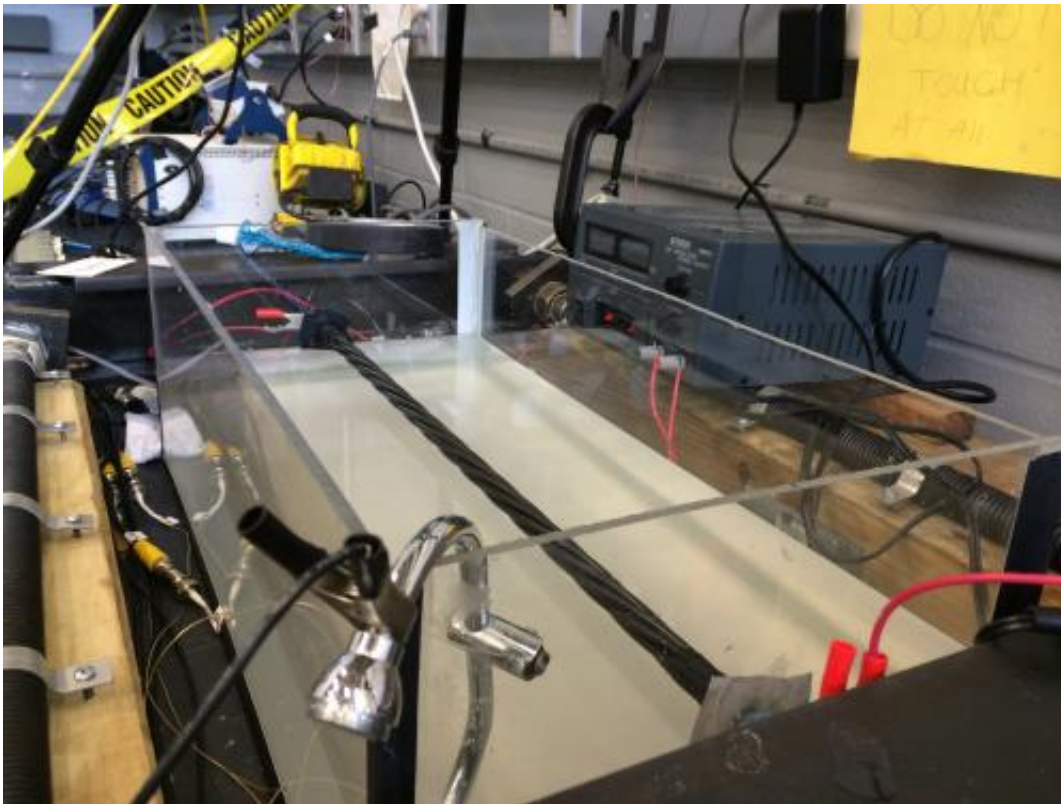


# Engineers zap bridges with electricity to test for corrosion

December 11 2013, by Marcene Robinson

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UB engineers believe they can detect corrosion in bridges by sending a jolt of electricity between opposite ends of steel cables. A reduction in the strength of the charge would mean the cable is suffering from corrosion.

(Phys.org) —Rust is a civil engineer's nightmare. Motorists in the United States make more than 200 million trips across bridges rated structurally deficient or in need of significant maintenance and yearly inspection. Of

the more than 17,000 bridges in New York, 12.5 percent are structurally deficient and 27 percent are considered functionally obsolete. One major culprit: corrosion of reinforcing steel.

Now, however, University at Buffalo researchers believe they can detect corrosion before the damage becomes severe by sending a jolt of electricity between opposite ends of steel cables. A reduction in the strength of the charge would alert them that the cable is suffering from corrosion and the [bridge](#) is in danger of failing.

The new technique could do away with time-consuming and expensive visual tests, which often rely on drilling through concrete to inspect the cables or spotting cracks in the concrete caused by increased stress on the weakened wires.

"The No. 1 priority of all civil engineers is the safety of the public," says Tresor Mavinga, a UB senior civil engineering and mathematics major involved in the research. "Corrosion can affect any structure, not just bridges, and we don't want that to happen. We need to be as accurate as possible to save money, time and lives."

Led by Salvatore Salamone, PhD, assistant professor of civil engineering, Mavinga and Alireza Farhidzadeh, a civil engineering graduate student, embedded piezoelectric transducers—devices that convert a signal from one form of energy to another—onto each end of a wire.

They then fired one volt of electricity through the metal using ultrasonic guided waves, which can travel a long distance with little loss in energy, while monitoring the charge received at each end. The experiment was then repeated with the same wire after it was rusted with a saltwater mixture. When cables are corroded, most of the energy from the electrical charge will be lost during the transfer between transducers.

Since the sensors and transducers are permanently attached to the cable, engineers can test the wires remotely off-site.

According to the Federal Highway Administration, [corrosion](#) problems have increased significantly over the last three decades and are likely to continue. The increase is in part due to the rising use of road de-icing salts, which are extremely corrosive to the protective films on metals.

Improved testing is a needed step toward the improvement of American infrastructure.

U.S. bridges were graded a C-plus by the American Society of Civil Engineers in its 2013 Report Card for America's Infrastructure.

The report adds that one out of nine of the nation's bridges is structurally deficient and that more than 30 percent of bridges have exceeded their 50-year design life; the average age of the nation's bridges is currently 42 years.

Provided by University at Buffalo

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