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precast solutions

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Photo courtesy of Elematic



Dream Big

The world's largest precast plant is helping to build a new city from the ground up.

By Shari Held



Photo courtesy of Elematic

Like a beacon of hope, the pristine precast concrete towers of Bismayah, Iraq, rise more than 100 feet out of the desert six miles southeast of Baghdad. The new city, roughly the size of 3,425 football fields, will contain a central business district surrounded by 834 U-shaped apartment towers, schools and social amenities. It will provide a new start for 600,000 Iraqis.

To say Iraq has an acute housing shortage is an understatement. The country is about 2/3 the size of Texas, but has a population of 38 million compared to about 28 million for Texas.¹ Baghdad, Iraq's largest city, is home to 9 million people. In Baghdad's most populated neighborhoods, it's common for 31 people to live in a one-bathroom home intended for use by a single family.²

South Korean engineering and construction firm Hanwha E&C was awarded the massive task of planning, designing and producing 100,000 apartments in just five years. They then had to determine how to get the job done.

"In the beginning, we naturally thought of using more traditional construction methods, but we changed to a precast method to shorten the construction time and reduce the workforce," said Jae Hyuk Choi, a Hanwha structural engineer for the project.

To facilitate an uninterrupted supply of materials, Hanwha constructed a base camp and plant complex near the site. Hanwha built 14 factories, turning to Elematic of Akaa, Finland, to create the three core facilities that compose the precast plant.

SETTING THE FOUNDATION FOR MASS PRODUCTION

Elematic broke ground for the precast plant in 2012. "The big challenge was how we could design and supply the plant in the 24 months that were given us," said Ismo Kallio, Elematic product director for walls.

Elematic determined the capacity of the precast factory based on the number and types of elements to be cast and the timeframe in which the elements needed to be manufactured. They used that information to develop the layout of each plant.

The gargantuan plant contains more than 7 million square feet. It consists of a hollowcore plant, a battery mold plant and a sandwich plant, each with its own dedicated batching plant and automated concrete transportation system.

"Our company structure is flexible and we can quickly increase our production capacity," Kallio said. "It also helps that our production lines are based on standard equipment that we have



Photo courtesy of Elematic

The battery mold plant houses 18 precast concrete stair molds.



Photo courtesy of Elematic

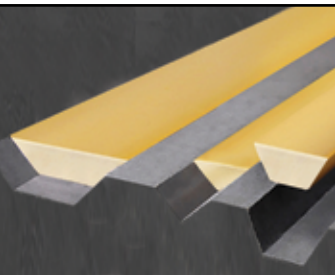
Each of the towers is constructed with 58 precast concrete staircases.



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designed and built many times. If we had to make all this starting from zero, we never could have made it in 20 months.”

The hollowcore plant produces the prestressed floor slabs and roofs for the apartments. It houses 32 parallel casting beds and eight extruders. Casting a bed takes about two hours. Six hollow cores within each slab decrease the overall weight of the slabs without sacrificing strength.

The battery mold plant produces the interior walls and staircases. It contains three battery molds with 12 casting cells each and two battery molds with 20 casting cells each. It also contains 18 stair molds.

The sandwich plant produces the external precast walls, which are injected with Styrofoam insulation. It contains 300 custom-made circulating flat tables for the four circulating wall lines and four 10-level high curing chambers.

A computer control system ensures the safety and security of manufacturing processes across all plants.

BISMAYAH BY THE NUMBERS

To make it all happen, Hanwha sent a team of 300 managers and engineers to Bismayah on 30-month long assignments. An additional 300 Korean subcontractors and hundreds of Bangladeshi workers are also involved.

It takes 1,050 wall elements, 1,316 prestressed hollowcore slabs,



Photo courtesy of Elematic

The three core production facilities contain more than 7 million square feet.



Photo courtesy of Elematic

More than 1,000 hollowcore slabs are installed in each tower.



When the project is complete, it will provide housing for more than half a million Iraqis.

196 parapets and 58 staircases to construct one tower. That translates to nearly 140,000 cubic feet of concrete, 213 tons of steel rebar and approximately 44 tons of prestressed strands for the hollowcore slabs. Typically, Hanwha stockpiles elements for a dozen towers – more than 31,000 elements. In total, the three plants use 78,000 tons of cement annually.

The number of precast elements produced each month is mind-boggling: 13,182 for the sandwich plant, 6,396 for the battery mold plant and 18,252 for the hollowcore plant. These figures represent only 1/4 of what the operation is capable of producing.

“According to the initial plan, we were supposed to make precast products for 20,000 housing units per year, but for external reasons we had to downsize to 5,000 housing units per year,” Choi said.

As of September 2016, Choi said Hanwha had cast 12% of all the precast elements and completed 87 of the 834 towers.

What has Hanwha learned from this project so far? “With careful plans and excellent production machinery, nothing’s impossible,” Choi said. **PS**

Shari Held is an Indianapolis, Ind.-based freelance writer who has covered the construction industry for more than 10 years.



Endnotes

- ¹ worldpopulationreview.com
- ² pri.org/stories/2010-10-15/baghdads-housing-crisis