National Center for Intermodal Transportation for Economic Competitiveness (NCITEC)

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Project title: Disaster Protection of Transport Infrastructure and Mobility Using Flood Risk Modeling and Geospatial Visualization

Investigators:
Dr. Waheed Uddin (PI), University of Mississippi cvuddin@olemiss.edu (662) 915-5363
Professor of Civil Engineering & Director, Center for Advanced Infrastructure Technology (CAIT)
Dr. Mustafa Altinakar (co-PI), University of Mississippi altinakar@ncche.olemiss.edu (662) 915-7788
Director, National Center for Computational Hydroscience and Engineering (NCCHE)

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Project description:

About 60% of all disasters costing one billion dollars or more in the U.S. were related to weather; most occurred in southeastern states. Weather-related natural disasters include flooding, hurricanes, severe storms, tornadoes etc. These disasters also have significant socio-economic impacts on people's lives and their livelihoods. Recent coastal disasters (2005 Hurricane Katrina, 2011 Hurricane Irene) and inland flooding disasters (2011 Great flood of Mississippi River) have shown the vulnerability of transport infrastructure assets. These disastrous events cause catastrophic damages to road infrastructure including pavements and bridges. Washing away of bridges and highway segments disrupt public mobility, freight traffic and supply chain, emergency management, and even disaster evacuation routes. Each year millions of dollars are devoted to emergency funds and mitigation of damaged transport infrastructure. This project addresses the NCITEC theme of efficient, safe, secure, and sustainable national intermodal transportation network that can be made resilient to disasters. Specific focus is on developing technologies to enhance decision support systems for transport infrastructure protection from extreme weather related natural disasters such as floods.

The primary objective of this project is the use of airborne and spaceborne remote sensing and geospatial technologies for modeling and visualization of terrain and built environment, flood risk mapping on regional and local levels, and simulation of extreme events for estimating flood disaster impacts on intermodal transport infrastructure network assets. The project objectives will be pursued using the CAIT expertise in geospatial visualization of terrain and built infrastructure using remote sensing imagery and/or laser survey data and the NCCHE expertise in flood modeling and flood risk mapping. NCCHE researchers will use the same remote sensing data to implement flood risk mapping models. In order to simulate the overflowing of a river over a bridge we will develop extreme flood scenarios. The flood volume flow will be superposed on infrastructure visualization models to simulate the devastating power of floodwater. These simulations will help to understand the catastrophic failures of bridges and road segments. This approach will create a geospatial decision support system for floodwater vulnerability assessment of transport infrastructure assets. This project is intended to develop geospatial methodologies to visualize the potential disaster risk vulnerabilities and protection strategies.

When implemented the geospatial decision support system approach will help to save billions of dollars in cost avoidance of infrastructure destruction and reconstruction, as well as improve efficiency of emergency management operations, and save communities from flood related devastation and displacement from their homes. Furthermore, vulnerable areas in the flood plains that can affect surface transportation corridors will be identified in a case study, structural integrity of bridge structures will be evaluated, and mitigation alternatives such as structural strengthening of levees and structures will be evaluated for protection from flood disasters.