

Jamaica Bay Rail Bridge, New York – Construction Monitoring

CLIENT: BIG APPLE GROUP; NEW YORK CITY TRANSIT AUTHORITY - MTA

How the use of precise and robust wireless Triaxial Tilt and Optical Displacement sensors informed decision-making and ensured safety during bridge construction works

Challenge

New York City was severely affected by Hurricane Sandy in 2012. Considered the fourth most expensive storm in U.S. history, the storm damaged around 100,000 homes and businesses and the economic losses were estimated at around \$19 billion for NYC alone.

The city's infrastructure is still recovering, including tunnels and bridges which were affected by substantial flooding. The New York City Transit Authority's (NYCTA) has made a continued effort to rehabilitate affected structures which includes a parallel effort of making repairs and strengthening critical infrastructure against future storms.

The NYCTA Rail Bridge in Jamaica Bay, NY is an elevated commuter subway which serves MTA line A customers and provides a link between the communities of the Rockaway Peninsula and Brooklyn and Queens. Works were planned to replace ageing pier fenders, and NYCTA needed to ensure the bridge was monitored for stability during the replacement process.

A conventional optical based monitoring method was originally specified to monitor both track and pier deflection, but this method was determined to be unfeasible. The closest location for a stable reference point was over 2,000 linear feet from the bridge, precluding traditional survey methods such as robotic survey which relies on line-of-sight and availability of backsights (or reference points). Also, these types of systems need repeated maintenance which would have been complicated due to access issues.



Solution

The Big Apple Group NY (Big Apple), a NYC based construction quality assurance and control organization, proposed an alternative approach using Senceive wireless monitoring technology. They were attracted by advantages including quick installation, fast and continuous data reporting capabilities with no line of sight required for continuous data collection.

Site access and installation was challenging, with track outages not possible, and only short access windows available in between trains. The discreet monitoring system from Senceive including sensors and two data communication gateways were quickly installed within available access windows, without having to deal with bulky equipment and external power systems.



A total of 56 FlatMesh™ NanoMacro High-G track tilt sensors were installed every 20 feet along the track to measure changes in twist and crosslevel displacements. A further 10 FlatMesh™ IX Triaxial Tilt sensors and 20 Optical Displacement Sensors (ODS) were installed on five of the piers to measure pier rotation and displacement. The two cellular gateways with internal batteries and small 20-watt solar panels were installed on opposite ends of the bridge for continuous data collection.



Outcome

The system was up and running immediately following installation with data sent from the sensor nodes to the gateways and on to WebMonitor™, Senceive's cloud-based data visualization platform. The system was configured to send data at a 20-minute frequency, but has the ability to sample at sub-minute rates if required during construction. Automated alert warnings were set up to be triggered if movement exceeded pre-selected threshold values. Reporting frequencies could be changed remotely from WebMonitor™, if required.

The use of Senceive's wireless monitoring technology helped the construction team keep the bridge open throughout the upgrade work by providing insight into the structural stability of the tracks and piers. It helped engineers and other stakeholders proceed with confidence that they will be immediately alerted of any concerning movements. With long-life batteries and very low power consumption, this type of system can be re-used on further projects.

“We needed a monitoring system that was fast and easy to deploy with continuous data reporting capabilities, automated alarms, and no line of sight required. We were able to install the Senceive wireless system without stopping busy commuter trains and now have remote insight into the structural stability of the bridge during this period of construction work.”

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