

## **IRISE Consortium**

**Impactful Resilient Infrastructure  
Science and Engineering**

Annual Report 2020



175

CELEBRATING  
175 YEARS  
OF ENGINEERING  
EXCELLENCE  
1846-2021



University of  
Pittsburgh

Swanson School  
of Engineering

BENEDUM  
HALL



BIOENGINEERING

50

CELEBRATING

50

YEARS

OF

RESEARCH

AND

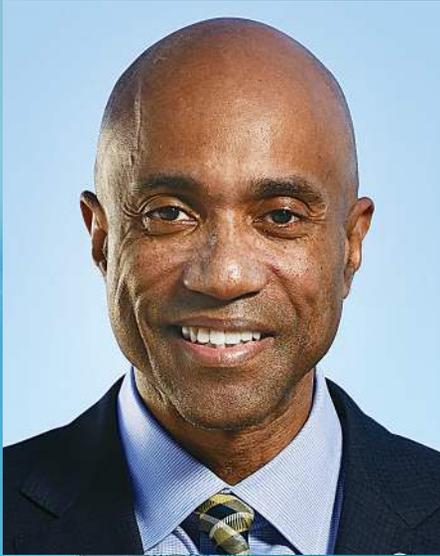
EDUCATION

AT

UNIVERSITY

OF

PITTSBURGH



Friends and Colleagues of IRISE,

The challenges of COVID-19 and the disruption of the past year have transformed us as a society, individuals, and as a profession. Our mission as engineers has always been to create new knowledge that improves the human condition. The work of our IRISE Consortium is exemplary of that task – throughout the pandemic, its research and collaborations have established new foundations for infrastructure technology.

I share a bias of pride in this IRISE report, not only as a civil engineer but for the impact our profession has had on the evolution of engineering at Pitt. This year we mark three important milestones:

- The 175th anniversary of the first students to earn engineering degrees from the Western University of Pennsylvania (today's Pitt)
- The 100th anniversary of the establishment of our American Society of Civil Engineering chapter
- The 50th anniversary of the opening of the Benedum Hall of Engineering

Indeed, our first two engineering graduates, Isaac Morley and J.B. Stilley, would today be considered civil engineers. After graduation they influenced nascent engineering programs for the City of Pittsburgh and Allegheny County, respectively.

I can say with conviction there has never been a more important time for leadership and for the profession of engineering to provide solutions for an increasingly complex world – our value has never been higher. My congratulations on another year of success and I look forward to future solutions from this critical collaboration.

– Jimmy

**James R. Martin II, PhD, M. ASCE**  
*U.S. Steel Dean of Engineering*

**PITT** | **SWANSON**  
ENGINEERING



OUTS FOR LIFE

## Greetings

I am pleased to report that despite the challenges associated with the pandemic, the Impactful Resilient Infrastructure Science and Engineering (IRISE) research consortium had a successful third year of operation.



We very much appreciate the active participation of our founding consortium members: Allegheny County, Golden Triangle Construction, Michael Baker International, the Pennsylvania Department of Transportation and the Pennsylvania Turnpike. The Federal Highway Administration has also been participating as an important ex officio member. We are also very excited to welcome the Constructors Association of Western Pennsylvania (CAWP) as our newest member. They have already contributed greatly to the worker's safety initiative that IRISE has undertaken.

Input from all of our members has been invaluable in many ways – identifying relevant issues, such as the increase in the occurrence of landslides developing in southwestern Pennsylvania and the safety of construction workers; guiding the research as it is being performed; and providing students opportunities beyond the classroom including engaging with professionals.

This third annual report provides information on what we accomplished together and what we hope to accomplish in the future. We are excited about the variety of projects that we have been able to undertake, as summarized in this report. Additional information is available on our website ([engineering.pitt.edu/irise](http://engineering.pitt.edu/irise)). And we are looking forward to getting our fourth year program started this fall.

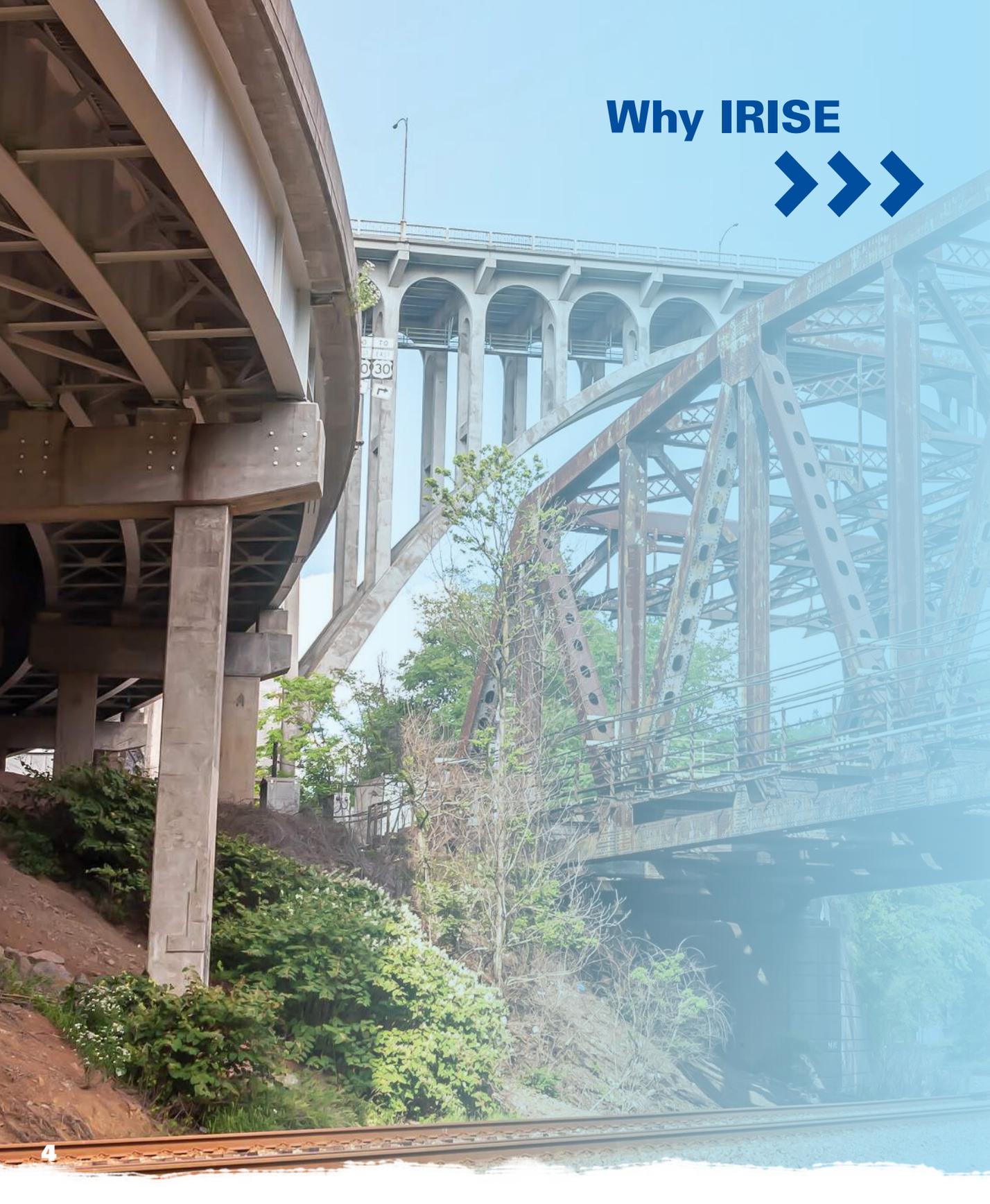
We look forward to continuing to apply our expertise in producing innovative solutions for transforming the declining transportation infrastructure into a more sustainable and resilient network of roadways capable of meeting future demands. I invite your participation and look forward to working together to address these issues.

**Julie M. Vandenbossche, 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 the aging highway infrastructure.

In conducting its research, IRISE is guided by two main principles:

- Innovative solutions can be best achieved through a collaborative program featuring public agencies that own and operate the infrastructure and the private companies that design and build it.
- IRISE must provide implementable solutions that meet the needs of its members.

These principles were strongly reinforced in the following interview that IRISE conducted with Pennsylvania Department of Transportation Secretary Yassmin Gramian.



**Yassmin Gramian**  
*Pennsylvania Department of  
Transportation Secretary*

### **1. Why is innovation so vital to PennDOT?**

Innovation is one of my top priorities as Secretary and it's at the forefront of everything PennDOT, especially considering Pennsylvania's limited transportation funding resources. Applying safer, more efficient, and more sustainable approaches to address our transportation challenges today and in the future requires diligent attention across the Department. Responding to the changing needs of our citizens and our economic engines also requires a nimbleness that can only be acquired through embracing new and rapidly developing technologies, along with a careful review of best practices.

### **2. What are PennDOT's research priorities related to infrastructure durability and resiliency?**

We as civil engineering professionals have to adapt to the environment with appropriate design, construction and maintenance standards and practices. We have updated bridge standards from a 50-year service life to 100 year service life, updated standards to account for more frequent overweight permit vehicles, design for scour to ensure survival due to a 500-year flood event. Similarly, we have design requirements for long life pavements. But there are emerging issues that need to be addressed. We have some exciting research ongoing with Pitt on Data Mining of Structural Health Monitoring, and Corrosion Repair Strategies for Steel Bridges using High Performance and Traditional Materials.

### **3. Do you think that the public/private collaboration that lies at the heart of IRISE will lead to better research products that are likelier to be adopted into practice?**

The IRISE consortium allows for each partner to work collaboratively to identify and remove obstacles from the earliest stages of research identification and development, leading the way to deployment and implementation of important innovations.

The unique collective experience and expertise that academia, the public sector, and private sector offer can identify challenges faster and address them earlier in the process. This collaboration can greatly reduce or eliminate rework and the potential for future delays, resulting in improved value to the traveling public.

# The IRISE Partnership



The IRISE partnership was formed with the following five founding members: three public and two private organizations. The names of the individuals representing these organizations that serve on the IRISE Steering Committee are shown.

This past year, the Constructors Association of Western Pennsylvania became IRISE's sixth member.

The Federal Highway Administration (FHWA) also serves as an ex-officio member.

In total, members are contributing \$700,000 in annual funding for IRISE research. All administrative and management costs are covered by the University of Pittsburgh.

The Steering Committee has substantial influence on the research topics to be addressed and appoints technical representatives to project panels that guide each project as it is being conducted. These organizations then have a vested interest in implementing the innovations that result.



**Stephen G. Shanley**, Director  
Allegheny County Department of Public Works



**Charles J. Niederriter**, Chief Operating Officer  
Golden Triangle Construction



**Richard Barcaskey**, Executive Director  
Constructors Association of Western Pennsylvania



**H. Daniel Cessna**, Senior Vice President  
Michael Baker International



*IRISE members were saddened by the passing of PennDOT Executive Deputy Secretary George McAuley. Mr. McAuley was a strong supporter of innovation and of the IRISE consortium. He is missed.*



“CAWP is pleased to be able to bring the perspective of the construction industry to the IRISE consortium. As a collaborative organization ourselves, we understand the benefits and power of working together to develop innovative solutions to critical problems.”

– **Richard Barcaskey**  
*Executive Director*



**pennsylvania**

DEPARTMENT OF TRANSPORTATION

**Brian Wall**, Research Division Manager  
Pennsylvania Department of Transportation



**Michael Schultz**, Strategic Planning &  
Program Manager  
Pennsylvania Turnpike Commission



U.S. Department  
of Transportation

**Federal Highway  
Administration**

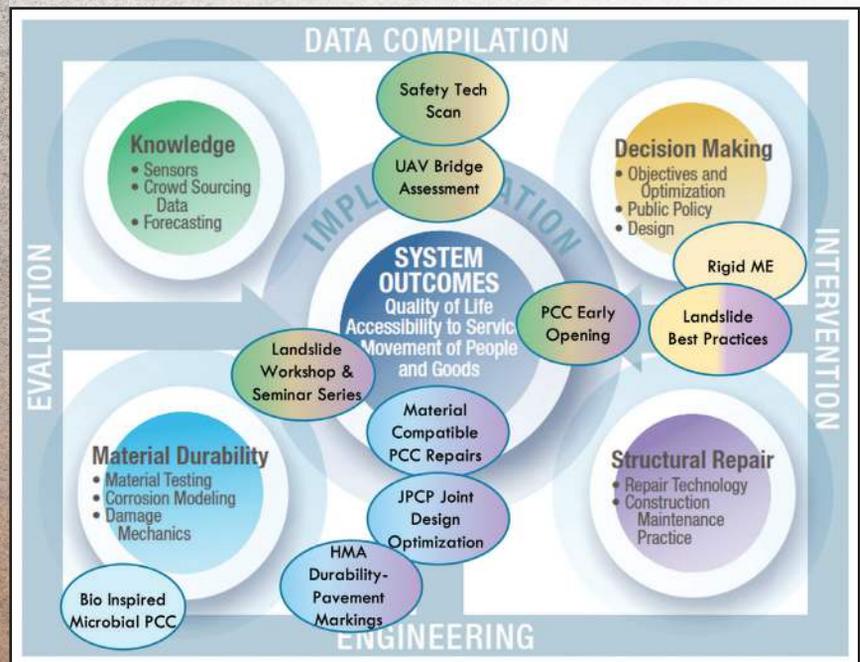
**Clint Beck**, Director of Programs  
and Performance Management  
FHWA

# Activities



The following sections contain capsule descriptions of the individual projects that IRISE has completed, are ongoing or being initiated in 2021. The graphic depicts how each of the projects fit into the IRISE research framework. More information on each project can be found on the IRISE website:

<https://www.engineering.pitt.edu/Sub-Sites/Consortiums/IRISE/Content/Achievements/Products/>



## Projects Completed this Past Year

### Feasibility of Using Microbes for Sustainable Construction

This project provided insight into the potential application of bio-restoration of reinforced concrete. The results of the study suggest that isolating microorganisms of microbially induced carbonate precipitation (MICP) from pre-existing reinforced concrete structures is a viable option when developing sustainable remediation strategies. Large potential cost savings are possible. However, significantly more research is needed to assess the ability of MICP to realize the same degree of crack sealing as epoxy.

Because of its potential for mitigating adverse environmental impacts and implications for green building design and sustainable construction, this project was co-funded with the University's Mascaro Center for Sustainable Innovation.

### Landslide Capacity Building Seminars

In the fall of 2020, IRISE conducted a series of three virtual seminars devoted to the landslide issue facing the Southwest Pennsylvania region. The initial seminar focused on civil engineering and geology students from Pitt as well as several other universities in the region, providing them with information on the geological aspects of the landslide problem, as well as historical perspective highlighting regional challenges.

The second and third seminars were devoted to the topics of 1) landslide recognition and monitoring and 2) new technologies. Approximately 400 people participated over the course of the seminars, providing an opportunity for professionals to interact with each other and serving to engage and familiarize participating students with problems and solutions. All of the presentations can be found on the IRISE website, along with videos of the seminars: [https://www.engineering.pitt.edu/Sub-Sites/Consortiums/IRISE/\\_Content/Achievements/Event-Pages/LANDSLIDE-CAPACITY-BUILDING-SEMINARS/](https://www.engineering.pitt.edu/Sub-Sites/Consortiums/IRISE/_Content/Achievements/Event-Pages/LANDSLIDE-CAPACITY-BUILDING-SEMINARS/)





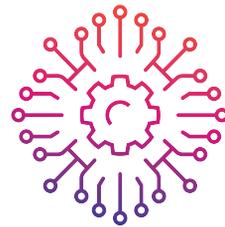
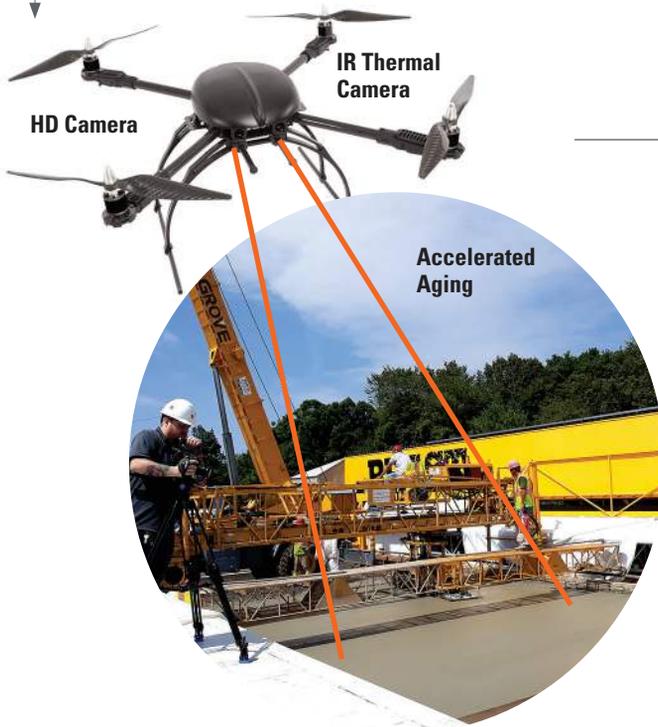
## Ongoing Projects

*The following projects are ongoing in 2021.*

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

The study is establishing a framework to support bridge maintenance investment decisions that will reduce life-cycle costs. Advanced statistical analyses are being applied to fuse data produced by Structural Health Monitoring (SHM), Non-Destructive Evaluation (NDE) and visual inspection techniques. A series of recommendations is being developed regarding the effectiveness of each sensing technology (or a group of techniques in conjunction with each other) as well as the most appropriate data collection configurations (in terms of temporal and spatial resolutions).

This project is being performed in collaboration with the Center for Advanced Infrastructure and Transportation (CAIT) at Rutgers University along with Wiss, Janney, Elstner (WJE) Inc. (industry partner), leveraging access to the unique dataset generated by the Bridge Evaluation and Accelerated Structural Testing (BEAST) facility at Rutgers.



MACHINE LEARNING

**Pitt Bridge  
Condition  
Assessment  
System  
(PittBCAS)**

## Early Opening of Concrete Pavements to Traffic

This research aims to reduce user costs by developing a strategy for the optimal timing of the opening of concrete pavements to traffic. A methodology for the accurate in-situ monitoring of early age concrete strength development is being proposed. An innovative mechanistic-based model for quantifying the risk of premature failure and long-term damage caused by traffic opening at various concrete strengths is being developed as well. Reductions in user delay costs associated with earlier openings relative to current criteria are being assessed.

## Developing Methodologies to Predict and Quantify the Benefits of IRISE Research

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

- Development of a Simplified Rigid Pavement ME Design Tool for Pennsylvania
- Joint Design Optimization
- Landslide Best Practices
- Material Compatible Partial Depth Concrete Repair
- Asphalt Surface Distress Associated with Pavement Markings
- Remote-Controlled Technology Assessment for Safer Pavement Construction and QA/QC





## Projects Getting Underway

The following projects will be initiated in 2021.

### Landslide Best Practices

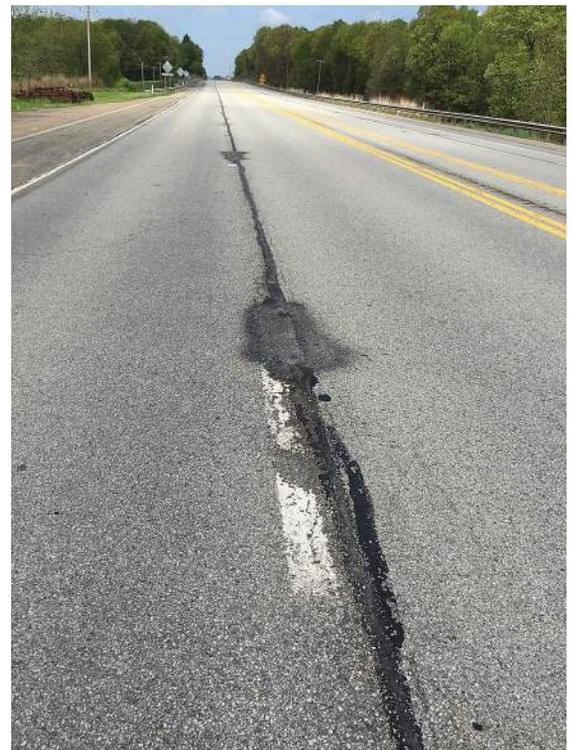
A best practice compilation document is being prepared that will:

1. Identify the class and types of landslides impacting Southwestern Pennsylvania
2. Identify corrective actions to be taken for each landslide class and type
3. Identify challenges in design and permitting process, including recommended revisions to design specifications.

This project is being performed in collaboration with IRISE member Michael Baker International.

### Preliminary Evaluation of Pavement Surface Distresses Related to Pavement Markings

This project investigates if pavement markings are causing pavement surface deterioration. The project includes visual surveys, field evaluations (including non-destructive testing), gathering of information on products and installation practices, finite element modeling and development of mitigation strategies.



## Remote-Controlled Technology Assessment for Safer Construction

New and emerging remote-controlled processes that can be deployed for safer pavement construction and QA/QC testing and evaluation are being explored. IRISE members will be informed about the latest developments through a technology transfer workshop. The goal is to help achieve safer and more effective pavement construction by facilitating the implementation of emerging technologies.

## Joint Design Optimization

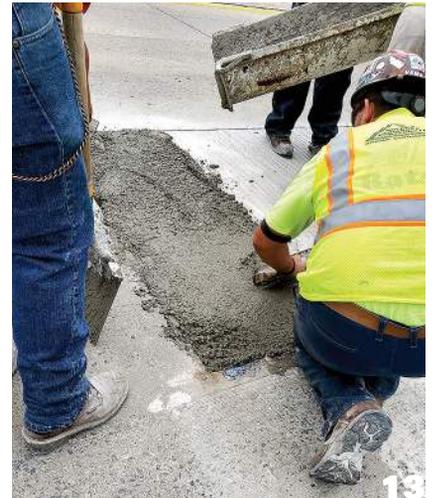
Guidance on how to optimize the long-term performance of contraction joints in jointed plain concrete pavements, while minimizing maintenance costs, is being developed. The project is considering the type, reservoir design, construction practices and joint sealant performance. Additional activities include assessing how to quantify the additional life achieved when using corrosion resistant dowel bar materials.

## Material Compatible Repairs Evaluation

This project is assessing the performance of partial depth repairs in the field made using the recommendations in an earlier IRISE research report on the use of performance engineered repair materials. Concurrently, for the same repairs, the ability of ultrasonic tomography testing to provide reliable information for required partial depth repair dimensions and to evaluate bond condition after repair placement will be assessed.



Photo courtesy of Minnesota DOT





## Student Involvement

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



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### Post-Doctoral Fellows

**Lucio Salles de Salles, PhD** was a key staff member on the Early Opening project and will play a critical role on the pavement markings and worker safety projects. He is a civil engineering professor at the Federal University of São Carlos in Brazil. His research interests include full-scale and non-destructive pavement testing, finite element modeling and simulation, road markings, and overall pavement design and performance.

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### Supported Students

Several students were supported by IRISE projects during the past year, as indicated below:

- **Kaveh Barri:** PhD student, Improving Bridge Assessment through the Integration of Conventional Visual Inspection, Non-Destructive Evaluation, and Structural Health Monitoring Data
- **Bashear El-Hajj:** PhD student, Feasibility of Using Microbes for Sustainable Construction
- **Katelyn Kosar:** PhD student, Early Opening of Concrete Pavements to Traffic
- **Kit Leng Ing:** Undergraduate student, Developing Methodologies to Predict and Quantify the Benefits of IRISE Research
- **Haoran Li:** PhD student, Early Opening of Concrete Pavements to Traffic
- **Sarah Pitell:** PhD student, Feasibility of Using Microbes for Sustainable Construction
- **Evan Trump:** Undergraduate student, Feasibility of Using Microbes for Sustainable Construction
- **Gloria Zhang:** PhD student, Improving Bridge Assessment through the Integration of Conventional Visual Inspection, Non-Destructive Evaluation, and Structural Health Monitoring Data

Ms. Zhang's IRISE work related to "Automated Detection and Quantification of Cracks and Spalls in Concrete Bridge Decks Using Deep Learning" resulted in her winning a competition among graduate students and postdoctoral fellows from all schools at the University sponsored by the Center for Research Computing.

Student involvement in IRISE projects and activities included:

- Three papers produced under the Bridge Assessment project were published by the Engineering Journal, the Transportation Research Board and the American Professional Society of Photographic Instrumentation Engineers.
- The Early Opening project was presented at a poster session at the 101st Transportation Research Board (TRB) Annual Meeting.
- PhD student Tyler Rohan and Masters student Max Winn both made presentations during the Landslide Capacity Building Seminar series.
- Multiple students were involved in the demonstration of the Material Compatible Repair project presented at the 2020 TRB Annual Meeting.
- Hundreds of students participated in each of the Landslide Capacity Building Seminars.
- Undergraduate Civil Engineering students benefited from a virtual presentation made by IRISE member Allegheny County on the history and rehabilitation of Pittsburgh's Three Sisters Bridges.



*"I'm very grateful for the opportunity that IRISE provided to engage in this research. I'll use and transfer the knowledge I've gained about concrete deck performance and deep learning to create more durable and sustainable bridge infrastructure."*

*– Gloria Zhang*

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## **IRISE Cooperative Education Scholarship Program**

IRISE 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 each of the three fields of employment offered by the IRISE partners: construction, design and public owners/operators, as well as 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 will be selected through a competitive process and awarded a scholarship of \$3,000. After the successful completion of each rotation the student will be awarded \$1,000. The first scholarship award process and selection will be made during the 2021-22 academic year.



## Planned Activities

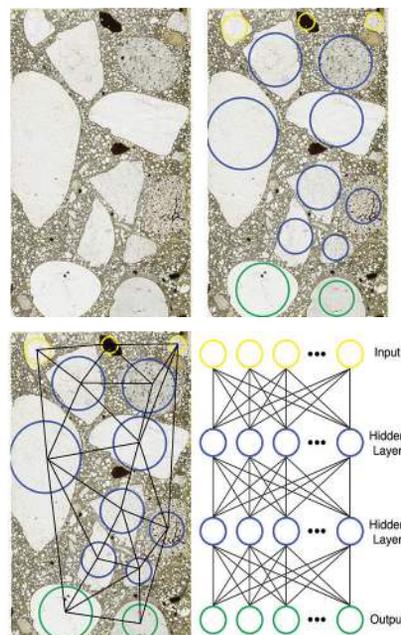
The IRISE annual work program planning process commences in the fall with a brainstorming session, held on October 14 and 15, 2020 for next year's program. Research ideas are gathered and short problem statements prepared and discussed with the IRISE Steering Committee and its technical representatives. The projects 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 2021.

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

This project aims to: 1) Design a structure for a unified inventory of landslides that addresses the needs of stakeholders; 2) Initiate a data collection effort focused on historical landslide observations to establish the working database and document workflows that enable the collection, sharing, and analysis of new data across agencies; 3) Demonstrate the power of comprehensive landslide data through evaluation of the collected data.

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

Novel experimental and numerical tools would be built to enable the optimization the concrete mixture design and construction process for concrete pavements. A characterization of concrete paving would be combined with computer vision techniques to reconstruct the spatial and temporal arrangement of coarse aggregate in the mix during the paving process.



### **Integrating Additive Manufacturing and Accelerated Bridge Construction Techniques**

This project looks to improve the construction quality of prefabricated bridge elements and systems (PBES), reduce their construction time and labor cost, enhance their safety and reliability, minimize the environmental footprint of the PBES fabrication plants, produce structural elements with optimized topologies, and enable in-situ repair of existing accelerated bridge construction (ABC) elements via customizable design. It would explore the feasibility of integrating additive manufacturing (3D printing) with ABC techniques.

### **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 would be investigated to improve safety and optimize highway construction scheduling. Requirements for the equipment and test protocols for data collection and data analysis would be developed.

### **Identifying Major Causes of Highway Construction Accidents**

This project would identify and rank dangerous scenarios, taking into consideration near-misses, in highway and street construction. Recommendations would be developed for avoiding or minimizing dangerous scenarios in the future and qualitative information for the improvement of safety training and the development of safety-related equipment.



# Faculty



- 1. Julie Vandebossche, PhD, PE**, serves as IRISE Director and Principal Investigator for the Joint Design Optimization project, and is the William Kepler Whiteford Professor of Civil Engineering. Her research interests are concrete pavement analysis, design, evaluation, rehabilitation, and construction, including Instrumentation and advanced material characterization. Dr. Vandebossche has collaborated extensively with state agencies, contractors and suppliers to help ensure that her research products are relevant, innovative and implementable.
- 2. Gary Euler** serves as Associate IRISE Director, with day-to-day management responsibilities. Mr. Euler's experience features extensive time as a senior program manager in both the public and private sectors, including time as a senior program manager in the US Department of Transportation's Federal Highway Administration and as a business development manager for prominent engineering companies.
- 3. Amir Alavi, PhD** is an Assistant Professor of Civil and Environmental Engineering and serves as Principal Investigator for the Improving Bridge Assessment project and the proposed Principal Investigator for the Integrating Additive Manufacturing and Accelerated Bridge Construction Techniques project. Dr. Alavi's research interests include structural health monitoring, smart civil infrastructure systems, deployment of advanced sensors and engineering informatics.
- 4. Daniel Bain, PhD** is an Associate Professor of Geology and Environmental Science. Dr. Bain participated in

the Landslide Capacity Building Seminar series and is the proposed Principal Investigator for the Landslide Inventory and Analytical Tool project. Dr. Bain's research focuses on human-driven changes in environmental systems.

- 5. Alessandro Fascetti, PhD** is an Assistant Professor of Civil and Environmental Engineering and is the proposed Principal Investigator for the Three-Dimensional Micro-Mechanical Characterization of the Effect of Vibration and Compaction in Concrete Pavements project. Dr. Fascetti's research interests revolve around the use of multiscale computational techniques, advance remote sensing and machine learning algorithms for the resilience assessment of large-scale civil infrastructure systems.
- 6. Sarah Haig, PhD** is Assistant Professor of Civil and Environmental Engineering who served as the Principal Investigator for the Feasibility of Using Microbes for Sustainable Construction. Dr. Haig has broad microbial ecology expertise with experience isolating microbial degraders of emerging contaminants using both culture-based and molecular methods.
- 7. Joel Haight, PhD** is Professor of Industrial Engineering and has been instrumental in advancing IRISE's highway construction safety emphasis, having previously served as a Research Branch Manager in the National institute for Occupational Safety and Health. He applies an operations research approach to optimizing the performance of human driven systems.



**8. Kent Harries, PhD, FASCE, FACI, FIFC, PE** is Professor of Structural Engineering and Mechanics in the Department of Civil and Environmental Engineering. Dr Harries led the discussion on bridge research needs during the fall 2020 Brainstorming session. Dr Harries' research interests include the use of nonconventional materials in civil infrastructure.

**9. Anthony Iannacchione, PhD** is serving in a senior advisory capacity. Dr. Iannacchione led the Landslide Capacity Building Seminar series and is helping to define the proposed Landslide Inventory and Analytical Tool project. Prior to 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.

**10. Lev Khazanovich, PhD** is Professor of Civil and Environmental Engineering and serves as the Principal Investigator for several projects: the Early Opening of Concrete Pavements to Traffic, the Preliminary Evaluation of Pavement Surface Distresses Related to Pavement Markings and the Remote-Controlled Technology Assessment for Safer Construction. He is the proposed Principal Investigator for the Utility Location Technologies and Causes of Major Construction Accidents projects. His research has featured performance prediction modeling, non-destructive testing and finite element modeling.

**11. Mark Magalotti, PhD** is serving in a senior advisory capacity and as Principal Investigator for the Benefits Analysis project. Dr. Magalotti previously was Coordinator of the Graduate Program for Transportation and as a Senior Lecturer in the transportation engineering graduate program. His research interest is multi-modal transportation planning.

**12. Steve Sachs, PhD** is an Assistant Professor of Civil and Environmental Engineering. Dr. Sachs is the proposed 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.

**13. Eitan Shelef, PhD** is an Assistant Professor of Geology and Environmental Science. Dr. Shelef participated in the Landslide Capacity Building Seminar series and is a proposed key staff member for the Landslide Inventory and Analytical Tool project. His research interests include linking climate change with hill slope processes and modeling landscape evolution by various types of erosive processes.

**14. Aleksandar Stevanovic, PhD**, Associate Professor of Civil and Environmental Engineering, is engaged in the Early Opening of Concrete Pavements project. Dr. Stevanovic's research interests include traffic signal control systems, intelligent transportation systems, multimodal and sustainable operations and transportation simulation modeling.

# The Future

IRISE will build on the solid foundation established during our first three years. Our research program will continue to focus on issues identified by our members and on producing implementable results. In the immediate future, resources will continue to be directed towards the four priority areas that have emerged:

- Assessing bridge performance so that maintenance resources can be more efficiently spent
- Creating more durable concrete pavement designs and repairs
- Increasing transportation resiliency by providing information on landslide repair and prevention methods
- Improving construction worker and inspector safety by identifying and developing technology innovations to address the most pervasive problems

IRISE will continue to pursue growth in order to more comprehensively address member needs and to afford exploration of more fundamental research ideas. The University and the other IRISE consortium members are extremely grateful to PennDOT for increasing its annual membership contribution during the past year. IRISE will continue to pursue funding contributions from other sources, including the Department of Transportation's University Transportation Centers program and the National Institute of Occupational Safety and Health (NIOSH).

President Biden's Jobs and Economic Recovery Plan is entitled Build Back Better. The words "building better" strongly suggest innovation. The infrastructure we rehabilitate or build must be more durable and resilient so that public money is spent as efficiently as possible. IRISE stands ready to meet that challenge.





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**Science and Engineering**

Annual Report 2020



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of Engineering**

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