3D Software Helps Marine Contractor Cut Pile Placement Time

By Judith Powers

A request by a marine construction contractor in Canada for an economical method of setting raked, or batter, piles produced pile-driving software that cut the time for setting and driving piles from a floating crane in half, a benefit that will increase safety and production time for river contractors.

Reg Tramble of Alva Construction Ltd. of Antigonish, Nova Scotia, is the project engineer on a wharf replacement project that includes more than 40 meters of timber cribbed wharf in addition to 80 meters of timber piling wharf with concrete caps and deck. There are 180 piles in the section: 132 vertical and 48 batter piles, which are driven at an angle.

"We use GPS machine control on our excavators and dozers and were trying to get the system to work on our floating crane," said Tramble. Positioning and adjusting the angles of the piles had always been accomplished by crew members in a raft, which, in addition to being time consuming, presented an element of danger to the crew, said Tramble.

He visited the Trimble booth at CONEXPO in Las Vegas in March, where Teledyne was announcing the rebranding of its PDS (port dredging survey) software with the Trimble name—Trimble Marine Construction (TMC). The partnership was signed at the show by representatives of the two companies. The PDS software added a necessary 3D element that Trimble hadn't had before. On display were screen shots from a dredging project showing a colorful 3D real-time image of the dredging project, along with multiple screens displaying other aspects of the project.

Applied To Pile Handling

Lou Nash, president of systems integrator Measutronics, brainstormed with Reg Tramble, and the two came up with a plan that applied this visualization to pile handling. Nash agreed to create the software and install the system on Alva's barge-mounted Terex crane, which is fitted with a fixed-lead Birmingham VTL (vertical travel lead) pile driving system and Pileco diesel hammer.

Within two weeks, Nash and other Measutronics engineers had completed the system. This included creating a mock-up of the crane to find the optimum location of the pitch and roll sensors and GPS antennas, the creation of the graphics on the operator's screens, and the equipment installation in the small cab on the crane. Teledyne's programmers in Rotterdam created the drivers that integrated the signals from the sensors into the software package.

Measutronics Systems Specialist Nathan Keys worked with Nash to envision and create displays showing a simple and accurate method of positioning a pile before and during engaging the hammer, along with monitoring and displaying other statistics of the ongoing project.

Keys described the main operating screen: "The current pile location is represented in green and the target location in yellow. Basically, they want to move the green pile on to the yellow one," he said.

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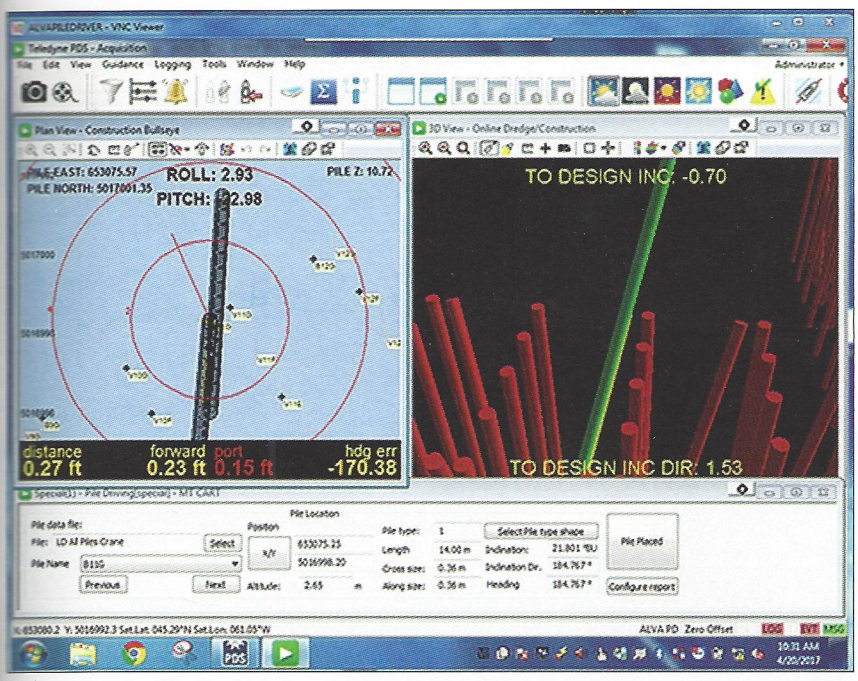
Above: A closeup view of the pile driver positioned over one of the batter piles which are driven at an angle.

Above, the crew installed the equipment bracket high on the lead to protect the two GPS antennas and the pitch/roll from the free-swinging piles as they were positioned in the lead. Left, after the timber piles were placed, they were cut off to design elevation and the wooden cribbing installed in preparation for installation of the concrete cap. The batter piles provide extra strength to the structure by resisting heavy lateral or inclined loads.



Screenshot of 3D software.

Pile Placement

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Text indicates movement from left to right, straight line distance to the target, the change required to get from the current location to the target location, and change required to get from current heading to the design heading.

As the operator moves the joysticks, the text reads the inclination change required to get to design inclination, and another reading gives the inclination heading change required to achieve the design inclination heading.

Another screen is for selecting the design pile. "Once the pile is selected, the screen shows the design pile properties such as Northing, Easting, Elevation, Length, and Inclination," explained Keys.

"Our crew came up with a mounting system that protected the (external) equipment, mounted on the lead," said Tramble. This included the two GPS antennas and the pitch and roll sensor. The cab-based equipment included a laptop computer to run the TMC software and the Trimble GNSS receivers, which provided position and heading.

After the equipment bracket was in place on the lead, followed by three days of installation, calibration, and training by Measutronics, the system was put to work.

"We were already working on the project and it was 65 percent complete before the system was installed," said Tramble. "This gave us a comparison between pre- and post-install times. For the vertical piles, it took 40 to 50 percent less time. For the raked (batter) piles, we were still on a learning curve, and saw a 25 percent decrease in time, but I think it will go up to 50 percent in the long run," he said.

Nash said that a feature they plan to develop in the software is to preplan barge positions in order to minimize moves.

"Contractors tell us that the biggest savings is in minimizing moves," he said.