IRISE 2021 ANNUAL REPORT

UNIVERSITY OF PITTSBURGH | SWANSON SCHOOL OF ENGINEERING





Presenter: Julie Vandenbossche, PhD, PE



MPACTFUL RESILIENT INFRASTRUCTURE SCIENCE AND ENGINEERING (IRISE)

- Developing sustainable, resilient, engineering solutions
- Improving worker safety

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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 ESPECIALLY THANK OUR 2021-22 STEERING COMMITTEE

- Rich Barcaskey, CAWP
- Chuck Niederriter, Golden Triangle Construction
- Michael Schultz, Pennsylvania Turnpike (Edward Skorpinski)
- Stephen Shanley, Allegheny County
- o Brian Wall, PennDOT
- Tom Zagorski, Michael Baker International
- Yathi Yatheepan, FHWA (ex officio)

WE WELCOME OUR NEWEST MEMBER!

CDR MAGUIRE ENGINEERING

* Dan Cessna – Steering Committee

ONGOING RESEARCH

Eleven on-going projects

- 1. Assessing Benefits
- 2. Construction
 - Additive Manufacturing and ABC
- 3. Landslides
 - Best Practices
 - o Data Inventory

4. Pavements

- Concrete Compaction/Vibration
- Distresses under Pavement Markings
- Joint Sealing/Design Optimization
- Material Compatible Repair Field Assessment

5. Worker safety

- Construction safety data analysis
- Tech Innovations
- Utility location



PA TURNPIKE: Climate Resilient Corridor

- 1. Sound Walls Constructed of Metamaterials
- 2. Digital Twin of Ecosystem (pavement/bridge/stormwater basin)
- 3. Electric Vehicle Charging
- 4. Multi-purpose Assets: Energy Harvesting



YEAR 5 WORK PROGRAM TOPICS

7 New projects

- **Corrosion:** bridge decks and dowel bars
- Materials: development of metamaterial light-weight concrete
- Pavements: two-lift and sealcoating
- **Safety:** virtual reality worker training
- Stormwater: seminar series











STUDENT INVOLVEMENT

- 3 post-doctoral fellows
- o graduate/undergraduate students
- Conference presentations
- Awards
- Class projects/site visits
- Coop/internship scholarship program







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Knowledge

- Sensors • Digital twin
- Crowd sourcing Automated
- Forecasting

Intervention

- Worker safety
- Repair technology
- Maintenance

- MISSION **Engineering Resilient**,
- Sustainable Infrastructure
- Cost effective • Limited disruptions
- · Design and construction efficiency
- Safety

Solutions

Design of Materials and Assets

- Multi-functional (ie., • Efficient energy harvesting) • Resilient
- Integrated
- Durable

Decision Making

- Minimize life



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• Sustainable

UPDATED IRISE RESEARCH DIRECTION

Year 1

- Material compatible repair
- Corrosion 0
- **Microbial concrete** \cap
- **Pitt Rigid** Ο

Year 2

- **Bridge assessments** \mathbf{O}
- **Early opening**
- Landslide workshop
- Landslide seminars 0

Year 3

- **Benefit analysis** 0
- JPCP Jt Design Opt. Ο
- Landslide best practices
- AC pavement markings Ο
- Safer pave. construction
- **MCR** Implementation Ο

Year 4

- **ABC Construction** \cap
- **Construction safety**
- Landslide inventory 0
- **Utility location** 0
- **Vibration compaction**



- Sensors • Digital twin
- Crowd sourcing Automated
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Intervention

Worker safety

Maintenance

MISSION **Engineering Resilient**,

Sustainable Infrastructure Solutions

- Design and construction efficiency
- Repair technology

Cost effective • Limited disruptions

Safety

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Decision Making

- Public Policy

- Minimize life



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Year 4

- **ABC Construction** 0
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Worker safety

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MISSION **Engineering Resilient**,

Sustainable Infrastructure Solutions

- Cost effective
- · Limited disruptions • Design and construction efficiency
- Repair technology Safety

Design of Materials and Assets

- Multi-functional (ie., • Efficient energy harvesting)
 - Resilient • Sustainable
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Decision Making

- Public Policy
- Timing of intervention
- Minimize life



80% Applied 20% High risk/high reward

CURRENT = 21%



Proposed Year 5

- Bridge deck corrosion 0
- Dowel corrosion \cap
- LWC Metamaterials \cap
- Seal coat best practices Ο
- Stormwater seminars
- Two-lift paving
- VR safety 0



- Sensors • Digital twin
- Crowd sourcing Automated
- Forecasting

MISSION **Engineering Resilient**, Sustainable Infrastructure Solutions Cost effective · Limited disruptions

- Design and construction efficiency
- Safety

Intervention

Worker safety

Maintenance

Repair technology

- Making
 - Minimize life

Decision

- **Design of Materials and Assets**
- Multi-functional (ie., • Efficient energy harvesting)
- Integrated
- Durable
- Resilient
 - Sustainable



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80%

80% Applied 20% High risk/high reward

CURRENT = 14-28%



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• Sustainable

Questions



Additional details can be found at...



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

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Thank you for all your contributions this past year!