

On Oct. 3, 2009, thousands of people are expected to gather along the east and west sides of the Hudson River near Poughkeepsie, N.Y., to celebrate the grand opening of the Walkway Over the Hudson—the longest pedestrian bridge in the world. Originally constructed in the late 1800s as the Poughkeepsie Railroad Bridge (also called the Poughkeepsie-Highland Railroad Bridge, the Poughkeepsie Bridge and the High Bridge),

Railroad Bridge operated for nearly 100 years and was once a major rail crossing; at its peak during World War II, an estimated 3,500 train cars crossed the bridge daily. However, this rail traffic slowed as other railways and highways were constructed, and by the early 1970s, traffic had dwindled to only one train per day. Then, on May 8, 1974, a fire caused severe damage to the bridge decking on the east side, and the bridge was closed to the public.

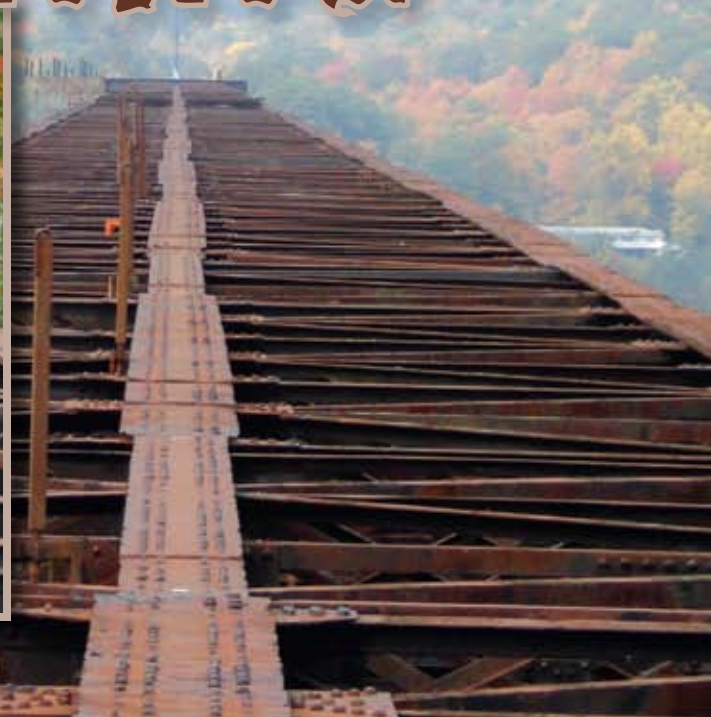
The Poughkeepsie Railroad Bridge is set to reopen as a pedestrian walkway in October—thanks in part to two brave surveyors with high-tech GNSS equipment.

BY CHRISTINE L. GRAHL

the structure has always been impressive. Extending 6,767 feet across the river at a height of 212 feet above the water at its highest point, the multispan cantilever bridge is both longer and higher than the Brooklyn Bridge, which was completed a few years earlier in 1883. The Poughkeepsie

The bridge was abandoned—but it wasn't forgotten. Fred Schaffer, an attorney, historian, amateur photographer and avid bicyclist from Poughkeepsie, began lobbying to restore the bridge for pedestrian use. In 1992, Schaffer founded The Poughkeepsie-Highland Railroad

PRECARIOUS POSITIONING



Bridge Co. Inc. (more widely known as Walkway Over the Hudson) as a nonprofit organization dedicated to preserving the bridge as a historic structure and transforming it into a linear park and trailway. Many others joined Schaffer's efforts, and in 1998, Walkway Over the Hudson was granted ownership of the bridge. However, with the cost to restore the bridge estimated at \$25 million, obtaining the required funding proved challenging.

New York Congressman Maurice Hinchey, an early advocate of the project, secured the first significant funding appropriation for Walkway in 2006 in the form of a \$874,000 grant from the U.S. Department of Transportation. Other donations followed. Finally, in 2007, the organization was able to take a major step forward when the Dyson Foundation, a local philanthropic group, committed a \$1.5 million grant to complete the required in-depth planning and engineering studies. Detailed inspections of the bridge's superstructure and underwater piers, overseen by the engineering firm Bergmann Associates, pronounced the 120-year-old bridge structurally sound, and an economic impact study determined that a completed Walkway Over the Hudson would generate millions of dollars in new revenue within the Mid-Hudson Valley. The decision was

made to move forward, and construction officially began in May 2008 with removal of the remaining timber decking, railroad ties, utilities and railings by Environmental Remediation Services Inc. The goal was to complete the renovation work and open the bridge in time for the fall 2009 quadricentennial celebration of Henry Hudson's initial river voyage.

By August 2008, the demolition work was complete. Harrison & Burrowes Bridge Constructors Inc. (H&B) of Glenmont, N.Y., was selected as the general contractor to manage the structural repairs, installation of the new deck panels and installation of the new bridge railings. However, before this work could begin, new surveys were needed. To handle the survey work, H&B selected Spectra Engineering based in Poughkeepsie.

Establishing the Project Goals

The new walkway consists of large concrete panels set in place on the existing ironwork. These panels, manufactured by The Fort Miller Co. Inc., Schuylerville, N.Y., were prefabricated offsite and then transported to the bridge to be placed into position with a 110-foot crane. The panel dimensions varied depending on where they were located along the span—the main span, the western ramp or the eastern ramp approach. “The main span

over the Hudson River is level, but the top ironwork is perpendicular where the railroad tracks once existed,” explains Adolf Jonietz, PLS, senior surveyor for Spectra Engineering. “The western and eastern approach ramps are parallel to where the railroad tracks once stood. They are also on a downward grade from west to main span and then continue from main span on a downward grade to the east. The east approach also curves before landfall and is banked. With all of these conditions in play, project designers needed the ability to take a panel for a particular area and set it into place.”

H&B had already begun collecting field measurements for the concrete prefabrications and submitting the data to Bergmann Associates. However, the magnitude and time constraints of the project made it necessary for the general contractor to hand off the data collection work to an outside firm. As the subcontractor for the project, Spectra Engineering was charged with the following tasks:

- Locating the 102 separate U-beams for the main span over the Hudson River.
- Identifying the cross section at each pier location (on 46 separate bents).
- Identifying evenly spaced cross sections between pier locations. (Each cross section ranged from 30 feet long to more than 185 feet long.)
- Providing X, Y and Z coordinates for all locations and submitting spreadsheets and sketches of the areas located.

Jonietz was assigned to the project as acting party chief along with Jacob Fiske as rodman, but the crew wasn't quite ready to begin. “The highest point on the bridge is 212 feet above the water, and we weren't OSHA fall-protection certified,” Jonietz says. Fortunately, they were both able to take the required six-hour fall-protection class almost immediately, which prepared them—in theory, anyway—for their balancing act above the Hudson River.

Surveying on a Tightrope

On Sept. 24, within two days of being awarded the project, the crew began their



Left: Adolf Jonietz locates points on the curve of the east approach of the bridge. Above: Massive concrete panels are set in place for the new walkway.

work on the bridge. Each day started with a 7 a.m. safety meeting to discuss weather and site conditions along with other safety issues and reminders. In addition to the standard hard hat, steel-toed boots and safety vests, Jonietz and Fiske were issued safety glasses, work gloves, a fall-protection harness, a double lanyard and a 15-foot retractable lanyard. "We had to be tied off at all times during our work on the bridge—no exceptions," Jonietz says. "We were limited in the amount of safety cable that was installed, so that restricted the amount of work we could accomplish per visit."

The steel beams on the bridge were only 15 inches wide at their widest point, which left no room to maneuver around a typical total station or any other instrument that required a tripod. Jonietz determined that GPS equipment would offer the best solution. He chose a Leica System 1200 SmartPole with GNSS control and a cell modem for real-time network (RTN) capability. "This equipment is lightweight and very versatile," Jonietz explains. "New York state has a free real-time network, so no base station was necessary. Additionally using the New York network tied us into the New York East state plane coordinate system. This provided us with immediate results that could be verified while we were still out on the bridge, eliminating return trips for corrections."

Before entering the site, the crew checked into known control points inland from the bridge. They would use those points at the end of the day to verify the accuracy of their data. Jonietz and Fiske then clipped into the safety cable and began their ascent. "Our first few steps onto the bridge were eye-openers," Jonietz notes. "We were walking on a piece of steel that was 15 inches across at its widest and reduced to as little as 1 ½ inches wide. The beginning of the bridge was only approximately 50 to 60 feet off the ground, but we still didn't want to fall."

"We made our way to the starting point of our location, which was about 600 feet from where we first clipped into the safety cable and about 200 feet above land. As I

GPS equipment was used to gather the required data for the bridge work.

Bridge Restoration

The restoration process is being accomplished in four phases:

- **Phase 1:** Attain ownership of the bridge. *This phase is complete.*
- **Phase 2:** Do a structural analysis of the bridge and use it to generate a comprehensive plan, including budget and timeline for completion. The group also has to find funding for the project and secure funding for the start of construction. *This phase is complete.*
- **Phase 3:** Construct and open the first 1,800 feet of the walkway on the Ulster County side. The Dutchess County side will get an elevator and 900 feet of walkway. *This phase is in progress. On the west side heading east, panels have been set halfway over the Hudson River. On the east side, another crew with a crane started heading west in March 2009; by July, the crew was within 1,800 feet of the crew heading east. The elevator has been put on hold due to a lack of funding.*
- **Phase 4:** Construct the remaining 4,000 feet of the walkway and a connection to the Hudson Valley Rail Trail in Highland and the Dutchess Rail Trail in Poughkeepsie.

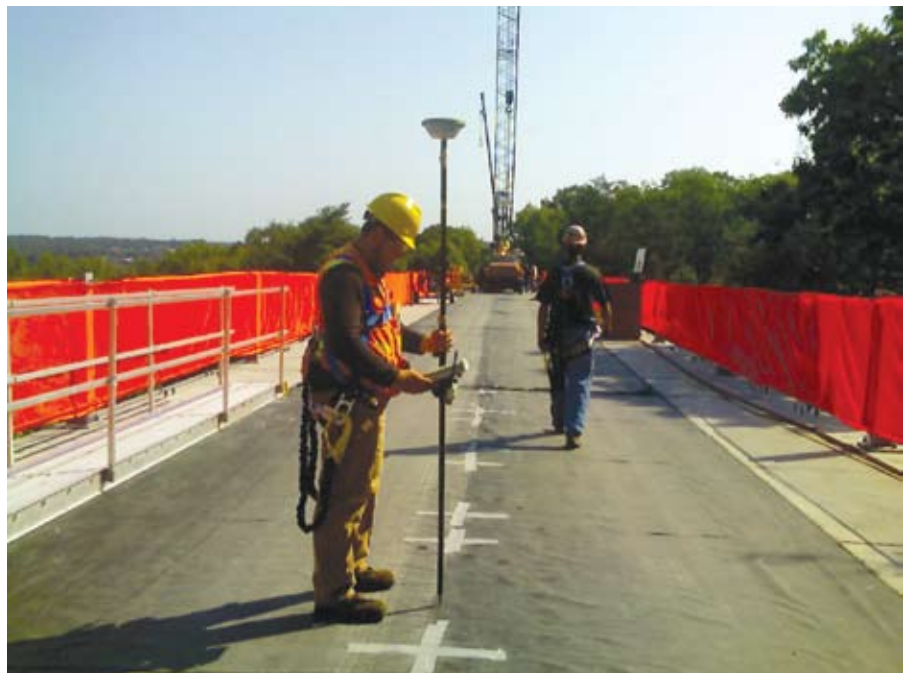
The Walkway Over the Hudson is set to open on Oct. 3, 2009, as part of the quadricentennial celebration of Henry Hudson sailing up the Hudson River. So far, construction remains on schedule.

For more information about Walkway Over the Hudson, visit www.walkway.org.

squatted down on the steel to mark out our location points, my mind began to race: *What was I thinking? Whose idea was this? Is it 5 o'clock yet? I get to do this again tomorrow? Wow—look at these views!*"

Using GPS, the crew located points for the main span over the river, three in the center line of each U-beam and two along the easterly edge (one to the north of the center line and one to the south of the center line) as they edged out onto the bridge. They relocated the center-line U-beam and center-line bridge span on their return

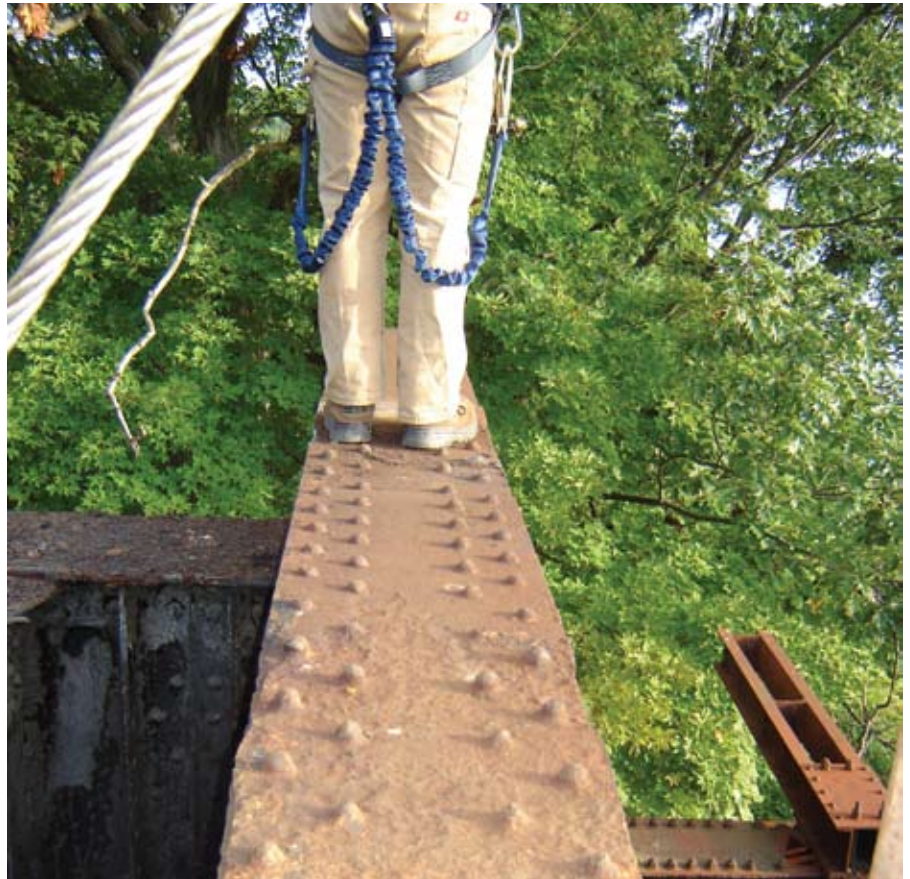
trip. For the ramps, they located the center of the three main girders approximately every 30 feet and the bents (placement of girders onto the piers) on the way out, and then they relocated the center-line girder at the bents on their return trip. To verify accuracy, they checked their data at different times of the day using different satellite geometry, and they also measured between location points with a conventional steel tape. "It was critical to show the changes in elevation from one side to the other in regard to the center line," Jonietz





Above: An aerial shot of the bridge before the renovation work began.

Right: The steel beams were just 15 inches wide at their widest point.



says. “These elevations gave Bergmann Associates actual results compared to plan drawings—they were looking for twisting, sagging or bulging areas of steel.”

Staying on Track

Since Spectra was only contracted to work on the bridge to develop an as-built survey, they were not required to tie into any boundary lines. After their second day of work, they had collected enough data to allow the site engineer to identify any discrepancies between the field measurements and the original plan drawings and to provide the details that The Fort Miller Co. needed to continue manufacturing the panels. The crew performed additional surveys on Oct. 1, 15, 16 and Nov. 21 following the same procedures every time. “H&B installed the safety cable for us each time, and the availability and location of the cable determined how much data we could collect each day and when we could return to continue gathering data,” Jonietz explains.

The work was temporarily delayed by permitting requirements. A 1,000-foot section on the east side of the bridge crosses an active passenger-train railroad, a state highway and an electric substation, each owned or managed by a different organization, and H&B had to secure permits from all three

groups before contractors could work in the area. However, once the permits were obtained, the work proceeded quickly.

After each field session, Jonietz provided the site engineer with spreadsheets containing the data. For each survey, the crew recorded the work date, time of day the work was performed, the weather, temperature and a description of the work completed. “The only change in data collection was whether we were working on the main span or the ramps,” Jonietz says. By the end of the project, the crew had gathered the following data:

- The dimensions between each U-beam on the main span to the north and south of the center line and the center line itself.
- The elevations at each coinciding location point on the main span to the north and south of the center line and the center line itself.
- The dimensions between each bent on the ramps to the north and south of the center line and the center line itself.
- The elevations at each coinciding location point on the ramps to the north and south of the center line and the center line itself.
- The dimensions and elevations between the bents.

In addition to compiling spreadsheets, Jonietz entered all of the data in a CAD file to provide the engineering team with the required sketches and drawings.

With the use of modern technology, the survey work was completed safely and ahead of schedule. “Spectra’s contract was for 14 days on site, but we were able to collect the necessary data in seven days,” Jonietz says. “The use of GPS on this site was unmatched to the use of a total station. No setup needed, open sky to GPS—connect and go.

“Although the work was challenging, being a part of this important project has been very rewarding.” 🌍

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