ORGANIZATION ROLE

Research Scientist – Flood Risk

PROJECT ROLE / FOCUS AREAS

Infrastructure Resilience

Flood risk

Situational awareness

Responsible AI

Smart and Equitable Cities

EDUCATION

Ph.D., Civil Engineering, Rice University, 2022

M.Tech., Structural Engineering, Indian Institute of Technology Bombay, 2014

B.Tech., Civil Engineering, Calicut University, 2010

PROFESSIONAL MEMBERSHIP

ASCE

PRAVANESH PANAKKAL, PH.D.

Research Scientist – Flood Risk

Pranavesh Panakkal, Ph.D., brings more than 10 years of experience in risk and resilience modeling and research. Pranavesh received his bachelor's degree in civil engineering from Calicut University and his master's degree in Structural Engineering from the Indian Institute of Technology Bombay. He then attended Rice University, earning a Ph.D. in Civil Engineering. During his Ph.D., Pranavesh developed multi-modal AI systems for real-time flood situational awareness. His postdoctoral research at Rice University developed probabilistic flood risk assessment methods for infrastructure resilience applications.

At The Water Institute, Pranavesh will leverage his expertise in infrastructure risk and resilience modeling, situational awareness, disaster response, and responsible AI to equip communities with algorithms and tools to predict and sense the performance of infrastructure systems to stressors such as natural hazards to inform response and recovery in short- and long- timescales. His work will focus on advancing the understanding of infrastructure resilience in response to natural disasters and climate change.

PROFESSIONAL EXPERIENCE

2024–Present: Research Scientist – Flood Risk, The Water Institute

2023–2024: Postdoctoral Associate, Rice University

2017–2022: Ph.D. Researcher, Rice University

2016–2017: Research Associate, IIIT Bombay

2014–2016: Graduate Engineer, Walter P. Moore

SELECTED PROJECTS

Probabilistic Flood Hazard Analysis for Infrastructure Resilience Applications. *Rice University. (2023–2024).* Developed a new probabilistic method to quantify parcel-level pluvial and fluvial flood hazards, overcoming the limitations of conventional methods focused solely on riverine hazards or inundation probabilities. The developed method uses spatiotemporal rainfall data, 2D rainfall-runoff models, and high-performance computing to quantify flood risk of concentrated (e.g., buildings) and distributed (e.g., roads) infrastructure systems to support risk mitigation decision-making (e.g., how much to elevate the road or building?).

Open-Source Situational Awareness Framework for Mobility Using Data Fusion (OpenSafe Fusion). *Rice University. (2019–2022).* Engineered a real-time multimodal AI tool for sensing flooded roads by fusing observations from existing public data sources, including social sensors (e.g., social media, crowdsourcing), physical sensors (e.g., traffic cameras, traffic speed data, gages), physics-based models, and traffic alerts. OpenSafe Fusion can enable communities to repurpose their existing data sources to enhance their ability to sense and respond to flooding.

Open-Source Situational Awareness Framework for Mobility Using Physics-Based Models (OpenSafe Mobility). *Rice University. (2017–2019).* Developed and operated a physics-based model for vehicle-centric sensing of flooded roads using radar rainfall data, 2D rainfall-runoff model, and network and spatial analyses. The developed OpenSafe Mobility framework can facilitate safer roadway navigation for safety-critical emergency response applications.

SELECTED PUBLICATIONS

1. Padgett, J.E., Rincon, R., & Panakkal, P. (in press). Future Cities Demand Smart and Equitable Infrastructure Resilience Modeling Perspectives. *npj Natural Hazards*
2. Panakkal, P., & Padgett, J. E. (2024). More eyes on the road: Sensing flooded roads by fusing real-time observations from public data sources. *Reliability Engineering & System Safety*, *251*, 110368.
3. Liu, Y., Panakkal, P., Dee, S., Balakrishnan, G., Padgett, J., & Veeraraghavan, A. (2024). ISLAND: Interpolating Land Surface Temperature using land cover. *Remote Sensing Applications: Society and Environment*, 101332.
4. Panakkal, P., Fattoracci, E., Padgett, J., King, D., & Yoo, T. (2023). Sensing flooded roads to support roadway mobility during flooding: A web-based tool and insights from needs assessment interviews. *Natural Hazards Review*, *24*(4).
5. Panakkal, P., Wyderka, A., Padgett, J., & Befient, P. (2023). Safer this way: Identifying flooded roads for facilitating mobility during floods. *Journal of Hydrology*, *625*.
6. Gori, A., Gidaris, I., Elliot, J., Padgett, J., Loughran, K., Bedient, P., Panakkal, P., & Juan, A. (2020). Accessibility and recovery assessment of Houston's roadway network due to fluvial flooding during Hurricane Harvey. *Natural Hazards Review*, *21*(2).