



# Bridge Health Monitoring



- **Objectives:** Monitor bridge structural integrity
- **Solution:** Jewell Instruments **SMI Single-Axis Inclinometer**
- **Benefits:** High-resolution and rugged
- **Results:** Reliable insight into bridge health

## Project

Approved in 1942, the Thruway started construction in 1946 near Syracuse. When the Tappan Zee Bridge opened nine years later, it linked the two portions of the roadway, giving the Thruway mainline a total length of 423 miles – the longest operating toll expressway in the nation. At that time, few would have believed a new bridge would be needed six decades later, and that the new bridge would cost nearly \$4 billion and span 3.1 miles

The New York State Thruway Authority's goal for the new bridge to replace the aging Tappan Zee Bridge was for the new two-span bridge crossing the Hudson River 25 miles north of New York City to have a 100-year useful life. In order to achieve that century mark, the new

replacement bridge relies on a battery of smart technology systems including sensors, gauges, monitors, data reporting tools and more. The new technology systems aim to ensure that the structure operates smoothly and safely on a day-to-day basis and does not need its core components replaced or repaired for its entire life.

"We'll have strain gauges, anemometers, tiltmeters—we're measuring movement where we think it's important, for strains or forces that we think we need to monitor, obviously for the health of the bridge," said Jamey Barbas, project director for what is officially called the New NY Bridge Project according to. "If there are huge winds, we'll be alerted right away and will be able to restrict whether trucks go over the bridge. If we see something wrong, we're able to go out and fix it before it becomes catastrophic in terms of the work effort."

Tappan Zee Constructors—the design-build team on the project that is anchored by Fluor Corp., American Bridge, Traylor Bros. and Granite Construction—has already installed more than 450 sensors, gauges and monitoring units on the new bridge, which is set to take all traffic from the old bridge on its northern span later this year, with both spans fully open in 2018. The team is now streamlining connection of the sensors to central data units and establishing reporting parameters with the Thruway Authority, says Marco Perez, the contractor's program lead for facilities. "The structural monitoring system is part of the overall infrastructure for the bridge," he says.

The new bridge, called the Mario M. Cuomo Bridge include the largest and most sophisticated Structural Health



Jewell Instruments [SMI Single-Axis Analog Inclinometer](#)



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Monitoring (SHM) system ever deployed on a bridge structure in the US. The system consists of 130 high speed data acquisition units, 12 data loggers for weather and corrosion measurements, 4 fiber optic interrogators and 15 GPS receivers integrated into a central server. All data are time synchronized within 3 milliseconds. Geocomp installed the smart technology systems and collects and manages 1GB of new data each day to assess bridge performance in real time. Intelligent data reduction algorithms show immediately the effects of unusual loads and cumulative performance. Short and long term behavior can be seen from easy to read statistical summaries, data analysis reports and measurement correlations. The information is being used to mitigate risks to the bridge.

The Structural Health Monitoring System incorporated over 300 of Jewell Instruments Emerald Series SMIC Inclometers. The Jewell SMI Single-Axis Analog Inclometer series are rugged, high-precision force-balanced inclinometers. These sensors were designed to have the accuracy and resolution similar to other force-balance technology sensors, but at a lower cost. The SMIC sensors utilized are customized with 10 ft. wire leads, 4-20mA output, and custom +/-10 Deg Range.

The new Governor Mario M. Cuomo Bridge replaced the former Tappan Zee Bridge crossing the Hudson River between Tarrytown & Nyack located 20 miles north of New York City. The new bridge is a 3.1 mile long cable-stayed twin span structure designed for a 100 year service life to remedy the issues of the highly deteriorated old bridge such as increased average daily traffic load, accident rate per mile and maintenance costs. The project is one of the largest ever transportation design-build contracts in the US with a \$3.98 billion contract value. Geocomp provided the Structural Health Monitoring (SHM) portion of this massive scale project from system design to integration by providing state-of-the-art software monitoring equipment and instrumentation expertise.

To build the new Mario M. Cuomo Bridge, 7,000 workers spent more than 9 million hours, 220 million pounds of American steel and enough concrete was used to stretch from New York City to Key West. Much of the new bridge was made on land, floated down the river, and maneuvered into place by a super crane. The new Mario M. Cuomo Bridge was built while the former Tappan zee Bridge was still in operation. Once the new bridge was completed, it took over a year to remove the older Tappan Zee Bridge.



An aerial view of the Mario M. Cuomo Bridge alongside the Tappan Zee Bridge, which was demolished. Photo: Courtesy of New York State Thruway Authority

## About Jewell Instruments

Jewell Instruments is a world leader in the design, manufacture, and distribution of high-precision products. Our expertise includes acceleration and tilt sensors, electronic compasses, avionics components, solenoids, and panel meters. The extensive application knowledge we have obtained through decades of experience allows us to provide custom solutions for a diverse group of industries. In fact, customers from all over the globe contact us for solutions to aerospace, medical, industrial, and telecommunications applications, to name a few.

To find out more, visit our website!



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