STATE OF MICHIGAN
GRETCHEN WHITMER, Governor

MACKINAC BRIDGE AUTHORITY
N415 I-75 ST. IGNACE, MICHIGAN 49781 906-643-7600 FAX: 906-643-7668

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CONTACT: Kim Nowack, Mackinac Bridge Authority, 906-643-7600

Innovative sensor testbed expansion slated for Mighty Mac

March 4, 2019 -- The first 20 prototype infrastructure sensors installed beginning in 2016 on the Mackinac Bridge, powered solely by vibrations from traffic, have proven their durability and performed as intended. Now researchers from Michigan State University (MSU) and Washington University in St. Louis (WUSTL) are ready to roll out the next phase of testing, installing up to 2,000 of the tiny devices to both explore the logistics of a large-scale deployment and provide useful monitoring data to the Mackinac Bridge Authority (MBA).

MSU associate professor of civil and environmental engineering Nizar Lajnef gave a presentation to the MBA board today detailing those next steps.

"The successful large-scale deployment of this novel low-cost sensing technology will dramatically transform the economics of bridge preservation/management and ultimately improve the serviceability of bridges," Lajnef said. "We also will explore how the collected data could be used for improved cost-effective, condition-based maintenance of the Mackinac Bridge structural components. We are very excited that this will be the first fully instrumented bridge in the country using advanced wireless and self-powered monitoring technology."

Beginning in 2016, Lajnef and WUSTL professor Shantanu Chakrabartty started deploying prototype sensors beneath the bridge as part of a demonstration project sponsored by the Federal Highway Administration (FHWA). The Mackinac Bridge provided a high-profile testing ground for these self-powered sensors. Since then, the new and improved versions of the self-powered sensors have been developed as a part of the National Science Foundation's (NSF) Cyber-physical Systems program and have been successfully deployed on the bridge.

Several of the sensors' features make them attractive to infrastructure managers. Because the sensors have no external power source, they eliminate the issue of requiring battery changes or wiring to power sources. They also don't need wires to access the data they collect; staff can access the information wirelessly.

"In addition to being a statewide need, the development of effective methods for preserving our transportation infrastructure systems is a critical national need," Lajnef said. "Through this large-scale deployment, we would show that the system can autonomously monitor the loading experienced by the bridge components, and that the information from the sensors can be collected without significant human intervention and at significantly low cost."

MBA staff will assist with installation of the additional sensors, offering both equipment and access to the bridge.

The MBA will retain ownership of the data gathered by the sensors, with WUSTL providing the sensor prototypes and MSU providing tools to analyze and interpret that data for bridge staff to use in guiding engineering and maintenance decisions. The research team can use the data for research publication with approval from the MBA.

The team plans to start installation of the additional and improved sensors this summer. The researchers will coordinate installation timing and any necessary lane closures with MBA staff.

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