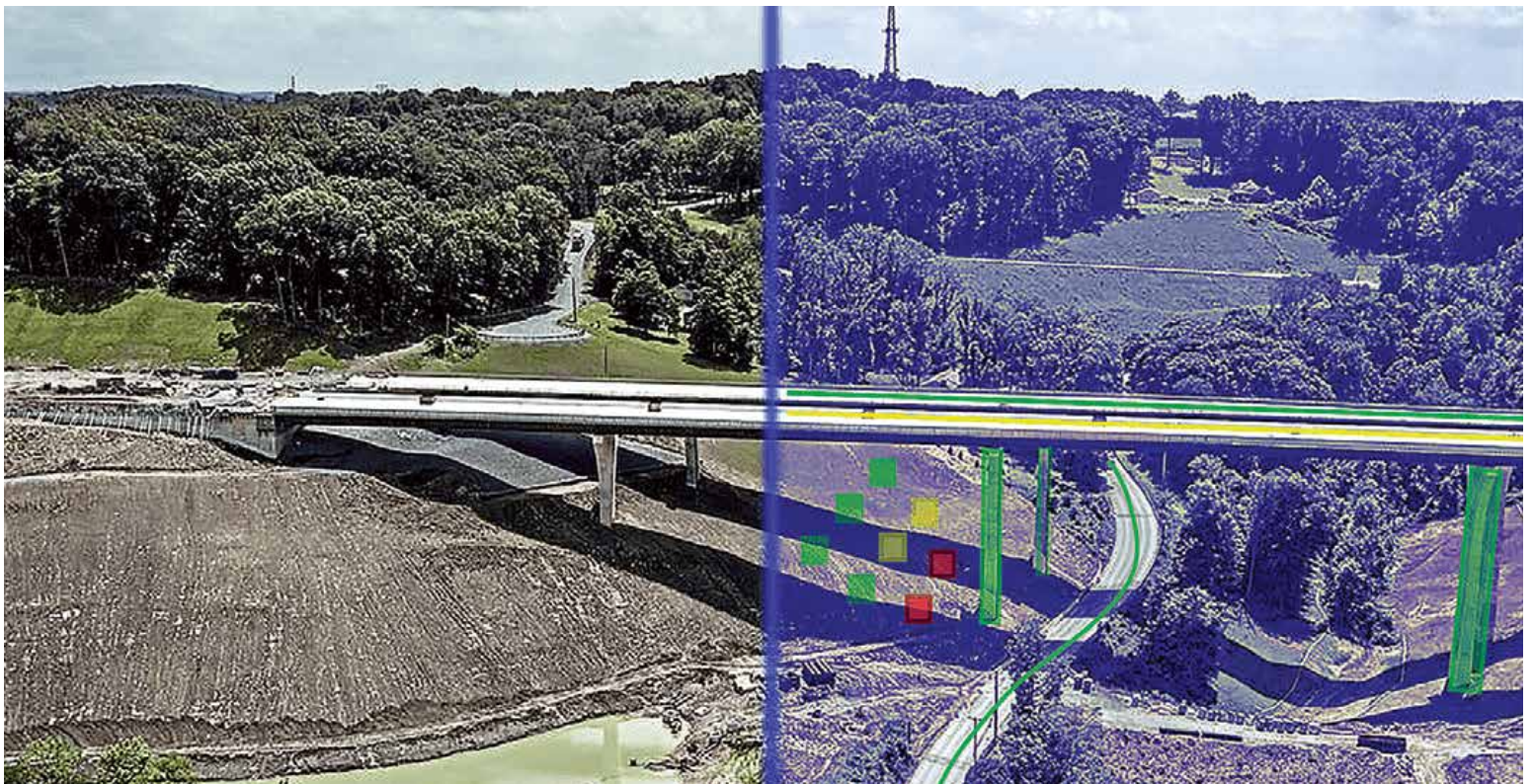


Pennsylvania Turnpike Initiative

During the past year, Pitt faculty were engaged in discussions with Pennsylvania Turnpike representatives to conduct research exploring innovations that could be applied as design and construction of the Mon-Fayette Expressway Extension proceeds. Four areas of interest were explored:

- Absorptive Sound Walls that would serve to both reduce noise and emissions and produce material cost savings
- Developing a Digital Twin of a selected portion of the Expressway to enable a holistic approach for resilience assessment, advanced predictions and risk-based maintenance of assets such as bridges, pavements, and stormwater management facilities.
- Harvesting energy from roadway traffic mechanical excitations of a geogrid for empowering roadside electronic devices.
- Developing a strategic plan to guide Turnpike investment decisions and policies in the coming years as the Electric Vehicle and Dynamic Wireless Charging technologies advance.

Work on several or all of these research topics could be advanced in 2022 as decided by the Turnpike.





Student and Post-Doc Involvement

Students and post-doctoral fellows benefit from IRISE activities in several ways. A number of students and post-docs were financially supported and directly involved in IRISE projects. They, and many others, benefited from participating in IRISE events and having information from IRISE projects included in their courses to help them bridge the gap between research and practical application.

Post-Doctoral Fellows

Lucio Salles de Salles, PhD played important roles on several IRISE projects: Early Opening of Concrete Pavements, Distresses Due to Pavement Markings, Major Causes of Highway Construction Accidents, Technology Assessment for Safer Construction and Utility Location Technologies. His research interests include full-scale and non-destructive pavement testing, finite element modeling and simulation, road markings, and overall pavement design and performance.



Sushobhan Sen, PhD contributed to the Distress Due to Pavement Markings project. His research interests are in pavement sustainability, climate change adaptation and computational modeling.



Naser Sharifi, PhD contributed to the Early Opening of Concrete Pavements project. His research interests are novel techniques to increase the service life of concrete pavements and identifying best practices in concrete pavement design and maintenance in wet-freeze climates.



Students

Students supported by IRISE projects during the past year, are described below:

- **Zachary Brody**, PhD student – JPCP Joint Design Optimization
- **Nathan Buettner**, Masters student – Early Opening of Concrete Pavements
- **Megan Darnell**, PhD student – 3D Micro-mechanical Characterization of the Effects of Vibration on PCC
- **Charles Donnelly**, PhD student – Early Opening of Concrete Pavements
- **Kit Leng Ing**, Undergraduate student – Methodologies to Quantify Benefits of IRISE Research
- **Katelyn Kosar**, PhD student – Early Opening of Concrete Pavements and Technology Assessment for Safer Construction
- **Haoran Li**, PhD student – Early Opening of Concrete Pavements and Distresses Due to Pavement Markings
- **Ping Lyu**, PhD student – 3D Micro-mechanical Characterization of the Effects of Vibration on PCC
- **Zhe Wan**, PhD student – Early Opening of Concrete Pavements and Distresses Due to Pavement Markings
- **Robert Wildish**, Undergraduate student – Technology Assessment for Safer Construction
- **Gloria Zhang**, PhD student – Improving Bridge Assessment Project





Student Events

← IRISE is very proud that one of our supported students, **Gloria Zhang**, won two prestigious awards this past year for her work on the Improving Bridge Assessment project. Gloria won the James D. Cooper Student Paper Competition, an annual competition among college and university engineering students “worldwide” sponsored by The International Bridge Conference . She was also awarded a scholarship by the Pittsburgh Chapter of the Association for Bridge Construction and Design.



← Although precautions due to the continuation of the pandemic prevented many in person events from occurring, the Pennsylvania Turnpike hosted Pitt faculty and students for a tour of the Southern Beltway project as the new section between US Route 22 and I-79 neared completion. The visit included a tour of the entire new facility, with intermittent stops to observe and discuss final paving operations, major structures, environmental issues that were addressed during construction, electronic tolling systems and a new maintenance facility.

IRISE Cooperative Education Scholarship Program

IRISE has established a Cooperative Education Scholarship Program to encourage students to consider careers in transportation infrastructure. The scholarship provides an opportunity for students to complete rotational assignments in fields of employment offered by the IRISE partners: construction, design and public owners/operators, as well as to gain experience in both the private and public sectors. The selected student gains valuable insight and experience to guide their career choice.

Each year a student is selected through a competitive process and awarded a scholarship of \$3,000. After the successful completion of each of the two six-month rotations the student is awarded \$1,500.



← This year’s selectee was **Gabriel Salgado**. Gabriel just completed his sophomore year in civil engineering with an interest in construction materials. He has also participated in several activities including the Debate Club, the Model United Nations and Engineers Without Borders.

Other Contributors

IRISE would also like to recognize the contributions of two others during the past year:

← **Fatma Ciloglu, PhD** served as the Principal Investigator for the Landslide Best Practices project. Dr. Ciloglu is an Associate Vice President and the Geotechnical Department Manager for IRISE member Michael Baker International.

Charles Nash provided valuable contributions to the Methodologies to Quantify Benefits of IRISE Research project. Mr. Nash is a Practice Leader with MS Consultants with extensive experience and knowledge in highway design and construction.





Faculty

- 1. Julie Vandebossche, PhD, PE** serves as the IRISE Director and the Principal Investigator (PI) for the Joint Design Optimization and the proposed Dowel Corrosion projects. Her research interests are concrete pavement analysis, design, evaluation, rehabilitation, and construction, including Instrumentation and advanced material characterization. She has collaborated with state agencies, contractors and suppliers and others to help ensure research products are relevant and implementable.
- 2. Gary Euler** serves as the Associate IRISE Director, with day-to-day management responsibilities. His experience includes time as a senior program manager in the Federal Highway Administration and as an engineering company business development manager.
- 3. Joe Szczur, PE** is a Senior Advisor who provides a unique perspective on challenges facing the industry based on his 37-years of experience, including over 16 years as the District Executive for PennDOT's Engineering District 12 in Southwestern Pennsylvania. Mr. Szczur is also serving as Senior Advisor for the Landslide Inventory project.
- 4. Amir Alavi, PhD** served as the PI for the Improving Bridge Assessment project and is the PI for the Additive Manufacturing and Accelerated Bridge Construction project and the proposed Lightweight Metamaterial Concrete project. His research interests include structural health monitoring, smart civil infrastructure systems, deployment of advanced sensors and engineering informatics.
- 5. Daniel Bain, PhD** is the PI for the Landslide Inventory and Analytical Tool project and the proposed seminar series on Comprehensive Stormwater Management. Dr. Bain is in the University's Department of Geology and Environmental Science. His research focuses on human driven changes in environmental systems.
- 6. John Brigham, PhD** is the PI for the proposed Structural Optimization of Bridge Decks Against Corrosion project. He provides expertise in computational diagnostics and inverse mechanics related to the testing of materials.
- 7. Alessandro Fascetti, PhD** is the PI for the Three-dimensional Micro-mechanical Characterization of the Effect of Vibration and Compaction in Concrete Pavements project and for the proposed Virtual Reality Platform for Health & Safety Training of Construction Workers project. His research interests revolve around the physical processes that contribute to the degradation of civil infrastructure systems
- 8. Joel Haight, PhD, PE** is advising on the Major Causes of Construction Accidents project. Dr. Haight is in the University's Department of Industrial Engineering. He previously served as a Research Manager in the National Institute for Occupational Safety and Health. He applies an operations research approach to optimizing the performance of human driven systems.



9. Kent Harries, PhD, P. Eng. led the discussion on bridge research needs during the Fall 2021 Brainstorming session. His research interests include the use of nonconventional materials in civil infrastructure.

10. Anthony Iannacchione, PhD, PE, PG is advising on the Landslide Inventory and Analytical Tool project. Prior to his time at Pitt, he worked for the U.S. Bureau of Mines and National Institute for Occupational Safety and Health. His expertise is in the design of underground facilities with minimal risk of environmental or workplace harm.

11. Lev Khazanovich, PhD is served as the PI for the Early Opening of Concrete Pavements to Traffic project. He is currently serving as the PI for the Evaluation of Pavement Surface Distresses Related to Pavement Markings, the Remote-Controlled Technology Assessment for Safer Construction, the Utility Location Technologies and the Major Causes of Construction Accidents projects. His research has featured performance prediction modeling, non-destructive testing and finite element modeling.

12. Mark Magalotti, PhD, PE is serving as a senior advisor and as the PI for the Benefits Analysis project. Dr. Magalotti previously served as the Coordinator of the Civil and Environmental Engineering Department's Transportation Graduate Program and is currently a Senior Lecturer in that program. His research interest is multi-modal transportation planning.

13. Steve Sachs, PhD is the Principal Investigator for the Materials Compatible Repairs Evaluation project. His research interests include pavement design and analysis, finite element modeling, and experimental characterization of structures and materials.

14. Eitan Shelef, PhD is participating in the Landslide Inventory and Analytical Tool project. He is in the University's Department of Geology and Environmental Science. His research interests include linking climate change with hill slope processes and modeling landscape evolution by various types of erosive processes.

15. Aleksandar Stevanovic, PhD, PE analyzed user benefits as part of the Early Opening of Concrete Pavements project. His research interests include traffic signal control systems, intelligent transportation systems, multimodal and sustainable operations and transportation simulation modeling.



The FUTURE

The Infrastructure Investment and Jobs Act provided additional Federal funding to repair roads and bridges. While this additional investment will be beneficial and was much needed, overall highway infrastructure repair funding levels will still fall well short of identified needs.

It remains critical that innovative approaches to improving infrastructure durability and sustainability in order to make best use of available funding are developed and implemented.

IRISE will continue to work with its members to address their problems related to bridges, geotechnical engineering, materials, pavements, safe construction methods, and stormwater management. Rapid advancements in areas such as electric vehicle charging, connected vehicles and virtual reality technology will provide opportunities for new ideas and innovations. IRISE will work to increase the leveraging of member contributions to address these needs by obtaining additional financial support through membership growth and pursuit of research funding opportunities offered by local, State and Federal organizations and agencies.



The background of the image is a dark blue city map with a grid of streets. Overlaid on the map are several glowing, curved light trails in shades of blue and orange, suggesting movement or data flow. The scene is filled with a digital atmosphere, with numerous small, glowing binary digits (0s and 1s) scattered throughout. In the lower-left quadrant, there are two large, semi-transparent, diamond-shaped overlays that appear to be part of a data visualization or interface.

It remains critical that innovative approaches to improving infrastructure durability and sustainability in order to make best use of available funding are developed and implemented.

IRISE Consortium

Impactful Resilient Infrastructure
Science and Engineering



engineering.pitt.edu/irise



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05/22