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One of North America's most modern pallet circulation plants goes into operation in Florida

In the first half of 2021, what is currently probably North America's most modern pallet circulation system for the production of precast concrete elements for residential construction, started operation in Florida. The Villages, one of the largest real estate developers in the United States, is setting a historic milestone by transitioning to precast concrete. German engineering office Reymann Technik has realized the project as planner and general contractor - the largest in the company's history.

The name The Villages stands for one of the largest housing developments for people aged 55+ in the United States. The community extends over three counties about 90 km North-West of Orlando in Florida. More than 150,000 people already live here and the community continues to grow. Spending their retirement in the mild climate of the "Sunshine State" with a high standard of living and in a safe community is what makes The Villages so appealing to many U.S. residents. The community has been growing steadily since the 1980s, now at the rate of about 4,500 people annually. For 2010-2019, the U.S. Census Bureau labeled The Villages as the fastest growing Metropolitan Statistical Area in the United States.

The mostly single-family homes were built so far conventionally using timber frame construction or brick-on-brick, which has been a very successful concept for decades. Nevertheless, The Villages and the companies involved in the planning, DZ Block and DZ Concrete, wanted to consider a possible switch to precast concrete construction. This was based on various developments and goals. The increasing shortage of skilled labor is also noticeable in the construction industry, making it necessary to develop less labor-intensive options for the future. Conventionally, an average of 10 houses per day were completed with a crew of about 2,500 workers. The objective was to develop a building system based on precast concrete elements, together with the architects, consultants and planners involved, primarily in order to operate with a smaller workforce, but also to reduce construction times, and at the same time to obtain an even better quality of the completed houses. Prefabrication in a protected and controlled environment, the possibility of automation and the resulting reduction of manual errors promised further advantages.



Fully automated steel processing including mesh welding system



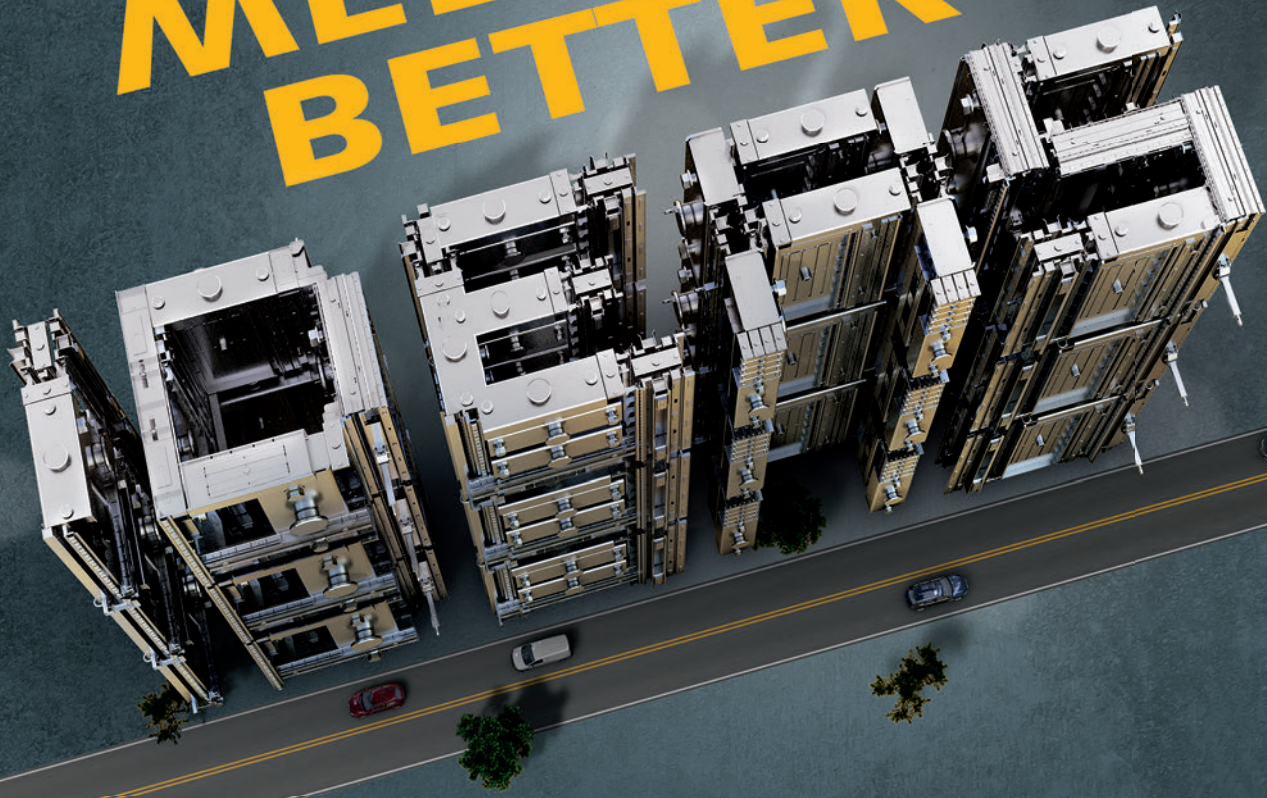
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The use of precast concrete elements in the construction of residential buildings is not yet as widespread in the USA as it is in Europe or parts of Asia, but is increasingly gaining acceptance. With regard to natural disasters such as hurricanes, tornadoes, floods or wildfires, concrete as a material alone brings great benefits. In combination with prefabrication and corresponding house concepts, the damage caused by such severe weather hazards for the residents can be minimized.

First discussions with Reymann Technik were initiated by the managers of Preconco Ltd. from Barbados. Preconco has been a leading precast manufacturer in Barbados since the early 1990s and has invested heavily in the development of its own construction systems and in new plant technology over the decades. Reymann Technik planned and realized two circulation plants for Preconco and for Carribean Homes about 15 years ago (detailed report in CPi 2.2008).

Based on their expertise in the design of building systems and their own successful projects, Preconco was asked to join as a consultant and help with the conversion of the building system to precast concrete elements.

In that course, Reymann Technik came into play and was approached to discuss a possible consulting and planning cooperation.

On Preconco's recommendation, Reymann Technik was approached to explore a possible consulting and planning cooperation.

For a project of this size, working with an experienced and independent plant designer offers several advantages, including:

- Know-how transfer from numerous projects in the past
- Planning and investment security
- Comprehensive project management and coordination of suppliers

- Optimal plant equipment for the targeted product portfolio through independence from machine suppliers
- Quality assurance and controlling of key figures

The biggest challenges and at the same time decisive success factors for the realization of such a project are:

1. Suitable construction system
2. Automation and reduction of manual effort
3. Trained personnel
4. Long-term planning

In 2019, Reymann Technik was commissioned to design and realize the pallet circulation system as general contractor for The Villages. It is the largest project in the company's history to date. The project was implemented in close coordination with the customer and its architects, the consultants of Preconco and the contracted machine suppliers.

In spring 2021, the plant went into operation with development stage 1. The plant at Governor Rick Scott Industrial Park is currently the production plant for precast concrete elements with the highest level of automation in North America. A further expansion stage 2 is already planned.

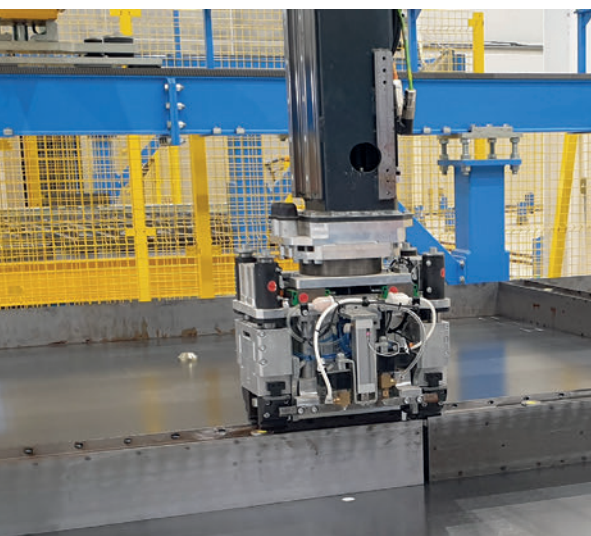
The production consists of a total of 3 halls in stage 1, with an area of approximately 650 x 220 feet (about 200 x 68 meters).

The product line mainly comprises of:

- Solid walls (exterior and interior walls)
- Insulated exterior walls
- Supplementary columns / columns

Success factor 1: Construction system

The construction system was developed and refined from the outset by an experienced precast concrete manufacturer, Preconco, together with Reymann Technik and the customer.



Completely robot-assisted formwork logistics

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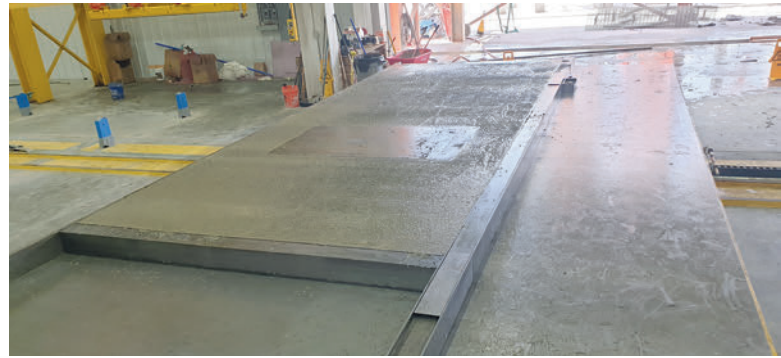
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The on-demand concrete supply was also planned to be automated.

Only that way is it possible to really match the construction system and the production plant in an optimal way and to guarantee a high plant capacity later on.

Initially, one house type was adapted to the precast concrete building system. However, the circulation system is designed in such a way that individual houses - in extreme cases in quantities = 1 - can be built. The exterior walls are anchored to the foundation via rebar and grouting tubes. In accordance with the applicable building code, the wall connections are carried out with loop boxes and grouting grooves. Exterior walls are produced with insulation. For this purpose, the reinforcement was adapted to a special lattice girder system in which the insulation is integrated.

Currently, primarily standardized wall heights of 8 feet (about 2.4 m) and 10 feet (about 3.0 m) are produced, including required sloped gable walls. There is flexibility to allow for variable wall heights up to 12'-1" (approx. 3.7 m).

Success factor 2: Automation and reduction of manual work

Progress Group was awarded the contract for the machinery equipment. The plant combines state-of-the-art technology in terms of automation. In addition to fully robot-supported formwork logistics, a fully automatic steel processing system including a mesh welding plant was installed. Concrete mix production, batching and concreting were also planned to be automated.

Work stations for manual formwork supplementation and for finishing were generously planned, including six stations with laser projection to minimize plotting and thus save time. In addition, three pallet lines are available for smoothing the concrete surface. The finished walls are transported out of the hall on commissioned wall transport frames via an automatic exit system, and then moved further into the warehouse by a mobile gantry crane.

Success factor 3: Trained personnel

Production in the first three halls started successively from spring 2021. An experienced Employee of Reymann Technik was on site for several weeks to actively support the commissioning and to train the new personnel in the plant.

As "Production Management Support" over almost 3 months in various stages, it was also his task to optimize the production process together with the new production management on site and to gradually achieve the targeted capacity.

Success factor 4: Long-term planning

„It's not a sprint, it's a marathon.“

Two further halls are already included in the current planning. The expansion stages have already been taken into account in concrete logistics. In concrete terms, this means that the mixing plant for stage 2 has been calculated, and the bucket conveyor for delivery to the new halls has also already been scheduled. If this had not been the case, a later expansion would mean considerably higher effort and costs. It is there-



Three pallet lines are available for smoothing of the concrete surfaces.



The finished walls are transported out of the hall on commissioned wall transport racks by an automatic exit system.

fore worthwhile to plan step by step and with a long-term perspective for projects of this size. The plant output is gradually increased and is currently at 19 houses per week, with an average of 2000 square feet (about 186 square meters) per house, and is planned to be further increased to 30 houses per week.

Special features of formwork technology

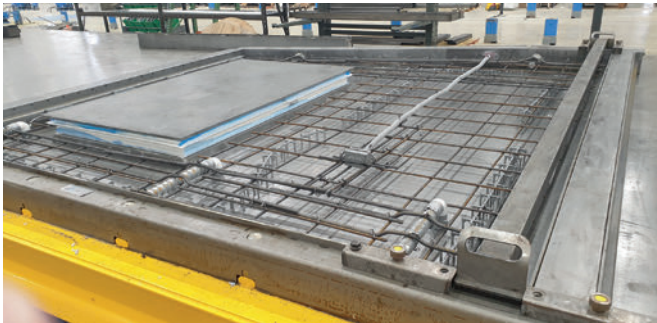
As the basic formwork for the variable wall profiles, robot-compatible steel siderails (SAS Standard Automatic Shuttering) from Ratec are used. They are perfectly tailored to the

completely automated formwork logistics with demoulding, storage and formwork robots, as well as automatic cleaning. The SAS shuttering is protected by cover plates during concreting to protect the magnet buttons (activation mechanism) from concrete. The cover plates are placed before concreting and removed after smoothing. However, for effective production, supplementary manual work is almost inevitable. The manual procedures include setting and removal of special formwork for doors, windows or standardized recesses.

For door openings, a shrinkable steel recess is used, which has been field-proven for windows in both vertical and hori-



Handling in the outdoor area is carried out by a mobile gantry crane, which moves the wall transport racks in and out of storages.



Completely cast-in windows – a special feature of the circulation plant

zontal production. Handling is carried out by crane and lifting magnet. The advantage of this solution is the handling of relatively few individual parts. The recess frame is placed and lifted off in one piece, which also reduces the manual effort for the factory personnel.

Casting of complete windows

The requirement for window recesses was that they should be directly cast-in and therefore a secure solution was needed to fix and protect the windows. Casting windows directly in concrete is not feasible in most cases with the current state of the art. However, since these are sliding windows, Ratec was able to come up with a solution. The formwork consists of a bottom part, which is magnetically fixed to the pallet, and on which the windows are placed. An upper part is then placed on the window and screwed to the lower part. The windows and their glass segments are protected from dirt and damage by the special formwork throughout the entire production process.

Block-out formwork is currently used for eleven window types and five door variants. Handling is carried out by crane.

For both doors and windows, two positioning magnets per recess are set on the pallet by the shuttering robot, onto which the respective formwork is placed. This procedure prevents that the wrong formwork is placed, reduces inaccuracies and also eases the workload of the production staff.

As with many other projects, the installation and commissioning took place in the midst of the global Corona pandemic. The resulting impacts by supply bottlenecks and longer transport times were the biggest challenges for project management. Since the project was attributed to critical infrastructure, it was possible to have installation and commissioning personnel as well as German project management on site on a regular basis despite the US travel ban. Great efforts were also made on the part of the customer to enable entries.

The Florida-based subsidiary Ratec America Corp. also proved to be a location advantage, as it was able to attend regular site visits and document the progress of construction, thus facilitating coordination with the planners in Hockenheim.

In addition, Ratec America was responsible for the design and delivery of the specified wall transport frames as well as forms for the production of supplementary columns and beams.

As a partner on site, Ratec America is the first point of contact for additional formwork as well as magnet components for fastening built-in parts such as electrical boxes, hurricane straps and grout tubes.

So far, as of April 2022, about 600 houses have been completed. The main focus now is on gaining experience, qualifying employees more and more and continuously optimizing production processes. At the same time, the building system will also be further optimized.



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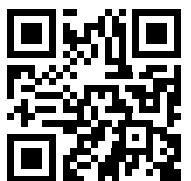
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New retirement homes are being built for the growing community in The Villages

Reymann Technik will continue to support the customer. "Our work does not end with commissioning or final acceptance," emphasizes Jörg Reymann, Managing Director of Reymann Technik / Ratec. "We want to ensure that the processes are

designed in such a way that our customer benefits from such an investment as quickly as possible and is also successful with it in the long term."

Images: © Reymann Technik GmbH, DZ Precast Solutions, Inc.

FURTHER INFORMATION



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