Intelligent River® Bridge Flood Monitoring System to Improve Transportation Mobility

Technology Transfer Activities

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Technology Transfer Activities

1 Outputs

This grant supported development of the Intelligent River® BridgeBox™, which is a revolutionary innovation in water level monitoring systems to improve mobility.

1.1 Presentations, Demonstrations, and Outreach

Our research results were disseminated through presentations to key stakeholder groups. This included a demonstration at the Future of Transportation Summit at DOT headquarters in Washington, DC (August 13-15, 2024), a presentation, abstract, and demonstration table at the SC Water Resource Conference (October 16-17, 2024). Presentations were also made to related stakeholders including: 1) SC DOT, 2) SC Office of Resilience (SCOR), 3) Southeast Coastal Ocean Observing Regional Association (SECOORA), as well as Greenville and Anderson County Bridge Administrators. Peer-reviewed publications are in preparation.

1.2 Methods and Products

This project supported a number of new methods and a new product.
Methods included:

1) Methods for testing water level sensors for algorithm improvement
2) Methods for non-invasive mounting of the water level sensor system on Bridges

Products included:

1) Mechanical systems for non-invasive BridgeBox™ mounting, including 3D printing technologies
2) A refined and optimized BridgeBox™ system.

1.3 Pilots and Demonstrations

A number of pilot installations have been completed and approved for future deployment to enable wider adoption and system optimization:

1) 15 BridgeBoxes™ systems have been deployed in the Clemson University Hunnicutt Creek Test bed
2) 4 systems have been deployed on bridges in Greenville, County, SC
3) 3 systems have been deployed in Charleston SC
4) 4 Systems have been approved for deployment in partnership with the SCDOT
5) 125 Stations have been approved and funded for deployment in the Upper Savannah and Saluda watersheds in South Carolina in collaboration with the SC Office of Resilience.

2 Outcomes

This project had direct outcomes to assist the current and future transportation workforce.

2.1 Training the Transportation Workforce

Three key training outcomes are evident from this project. First, county-level bridge managers have been engaged with through BridgeBox™ deployment and sharing of data. Also, through a pilot project with the SC DOT, hydrology professionals within SC DOT have been informed about the benefits of monitoring water level at bridge locations within SC. Finally, one postdoctoral

fellow has been trained in transportation-related resilience product development through this project.

2.2 New Technology Integration

The outcomes of this project developed and integrated radar technology in a way that greatly reduces the cost per sensor deployment and therefore enables mass deployment of water level sensing nodes across the hundreds of thousands of bridges. Furthermore, the techniques developed that enable rapid and non-invasive mounting of the BridgeBox™.

2.3 Technology Improvement of Water Level Monitoring to Support Mobility

The Intelligent River® BridgeBox™ when widely deployed has the potential to greatly enhance mobility during extreme weather events by informing transportation professionals of potentially dangerous conditions where water level is approaching the road surface. Furthermore, direct knowledge of water level can assist with bridge structural integrity evaluation because the specific water level during flood events will be available to transportation engineering staff.

3 Impacts

This project, even though brief, has already started informing new methods in bridge monitoring.

3.1 BridgeBox™ Implementation

While we are still at the beginning of wide-scale implementation and impact, we already have a formal pilot with the SC DOT, where flood-prone bridges have been identified, and they have accepted our mounting and security documents provided. Furthermore, they have approved deployment at four locations with an additional five locations pending. Additionally, we have a funded agreement for a wide-scale deployment of 125 locations in the Upper Savannah and Saluda watershed areas with the SC Office of Resilience.

3.2 Future Expected Impact on Transportation Safety

This project developed and tested technology that we expect to improve transportation safety when widely adopted, and it is the first example of low-cost water level monitoring systems that can be widely deployed because of ease of deployment as well as lack of need for solar or other power sources.