Carousel Course

Molin Concrete Products envisions high quality, consistency and timely delivery as it dedicates automated precast panel plant

A 118-year-old mainstay in Upper Midwest precast/prestressed production, Molin Concrete Products is ramping up an advanced, automated wall panel operation in Ramsey, Minn. The Precast/Prestressed Concrete Institute-certified plant will have annual capacity of 1.5 million square feet of architectural cladding, insulated sandwich wall panels and solid structural panels. Following the start of initial production in June, formal dedication at Ramsey is scheduled this month. Molin Concrete and its equipment supplier outfitted the operation in just eight months, a process that usually takes several years.

As Henry Ford demonstrated a century ago, a moving assembly line—where a product takes shape as it continuously moves along an in-factory production circuit—isn't new to manufacturing. The concept is seldom used in precast concrete component production in North America. In fact, though the system is somewhat common in Europe, only two other U.S. precast plants currently have similar automated carousel operations in place.

Why not? "The automated carousel production system is very capital intensive," says Molin Concrete Vice President of Sales & Marketing John Saccoman. "Traditionally, precast concrete panels are formed on long line, non-moving flat tables where concrete is delivered by either a truck or a bucket. All you need is a large space, a form, many laborers and a ready mix truck to pour. In our new system we bring the form to a pouring area and panels are cured in a steam chamber with few laborers.

"The carousel system requires a lot of equipment. Conveyors move the panels about to the concrete spreader, curing chamber, and tilt table for form stripping."

It's a marvel of automation, he adds. Conveyors form a continuous cycle where wall panel molds are automatically moved from one production station to another, each performing a specific process. Control comes from a central master device and production data is transmitted directly to the automated machines. Materials, such as steel reinforcement for panels, are supplied directly to appropriate stations where needed.

Computerized quality control is available at each station. For Molin Concrete, the result is faster production and less required labor.

The plotting machine in the lower left corner inks a CAD file on to the pallet for precise alignment of shutters. Also shown is the curing chamber and rack operator in the middle and right hand side.

Management estimates the new plant will operate with as little as one-third the labor required in traditional precast concrete plants. For building designers, contractors and owners, that means higher quality, more consistent products and faster product availability.

"A typical precast production plant of this capacity," says Saccoman "would require 48 workers. Our new plant will need just 14 to 18 workers."

The automated plant also requires far less space, the main floor measuring 80- x 350-ft., excluding batch plant and storage areas. Projected daily capacity will be 8,000 square feet of precast panels. To reach the same amount of product per day, a traditional precast plant would require four 12- x 200-ft. beds.

AUTOMATED CIRCULATION AND PRODUCTION

Molin Concrete's new Ramsey line has the feel of one of the ultra-automated Mercedes Benz plants in Stuttgart, Germany. The carousel wall panel line used by Molin is, in fact, manufactured by Weckenman, also a German firm. Precast concrete wall panels are formed, given shape, poured, cured, and finished in a continuous production line nearly untouched by human hands.

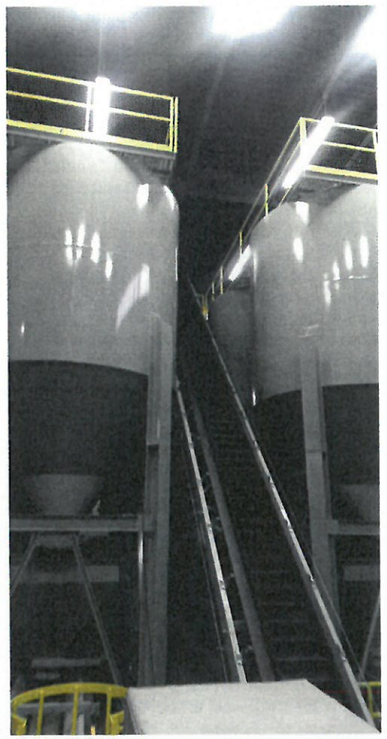
At the start of the line, carousel-style conveyors speed shuttering pallets (a concrete wall panel's base form) through a machine where brushes automatically clean the reusable form parts. Pallets consist of 12- x 40-ft. steel sheets framed by small steel beams. They roll down the line on pier-mounted rollers embedded in the plant floor. At certain stations, the pallets can be shuttled to the side on floor run traverse trolleys for special finishes, raised up on an elevator system to a troweling station, or slid into racks in the curing chamber. The 12-ft.-wide pallets are imported from Europe because sheets of that width are not available in the U.S. Cleaned and re-oiled after use, the pallets have a nearly indefinite life span.

Next, the prepped base arrives at a "shuttering" station where computer guided lasers zip around the form to indicate the location of desired panel openings, such as windows and doors, as well as the side edges that determine the dimensions. A handling crane sets magnetic metal profile pieces on guide lines. Shutters of 6-, 8-, 10- or 12-in. depth are available as needed. Molin Concrete can produce 12-in. thick panels as large as 12- x 38-ft. Panels can be solid or insulated and insulated panels can be composite or non-composite.

Continued on page 38

Overall view of the concrete placement stations. Two pouring buckets (one visible here) and a concrete spreader pour the concrete panels that will then move to the curing chamber by entering through the lower white doors. Directly above the chamber in the mezzanine is the troweling station where final finishes are applied to all products.

The batch station is ready to receive the pouring bucket (background) as two pallets are ready to enter the casting station (foreground).



As the panel moves further down the automatic conveyer system, the first layer of steel reinforcement is lowered by a worker-controlled crane into the panel form mock-up. The newly formed panel with reinforcement in place next arrives at the concrete spreader.

The Molin line runs a batch plant from Standley Batch Systems, Inc. It utilizes a weigh batching system and mixer; sand and aggregates are contained in 12 bins with 18 compartments. There are four silos for cement: two for gray cement, one of white cement, and one for fly ash.

Hanging from an overhead gantry, the spreader slides back and forth depositing concrete in the appropriate areas. Material is dispatched from the nearby computerized batch plant with a color pigment system and multiple aggregate bins for consistent batching of architectural mixes. The system automatically sends the correct type and amount of concrete mix to form the concrete panel. A second gantry-hung tool screeds the concrete and the panel is moved along to the curing chamber.

If the panel is to be a double wall with interior and exterior concrete wythes sandwiching a layer of insulation, the spreader will first pour the face mix to a prescribed thickness. The panel assembly is rerouted to a station where insulation is applied along with further reinforcement, and then it is run through the concrete spreader a second time for placement of the gray base mix. Insulated panels can obtain R-values as high as 23.0 with 4 inches of extruded polystyrene. Most panel finishes, including sandblast, exposed aggregate, hard trowel and broom, will be machine applied—providing unmatched consistency. Thin Brick and Formliner finishes will also be available.

With 3-yd. and 2-yd. output on three-minute cycles, the Rapid RP 3000 and RP 1500 planetary mixers bearing on the batch plant mezzanine have combined capacity of 800 yd. per shift. Each has two pneumatic discharge doors, mixer soft start, auto lube system and cylinder air control box. They supply all structural gray and colored architectural concrete needs for the Ramsey line.

Standley Batch Systems supplied the Rapid models as part of a package including 12 70-ton aggregate bins, equipped with Hydronix moisture probes. Four bins plus a 12-ft. square truck dump hopper are heated. Inbound aggregate are fed by a steep, pocket belt conveyor (top right) to a shuttle hovering the bins, each of which has weigh scale batchers charging collection belts charging the mixers. Standley Batch designed the plant with 98-ton and 86-ton split cement silos.

Molin Concrete crews and equipment suppliers turned the Ramsey plant project in well under 12 months.

The insulated panel is then screeded and shuttled off to the curing chamber. It sits in the curing chamber, set at 120°F with 100 percent humidity, for two to three hours. Initially, the curing chamber will be able to stack 18 pallets but capacity will eventually be expanded to 27 pallets. The panel is then pulled out and lifted to the top of the chamber by an automated elevator system, where helicopter troweling machines screed it smooth; then, back into the curing chamber for a final cure. To save plant space, the troweling station sits atop the curing chamber.

Next stop on the plant-long conveyor system is the stripping station, which consists of a large tilt table. It automatically tilts the completed assembly horizontal and the panel is de-molded from the shuttering profile elements and form. The tilt table is a critical piece of equipment. Traditional precast plants strip panels when they are laid flat. A poured concrete panel undergoes extra stress from the suction when it is stripped from its form while flat. In typical precast plants, wall panels are handled, stored and shipped flat, and rotated at the job site. In the new Molin plant, the panels are stripped, stored and shipped vertically.

Finally, automated equipment sets the finished precast panel on a run-off bunker or truck that holds multiple panels. The bunker is rolled outside the plant beneath a gantry system that electronically picks up each panel and places it either in storage in the plant yard or loads it on a truck for speedy delivery to a project.

Additional information on the plant and carousel production method can be obtained from Molin Chief Operations Officer Matt Westgaard, 612/889-6794, mattw@molin.com; or, John Saccoman, 612/720-2883, johns@molin.com.

PALLETS' PATH: 14 WORK STATIONS

The Molin Concrete Ramsey production line, as configured by Weckenmann and companion equipment suppliers, routes the 12- x 40-ft. panel pallets on an efficient course:

Cleaning/plotting/oiling station. Production data is transferred via a CAD interface to a host computer. Pallets move through a cleaning machine.

Mould station. Lasers plot the outline for shuttering moulds on the pallet. Cleaned moulds are picked up with the shuttering transport cross beam and either stored in a magazine or placed directly on the pallet as required. Custom formwork, if necessary, is executed by hand. Pallets and moulds are automatically oiled.

Reinforcement station. Prefabricated panel reinforcement cages or mats and lifting anchors are placed in the mould by crane; sockets and conduits are attached to the pallet surface.

Buffer station. Pallets with panels that require complex elements, such as upstands, are moved from the conveyor line to the buffer station by transverse trolleys so that this operation does not slow down the plant circulation system. The buffer stations handle anything that takes more time than normal to set up, such as laying in brick in a form liner, placing numerous reveals not created by a form liner, and complex shapes (circles, curves, angles, etc.).

Concreting/shake table station. Concrete is poured into the formwork contour according to the product being manufactured. Concrete discharge dosage is controlled via a moving control panel by opening and closing the dosing flaps in the concrete spreader. Concrete test cubes are taken. Following this process, the agitator or shake table is activated. The station includes two transverse trolleys to move the pouring buckets under the mixers to be recharged with concrete.

Insulation station. For sandwich wall panels, insulation (either foam or board) is inserted at this station using cross-lifting trucks. This is done after the first shell is concreted.

Reinforcement station. Reinforcement for the load-bearing shell of sandwich wall panels is laid on the insulation layer by crane and anchors for lifting are mounted. The second shell is then concreted and placed on this assembly.

Screeding station. A screed board on the concrete spreader, along with vibration or shaking, removes protruding concrete and excess water.

Curing chamber/storage stations. The pallet is then passed via an elevator system to a shelf in the storage and retrieval area and into the curing chamber racks for curing. The curing camber is considered two work stations in the plant since it has two bays, each with nine pallet positions.

Demoulding station. Moulds are removed at this station. Integrated magnets of the moulds are manually released with lever tools and lifted from the pallet with a cross beam and handling traverse and placed on the shuttering conveyor transport. The moulds pass automatically through the cleaning equipment and are then available for shuttering again. Custom formwork is stored in a special magazine.

Troweling station. Panels are elevatored up to a helicopter troweling machine area atop the curing chamber. After troweling by the hand-held tool, the panel is automatically stored on a rack again by the stacking device.

Buffer/lifting station for horizontal loading. Pallets are moved to this station right before demoulding via two cross-lifting trucks.

Tilting/lifting station for vertical loading. Station consists of two hydraulically powered tilting arms actuated by hydraulic cylinders designed to tip pallets vertical to allow an unloading crane to lift wall elements undamaged from the pallet and either stored or loaded for shipping to a job site.

Overhead view of the concrete spreader with the batch plant in the upper left-hand corner and curing chamber to the right.