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Continuous Innovation from Advanced Concrete Technologies Yields Profitable Results

Portsmouth, NH - Successful companies continuously innovate. This spirit of exploration is what drives new product and new market development. Nowhere is this truer than in the concrete industry. New construction challenges, changing requirements, new products, and resource availability all have played a role in bringing dramatic change to this industry category. That's where Portsmouth, NH based Advanced Concrete Technologies and its German parent companies, Wiggert + Co. and Wurschum have stepped into the forefront.

Advanced Concrete Technologies (ACT) and its German parent companies, Wiggert + Co. and Wurschum, have a global reputation for high quality, high precision mixing and batching solutions. ACT is particularly well-known in its main N. American market for its turnkey plants, featuring Wiggert planetary countercurrent mixers. These high speed mixing and batching plants are renowned for providing the fast, precise batching needed for today's demanding concrete production requirements.

Wiggert has never been a company that has rested on its laurels. From automated high-pressure mixer cleanout systems to automated microwave

moisture monitoring and programmable recipe-based computer control systems, Wiggert HPGM mixers have consistently led the industry in mixer intensity and quality.

Recently, Wiggert conducted extensive computer simulations of its planetary mixers in conjunction with a leading German concrete industry research institute. This exclusive research was designed to increase Wiggert's overall knowledge of mixer performance and help the company fine-tune its systems to provide even greater mixing intensity for optimal mix characteristics.

This on-going research program focused first on Wiggert's popular two cubic-yard mixer, the HPGM 2250. Wiggert this year will produce its 1,000th mixer in the HPGM series. To simulate the mixer action, the German research institute first created a computer model of the HPGM 2250, using Wiggert design schematics. The institute adapted a flow dynamics program that had been originally developed to simulate the operation of mining equipment.

Algorithms were created to simulate the friction coefficients for various size aggregates and cement particles. The independent motion and mixing action of approximately 25,000 mix particles and aggregates is simulated. The resulting program and data were repeatedly run to determine the impact of changes to mixing speed, mixing shovel angles, side scraper location, and other variables. Each simulation requires five computers, running in parallel 24/7, and takes approximately three weeks to complete.

According to Wiggert founder and president, Klaus Wiggert, the mixer simulation research is the first of its kind for planetary countercurrent mixers. The mix simulation research was initiated by Wiggert+Co. because of the advent of more critical and sophisticated concrete mix designs such as self-consolidating concrete (SCC) and ultra high strength concrete.

“We wanted to create a way to simulate our mixers without having to repeatedly run field tests at our own facilities or at customer sites,” Wiggert explains. “We still conduct field tests, but now we will be running those tests to verify the results of our computer simulations. So far, our simulations have been very accurate when compared with actual test situations. This type of research is essential in order to provide the best possible mixer for our customers.”

One of the theories that Wiggert+Co. explored in its research was that variations in mixing speed during the mix cycle can provide certain advantages. Many of today’s new concrete mixes, including SCC, require high energy mixing to achieve an optimal homogeneous mix. The Wiggert research, both in computer simulations and in the field, has found that by varying mix speeds at certain critical points in the sequence, an optimal mix can be achieved more quickly

Flexible New Feature

A product innovation that has been validated by the research is the introduction of variable speed control for the Wiggert/ACT mixers. This control system can be ordered with any of the ACT mixers or provided as a retrofit for existing mixers. The variable speed mixer control can be integrated into the PCS computer control system and controlled by recipe selection.

For instance, an SCC recipe may instruct the PCS control system to apply a moderate mixing speed for initial dry mixing of aggregates and cement. Near the end of the SCC mix cycle, critical admixtures (e.g., plasticizers) are typically added and the control system may accelerate the ACT/Wiggert mixer up to 20 percent over normal mixing speeds to achieve optimal admixture and cement dispersion for superior quality and consistency in a shorter time.

Later, if a delay occurs in the production process, the PCS control system can automatically slow the mixer speed using the variable speed controller so that the batch is agitated, but not over-mixed. Fixed-speed mixers often over-mix the

concrete, degrading mix quality if the mixer is not able to be discharged. Additionally, this reduces unnecessary wear, which can lead to lower operating costs.

One early adopter of ACT/Wiggert's variable speed mixer control system is High Concrete Innovations, LLC, Lebanon, Pa., a member of the High Concrete Group of Companies (High Concrete). High Concrete is a founding partner of AltusGroup, Inc., along with Oldcastle Precast, Metromont Corporation and TechFab, LLC. AltusGroup™ is the developer of a revolutionary new precast product line known as CarbonCast™, which uses a carbon fiber reinforcing technology, C-GRID™, to reduce the weight of precast architectural concrete and structural components.

In 2004, High Concrete began planning for a new production operation in Lebanon, Pa., to produce its new CarbonCast product line. The new plant would produce carbon fiber reinforced architectural panels and insulated wall panels, as well as serve as a research and development facility for other innovative products.

High Concrete looked at several batch plant offerings from leading manufacturers. The company chose a MobilMat 80 (Mo 80) turnkey plant from ACT. Among the features that were attractive to High Concrete decision makers was the plant's Wiggert HPGM 2250 planetary countercurrent mixer equipped with a variable speed controller.

"We knew that we would be primarily using SCC in our CarbonCast products," explains Mark Adams, High Concrete plant engineer. "We also knew that the mixing dynamics of SCC recipes required a very high level of control. We believed that the ACT variable speed control would allow us to really dial in our batching control."

According to Adams, the variable speed mixer control also provides the flexibility the company needs for future product development. “We have an on-going R&D effort that includes the use of fiber additives to our mixes to mitigate micro-cracking,” he adds. “We have found that the variable speed control allows us to achieve optimal dispersion of the fibers and other admixtures at the appropriate points in the mix cycle. We believe this mixer system is helping us to produce higher quality mixes and provides the R&D platform we need to continue innovating.”

Another key advantage offered by the ACT MobilMat batching plant was its modular design. High Concrete had a tight schedule for outfitting its new plant and a unique environment in which the plant had to fit. “Only the ACT MobilMat plant offered us a kind of snap together design that could be implemented in just a few weeks,” Adams notes. “Other vendors proposed what were essentially stick-built plants that would have taken much longer to build and required us to hire numerous outside contractors to complete it. The ACT plant is modular and designed to be mobile, if need be. It’s compact design allowed us to fit it easily inside the large building we occupied in Lebanon.”

The Lebanon plant is entirely housed inside a former aluminum foundry facility, providing all-weather operations. The MobilMat 80 plant, including six aggregate bins, three cement silos, reversible weigh belt conveyor, mixer platform and PCS Computer Control system, fits easily into a corner of the massive facility. An overhead crane bucket is used to move mix to forms.

The facility also includes an innovative shot blast system, used to finish CarbonCast architectural spandrel and wall panels. The shot blast system uses tiny steel beads sprayed at high velocity to expose aggregate to varying degrees. The system is considered more environmentally friendly and safer than conventional sand blasting systems. The steel shot is recycled and can be reused up to 1,000 times.

Color of the concrete and aggregates are critical to the final appearance of the CarbonCast architectural panels. It is vital that cross-contamination be avoided when changing batch colors. One of the new innovations built into the MobilMat 80 PCS control system is a recipe-triggered warning to an operator that a cleanout is required before starting a new color production run.

According to Gary Graziano, AIA, Vice President of Marketing for the High Concrete Group companies, the ACT MobilMat batch plant was a natural fit for the new Lebanon facility. “This is the place where we undertake all of our new, unique and different products and development,” he says. “It is important that we have equipment that will let us go places that we haven’t been before. The ACT variable speed mixer and computer-controlled batch plant is the cornerstone of our new plant.”

By replacing reinforcing steel with an epoxy-coated carbon fiber grid, the CarbonCast architectural panels produced in the Lebanon plant are up to 66 percent lighter than conventional panels and provide significantly improved corrosion resistance, durability and insulating properties. The reduced weight contributes to lower shipping and erection costs, as well as potential savings in foundations and steel framing.

“The accuracy of our SCC mix is critical to our success with this product line,” Graziano explains. “The ACT batching plant allows us to get every batch right-the-first time and provides the flexibility we need for sophisticated new products. We believe the plant, and the variable speed mixer, in particular, are helping to keep costs under control and maintain the highest possible product quality.”

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(Photo caption under three circle photos showing stages of mixer simulation with following sub captions:

Photo a: Start

Photo b: 8 Seconds

Photo c: 25 Seconds

These images show the computer simulated mixing action within a Wiggert HPGM planetary countercurrent mixer. Simulations are used to help optimize the position of mixing arms, shovels, side scrapers and other mixer components. Sand, stone and cement are represented by different size and color particles. This sequence shows initial mixer charging through achievement of a homogeneous mix in just 30 seconds of mixing.