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CEAS team's sensors to monitor Parkview Bridge health

For many who work at the Parkview Campus, replacing the Parkview Avenue bridge over US 131 meant an inconvenient detour for the past summer. However, for a CEAS research team, it was an opportunity to incorporate sensors inside the bridge to measure stresses in the concrete and to monitor the health of the bridge.

Dr. Osama Abudayyeh, CEAS associate dean, is principal investigator of the Michigan Department of Transportation (MDOT) project "Health Monitoring and Evaluation of the Rapid Bridge Replacement Technique at Parkview Bridge in Kalamazoo, MI," which funded the placement of the sensors and the monitoring of the bridge.

The sensors – vibrating wire gauges embedded in the concrete – can measure stresses and temperature inside the concrete deck. "The sensors are rugged and have been proven reliable," he said. "They have been used in other places in the world, but this is the first time this kind of monitoring has been used in Michigan."



Joe Barbera and **Mike Peake** embedded sensors – vibrating wire gauges – into the prefabricated bridge deck panels before the concrete was added. The panels are now a part of the Parkview Bridge over US 131. The sensors, which provide data on bridge stresses, are connected to data loggers that communicate with computers in the CEAS Parkview Campus.

Abudayyeh said that the Parkview Bridge was the first to use a new technique of prefabricating the bridge sections off site and assembling them at the bridge location. "That cuts the time to build a bridge," he said. "And it also allowed us to place the sensors in the bridge sections at the precast plant."

According to Abudayyeh, the three-year project began with research to select the sensors, which were inserted in the bridge panels in Midland, where the bridge sections were constructed. The sensors should be connected to telephone lines this month. "We are just awaiting the connection so we can begin the monitoring process," he said.

The final implementation stage, which involves monitoring and collecting data from the sensors, begins this year and serves both research and diagnostic functions. "The design has stress limits that we'll be



Posing with a laboratory setup of the monitoring system that will be used in collecting Parkview Bridge data are some key members of the research team (from left) **Brock Mellema**, **Dr. Hubo Cai**, **Dr. Osama Abudayyeh**, **Mike Peake**, and **Joe Barbera**

checking against with these sensors," Abudayyeh said. "It's research for us, and it's a monitoring tool for MDOT."

The sensor system is an inspection tool that can become an early-warning system for MDOT to learn about bridge performance before the problems become visible. Finding problems early could mean less costly bridge repairs. "If they find stresses early enough, there are remedial actions that can be taken," Abudayyeh said.

The data collected could also affect considerations for future bridge replacements and upgrades.

The key members of the bridge-sensor project include faculty and graduate and undergraduate students from Departments of Civil and Construction Engineering (CCE) and Electrical and Computer Engineering (ECE): **Dr. Hubo Cai**, CCE assistant professor (Co-PI); CCE students **Joe Barbera** (MS), **Brock Mellema** (MS), and **Mike Peake** (BS); **Dr. Ikhlas Abdel-Qader**, ECE associate professor (Co-PI); and ECE student Eyad Almaita (ECE Ph.D.).

Others involved in the initial phases of the project include **Dr. Sherif Yehia**, CCE associate professor (Co-PI) who is on leave of absence this year, and CEAS alumni **Vijay Meganathan** (ECE), **Ammar Zalt** (CCE), **Mike Maurovich** (CCE) **Ashwin Vijayakumar** (ECE), and **Pramod Govind Lalji** (ECE)

According to Abudayyeh, current plans call for one year of monitoring, but the research team has recently requested an additional three years of study. More information available at abudayyeh@wmich.edu