ENGINEERING BETTER BRIDGES

By: Carol Truemner, Faculty of Engineering

It's not often that you'll see an indoor pedestrian bridge – especially one that's 70 feet long and made from aluminum.

But that's what you'll find currently set up in Waterloo's civil and environmental engineering's structures lab.

There, a team led by civil and environmental engineering professors Scott Walbridge and Sriram Narasimhan is collecting vibration data to develop better models for simulating crowd loads on similar structures and discover ways to make aluminum pedestrian bridges more economical.

"One of the unique things about this bridge system is that it's modular so we can make it various lengths to see how the vibration behaviour changes according to the different lengths," says Walbridge.

The bridge is equipped with four load cells to accurately record the load and 12 accelerometers to measure the accelerations.

To help with the testing various groups, including a class of Grade 4/5 students, have been walking and running along the bridge. Earlier this week, 29 civil engineering students took their turn crossing the structure multiple times.

Watching them in action were industry partners Jacques Internoscia of the Aluminum Association of Canada, and Alexandre de la Chevrotière and Simon Lacasse of the MAADI Group, the company that built and donated the bridge.

Walbridge's interest in aluminum bridge research piqued when he became involved with the Canadian Bridge Design Code and was part of the committee that in 2011 released the first rules for designing aluminum bridges in Canada.

It was on that committee that he met de la Chevrotière, the president of the MAADI Group, who was so impressed with the research being done in Waterloo Engineering that he soon became an industry partner. It was de la Chevrotière who reached out to the Aluminum Association of Canada to help fund the project.

Aluminum advantages

The advantages of using aluminum rather than the concrete and steel are that it's lightweight, more durable – it won't corrode or degrade over time – and has the potential to last much longer. Aluminum bridges can also be prefabricated resulting in quicker installation and reduced delays for users.

But there is a downside points out Narasimhan.

"They come with a set of problems that stiffer concrete and steel bridges generally don't have, which is they're very sensitive to people walking on them. So we need to figure out how to better predict how they perform if they do exhibit this lively behaviour that you see right now," he says.

Two of Narasimhan and Walbridge's civil engineering graduate students have been working on the project for almost two years. Ann Sychterz, a master's student, and Pampa Dey, a doctoral candidate, have completed preliminary full-scale testing in the field and on the model bridge they helped set up in the lab last month.

"Seeing the lateral movement is fun and eye-popping at the same time," says Sychterz, who along with Dey, organizes the students walking across the structure.

The bridge, which Narasimhan says is the first full-scale modular kind in the world, will be dismantled before the end of July and moved to another location in engineering.

Next steps include analyzing the testing data, refining predictive models based on findings, and recommending changes to the way aluminum bridges are designed.