Assessing potential damage to aging infrastructure is an ever more critical issue every day. One of the areas in which Raimondo Betti, chair of the Department of Civil Engineering and Engineering Mechanics, specializes is damage detection for bridges using data correlation analysis. He and his team are leading the effort to develop a state-of-the-art corrosion monitoring system to be used in main cables of suspension bridges. His research is aimed at finding ways to safely extend the life of existing suspension bridges, focusing on those in New York City.

"New York City has among the oldest suspension bridges in the world," said Betti. "Many have been in service for over 100 years, in a harsh environment. They have deteriorated and will continue to, if nothing is done. Main cables are the most critical structural element in a cable suspension bridge. If a cable fails, the entire bridge fails and so special attention must be given to such elements." Replacing a bridge would be prohibitively expensive in a densely populated area as New York City. It is estimated that the failure of one of the city’s suspension bridges could cost billions of dollars.

Over the past five years, Betti has been conducting a unique experiment on the development of a corrosion monitoring system to be applied in main cables of suspension bridges. To test such a system, a mock-up of a bridge cable, 20 feet long, 20 inches in diameter, and made up of nearly 10,000 galvanized bridge wires, has been built inside an environmental chamber and subjected to a one-year cyclic corrosion test.

The cable—one of the largest ever built in the world and the only one subjected to a tensile axial force of 1,200 kips—has been enclosed in an environmental chamber to accelerate deterioration, simulating decades of wear, such as that endured by New York’s Williamsburg, Manhattan, and Brooklyn Bridges. Buried in the cable mock-up are 76 miniature sensors that are measuring corrosion rates, temperature, humidity, acidity, and chloride content.

Betti and his team are now analyzing the results in order to provide meaningful methods to assess, in real time, the actual conditions of the cable. The answers he finds should help insure a longer life for suspension bridges around the world.

This project—the first systematic study ever done on monitoring the corrosion of suspension cables—is also the first in a series focused on damage assessment in main cables of suspension bridges and is part of a National Center on Aging Infrastructure in Urban Environments created by the Department of Civil Engineering and Engineering Mechanics.

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Assessing Damage in Aging Infrastructure

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