

SITE MONITORING



STEALTH MODE

Surveying and monitoring play a key role in Long Island Rail Road's much-anticipated main corridor track addition

By Larry Trojak, Contributing Author

Think of it as stealth construction. On most major urban projects, long before the first bucket of dirt has been scooped, the first pile driven, even the first property corner verified, work, in the form of pre-construction survey and monitoring, has already been set in place. Critical for identifying existing conditions of adjacent properties before work begins, then monitoring those same properties—and others—for

movement after startup, these facets can be as important to a design-build team as the project itself. In an ongoing project to add a third track to a 10-mile segment on the main corridor of the Long Island Rail Road (LIRR), Bronx, N.Y.-based Vibranalysis is undertaking that effort throughout the length of the \$1.8 billion project. Utilizing an arsenal of total stations, optical prisms, and an abundance of geotechnical, structural and environmental monitoring

sensors, the company is helping ensure that the “before” picture is documented and any “after” events can be quickly identified and mitigated.

Working on the railroad

The LIRR's main line, which runs the length of the island from Long Island City, Queens, to Greenport, Suffolk County—roughly 95 miles—carries about 40 percent of the railroad's current 308,000 daily ridership.



Vibranalysis is using total stations, optical prisms and other monitoring sensors.

interruption in train traffic along that 10-mile stretch,” said Howard Jameson, Vibranalysis’ vice president. “The expansion will be huge for improving service reliability on the line. However, this project covers a lot more than just the additional track, and we are providing instrumentation and monitoring services in several of those areas as well.”

Indeed, the list of improvements covered under a larger \$2.6 billion cost umbrella is sizeable. It currently includes the elimination of seven grade crossings; seven bridge replacements and modifications; improvements at five passenger stations; replacement of seven electrical substations; improvements to existing parking facilities and construction of an entirely new parking ramp; and 7.5 miles of sound/retaining walls.

“Using monitoring gear on a job like this is essential,” said Jameson. “Anytime you are conducting an extensive scope of work adjacent to structures that are remaining active, you need to ensure that those structures react in the manner in which the way

A third track has been a subject of discussion since the 1940s but, for reasons ranging from fiscal concerns to resident complaints and everything in between, could never

reach approval. Until this time around.

“More than a hundred thousand people depend on the LIRR’s main line on a daily basis—people who are affected by any

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they are designed. And if they don't, you need to be able to quantify that change and mitigate it immediately. We provide that level of information."

While extremely complex in practice, the science behind monitoring movement is actually rudimentary. A semi-permanently mounted total station measures angles and distances to optical prisms affixed to the structures being monitored. Software, bundled with the monitoring system, applies statistically weighted adjustments to the measurements and outputs spatial coordinates for each prism. If the system notes a change in those coordinates, more than likely movement of the monitored subject has occurred. By comparing current and initially gathered coordinates, the degree and direction of the movement can be determined.

Locking on target

To gather the data needed to determine if construction is having an adverse effect on nearby assets, Vibranalysis is equipping each of the seven main line stations with

a fully Automated Deformation Monitoring System (ADMS) from Topcon Positioning Systems. The system is centered around a Topcon MS05AXII total station which provides angular accuracies of 0.5 in.; reliable distance accuracy at 0.5 mm; customizable 2-D monitoring; and an autocollimation accuracy of 1 in.. Unlike conventional total stations that simply lock on to the nearest targets, the autocollimation system chosen allows the instrument to lock on to targets that are closest to the center view of the instrument, providing long-range precision and accuracy even in low light conditions.

The ADMS also includes a Topcon Delta Link controller, which provides support for autonomous operation of the total station in the field, and offers communications options that include Ethernet, Wi-Fi, and a globally approved integrated cellular modem (data SIM provided by third parties).

To ensure uninterrupted operation and data transfer during any short power outages, Jameson's team added a solar panel

at each monitoring station installation to complement the 110/240 VAC standard power supply and internal battery backup. Data from the total station is handled via Topcon Delta Watch software, which can process and analyze it individually or as a network-adjusted solution.

The total package

Seven individual stations along the line—Floral Park, New Hyde Park, Merillon Ave., Mineola Ave., Carle Place, Westbury and Hicksville—also are undergoing major renovations as part of the project, including construction of longer station platforms to accommodate full-length trains. Vibranalysis will have monitoring station packages located at each major work location, positioning components in a number of ways (on pedestals, poles, rooftops, abutments, etc.), depending on the specific need.

"This protocol will allow us to monitor the adjacent receptors to determine whether there is any construction-related movement or vibration that could potentially cause damage," said Jameson. "We are conducting



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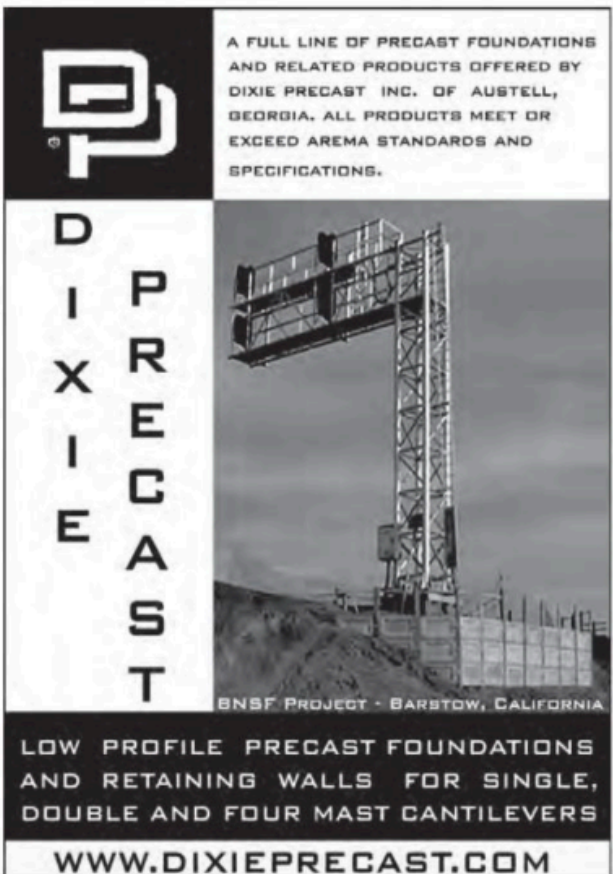
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similar work near the Mineola station at the site of a new five-level, 550-space parking garage. There, we've mounted a pair of [monitoring] stations in enclosures atop stout, 10-ft-high poles (for added security) and we will install optical prisms to monitor both the adjacent structures and the excavation's SOE (support of excavation) wall."

Efforts paying off

Since upping its game, Vibranalysis has been involved in some truly high-profile projects throughout the NYC metro area, including work associated with The High Line, a former elevated railway that has been repurposed into a 1.45-mile pedestrian greenway.

"We've worked hard to build this facet of the business and have been steadily seeing the fruits of those labors," said Jameson. "In fact we recently landed several projects in the Los Angeles area which is not only a huge step forward for us, it's an excellent opportunity to showcase our expertise to an entirely new market. We're landing some great projects, we have outstanding people



Monitoring station packages will be located at each major work location.

working for us—some of who have been with the company for well over a decade—and our equipment has been effective. On [another] project, we will be doing things that I think only three or four other firms

like ours in the world can do. And we're proud to be a part of projects like the LIRR expansion, which will have a real, positive impact on so many people. I'd say we're positioned exactly where we need to be." ■



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