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Advanced Concrete Technologies, Inc., Greenland, New Hampshire, 03840, USA

PennStress builds strong foundation for growth with state-of-art batch plant

In December 2014, the Newcrete precast division of New Enterprise Stone and Lime Co., Inc., of Roaring Spring, Pennsylvania, USA, was acquired by the MacInnis Group, LLC, and relaunched as PennStress. The precaster is a leading regional supplier of structural prestressed concrete elements for DOT and commercial projects, including highways, parking garages, stadiums, bridges, and modular correctional facilities. Since its founding in the 1950s, Newcrete relied on concrete from the parent company's high volume ready-mix operation. Under new ownership, PennStress evaluated new production options, including the choice to continue using ready-mix or invest in its own concrete batching system.

PennStress senior vice president and chief operating officer, Greg Gorman, who held a similar position in the Newcrete organization, developed a strategy to enable the firm to transition to an in-house batch plant. According to Gorman, the firm had experienced challenges over the years producing prestressed concrete structural products using solely ready-mix concrete.

Choosing the right tool for the job

The nature of the high performance concrete (HPC) products manufactured at PennStress demand advanced mix designs. Large PennStress "I" beams, for instance, may be prestressed with steel cable tendons to forces totaling more than three million pounds of pre-tensioning. The beam forms are filled with HPC and allowed to

steam-cure for approximately 26 hours before the forms are released and tension strand ends cut. Inconsistencies in concrete compressive strengths can result in differential camber from beam to beam.

"Our mix designs require in excess of 10,000 psi in specialty mixes," Gorman notes. "It's very difficult to get consistent high-strength concrete from a high volume ready-mix plant. So consistency in concrete quality was an ongoing concern and cost was another important factor. We sacrificed economy in mix constituents to compensate for the lower mixing energy typical in conventional ready mix."

Gorman adds, "Ultimately, we needed the right batching tool for our specific requirements. One that would enable us to deliver quality products and provide greater production efficiencies." Once PennStress began operations, the decision to transition to an in-house batch plant came swiftly. Gorman and his production management team had been researching their options in mixing and batching technology for almost a year by the time the company sale took place. The batch plant acquisition team added an experienced plant operator, Ed Flaugh, to help strengthen the decision process. The team used research from the National Institute of Standards and Technology, industry sources, reference calls, sites visits, and other resources to choose the right mixer – a planetary counter-current pan mixer. It came down to four vendors. "We did our due diligence, that's for sure," Gorman notes. "We saw the vendors at the PCI annual show, met with them individually, called their customers, and we received their proposals and drawings. We narrowed it down to three, then one: Advanced Concrete Technologies."



The PennStress precast facility (background), in Roaring Spring, Pennsylvania, USA, features 250,000 square feet of production space under roof. The company is a leading regional producer of high performance precast prestressed concrete products such as the "I" beams shown in the foreground.



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Batch plant acquisition analysis team for PennStress included, from left to right, batch plant operations supervisor Ed Flaugh; vice president of engineering and production Russell Dickson, PE; senior vice president and chief operating officer Greg Gorman, PE; plant supervisor Frank Musselman; and chief estimator Anthony Gayle.



PennStress chose an ACT/Wiggert MobilMat Mo3450 batch plant, equipped with an HPGM 3450 planetary countercurrent mixer, to supply high performance concrete for its three production bays. This flexible system features two discharge gates that allow the use of multiple concrete delivery systems simultaneously, including a rail-mounted crane bucket transport cart (at left in photo), a Tucker concrete transport vehicle (under mixer platform), and a forklift-mounted bucket (not shown). The entire batch plant, including four silos (in foreground) and aggregate storage, is located inside the facility allowing all-weather operations and consistent aggregate conditioning.

Gorman says his team liked ACT for several important reasons. "We especially liked the fact that ACT provides a complete, turnkey system that included everything we needed. We felt that the overall integrated and tested design of the ACT solution set them apart from other options."

Laboratory mixer saves months of testing

The PennStress selection team also liked the fact that ACT could provide a laboratory-scale batch plant that featured a planetary countercurrent mixer, which allowed the company to test and perfect mix designs prior to receiving the production system. "We knew that whichever batch system we chose, it was going to take some time to manufacture, ship and install the system," Gorman explains. "So we included in our specification that we wanted the vendor to provide a temporary small mixer in the meantime so that we could begin testing mix designs."

ACT had a laboratory-scale mixer available for immediate delivery. Within a few weeks of signing the deal in the spring of 2015, PennStress had the small countercurrent planetary mixer plant from ACT in its shop. "That was a huge time savings for us," Gorman notes. "The ACT lab mixer helped us adjust our mix designs to match



A rail-mounted ACT/Wiggert concrete transporter can carry up to two concrete crane buckets – one full, one empty – and supplies two of three production bays at the PennStress plant in Roaring Spring, Pennsylvania, USA. A crane bucket on the transporter is shown here being loaded from one of two mixer discharge gates. The third production bay is served by either a forklift-mounted bucket or a Tucker concrete transporter. The ACT/Wiggert HPGM 3450 planetary countercurrent mixer still looks brand new, even after nearly a year of operation thanks to the diligence of the PennStress operations crew aided by the ACT automatic high pressure mixer cleaning system that makes clean-up a 10-minute job at shift end or during breaks.



ACT/Wiggert MobilMat batch plant features PC-based WCS Control System with intuitive color-coded screen representation of all batching system components. The WCS system features integrated Hydromat moisture measuring with automatic batch water adjustment plus Hydrotester moisture sensors in sand bins to automatically maintain target batch yield. The WCS communicates with PLC controllers for execution of all commands. The controls feature password protection, recallable mix recipes, batching history, inventory control, and reporting for DOT compliance.



A four-compartment aggregate storage bin is housed inside the plant and can hold up to 200 tons. A weigh belt under the bins empties onto a conveyor that feeds a skip hoist for the final lift up to the ACT/Wiggert HPGM 3450 planetary counter-current mixer. Indoor storage allows aggregates to be conditioned for temperature and moisture to help ensure consistent batching.

the intensive mixing energy of the counter-current planetary mixer. We were able to test mix designs and go through the curing and strength testing process so we could hit the ground running when the production plant was ready. We saved at least three months and saved a lot of material that we would have wasted if we had to wait and test after plant installation."

ACT engineering staff assisted PennStress at every stage to design the plant solution, produce engineering drawings, prepare the installation site, batch plant installation, start-up and operator training. A centrally located area of the PennStress plant offered 21,000 square feet of space between its key production bays. The area was the ideal location for the new batch plant; however, a relatively low roof line made it a tight fit. "It was a real positive to be able to get everything inside, including our aggregate storage and silos," Gorman says. "Fitting the silos was a game of inches. The tops of the tallest silo is nestled between a couple of beams with about seven inches of clearance! We used a very experienced local erector and ACT was there to supervise everything." The ACT MobilMatMo3450-4-PCS batch plant installed in the PennStress facility includes the following components and systems:

- ACT/Wiggert HPGM 3450 planetary counter-current high-shear mixer capable of producing approximately 60 cubic yards per hour of high specification concrete. The three (3) cubic-yard mixer is equipped with two discharge gates for efficient filling of crane buckets or a Tucker concrete transporter. Concrete holding hoppers below each discharge gate provide enhanced efficiency during peak production.
- Rail-mounted ACT/Wiggert crane bucket transporter automatically shuttles crane buckets back and forth across two production bays from the mixer platform. The transporter can carry up to two buckets—one full, one empty—for optimal workflow efficiency.

- Four-compartment aggregate bin with up to 200 tons of capacity. The bins are currently charged via front end loader, but PennStress has future plans to implement an automated charging system that would allow the system to be charged by dump truck from a drive-over hopper feeding a conveyor system.
- Hydrotester moisture sensors are installed in two of the aggregate compartments to monitor and auto correct for the sand moisture content.
- WCS Control System is PC based and provides intuitive color-coded real-time display of critical elements of the batching process, as well as tracking of production statistics and reporting for material consumption, inventory, and maintenance scheduling. The WCS includes statistic, batching history and reporting that satisfies stringent DOT requirements.
- Hydromat moisture measuring and control system provides automatic batch water correction, which is critical for precision mix designs such as SCC.
- Four silos, installed near the mixer platform, provide up to 280 tons of total storage for cement, fly ash, and other components. The silos are fitted with anti-over-fill protection systems further protecting the environment.
- Ground-mounted dust collector uses cartridge style filters and features automatic air-shock cleaning to capture dust from silo charging and batching operations.
- High-pressure automatic mixer cleaning system reduces the cleaning cycle to about 10 minutes at the end of shifts or during breaks. Hand-operated lances allow spot cleaning and cleaning outside of mixer, chutes and crane buckets at the end of the day. Good housekeeping equals a happier work environment and longer life for equipment.
- Waste water reclamation system.



PennStress plant operations staff include: batch plant operations supervisor Ed Flaugh; batch plant assistant Josh Andrews; batch plant operator Matt Mock; and batch plant assistant Andrew Gorman.



A crane bucket is used to place high performance concrete in a form on the production floor at PennStress in Roaring Spring, Pennsylvania, USA. The company transitioned in the summer of 2015 from an all ready-mix operation to an ACT/Wiggert in-house concrete batching system. Since that time, the company has seen improvements in concrete consistency, far less deviation in compressive strength, better product quality, and a significant reduction in production costs.

Hitting the mark on the first try

"From left to right and front to back, we located our batch plant in the absolute sweet spot in terms of servicing our three main production areas," Gorman comments. The ACT/Wiggert MobilMat batch plant was installed and operational by early November 2015. "Pretty much all of the goals we set forth in our proposal have come true for us. By locating our batch plant completely indoors we can condition our aggregates in terms of moisture and temperature for optimal mix results."

He continues, "The central location of the plant and the multiple systems we have for moving concrete to the casting areas means we can pour in multiple locations simultaneously and achieve better efficiency results. We're using the bucket transporter for two bays, a forklift mounted bucket for a third bay and a Tucker transporter for pouring large volume products such as double tees for parking structures."

Gorman emphasized that they have perfected key mix designs to take advantage of the higher energy provided by the HPGM planetary countercurrent mixer. The standard deviation in compressive strength and the time required to achieve early strength has drastically improved with the new batching system. Today, standard deviation is in the range of a few hundred p.s.i.

and the firm is seeing savings in the amount of constituent materials required to hit required strengths.

The consistent workability and quality of concrete produced in the new batch plant is far superior to the ready mix it relied on for decades. "Bugholes are virtually eliminated and finish consistency is always excellent," Gorman says. The availability of HPC on a continuous basis has led to the implementation of key lean process improvements.

ROI is real

Bottom-line savings have emerged since installing the ACT MobilMat batching system. PennStress is able to change or adjust its mix design on-the-fly enabling the company to easily pour different products simultaneously. The firm is able to use its labor more effectively thanks to more predictable curing times and form releases. There's also less wasted material since the company controls its own mixing and batching.

"Conservatively, I'd estimate our concrete-related savings across the board to be on the order of 20 percent," says Gorman with a smile. "There's no limit to what we can accomplish now. We have the flexibility and control to produce the highest quality concrete and therefore the highest quality products on the market. While we're primarily a structural precaster, we are also certi-

fied as an architectural plant as well. Our new initiatives and new batching capabilities have opened the door for us to grow into new markets." ■

FURTHER INFORMATION



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