STATE-OF-THE-ART AUTOMATED PRECAST CONCRETE PRODUCTION PLANT FOR RESIDENTIAL HOUSING IN THE VILLAGES, USA

RATEC AMERICA

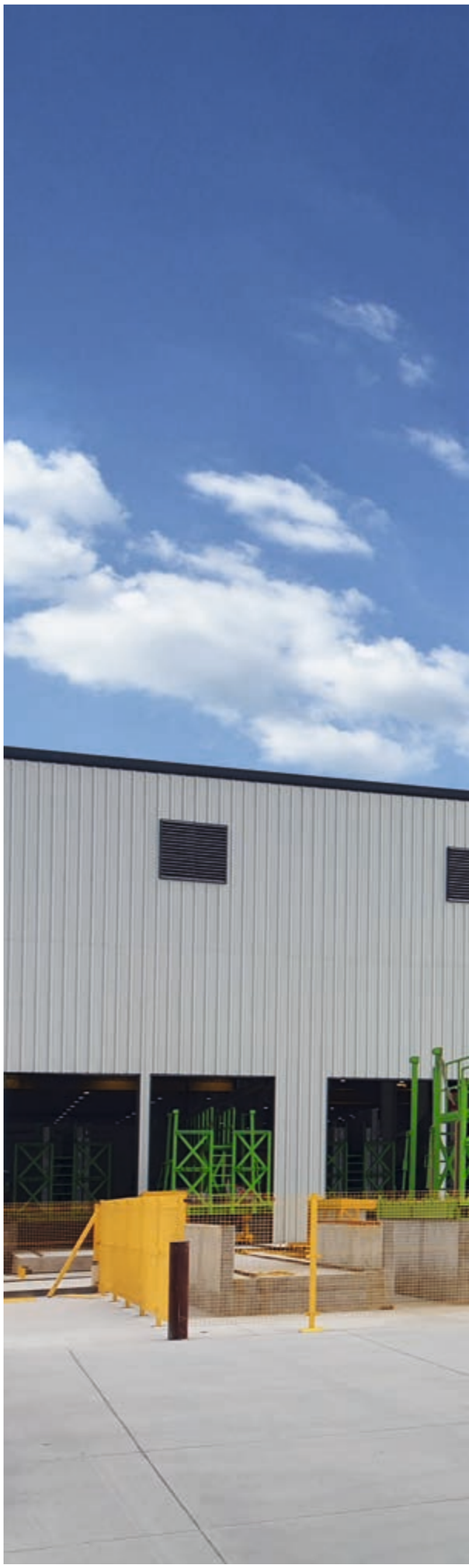
RATEC MEET THE BETTER IDEAS

REYMANN TECHNIK

North America's most modern pallet circulation plant goes into 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. Reymann Technik, was executing the project as designer and general contractor – the largest in the company's history.

Summer 2020 – assembly of production halls 1 – 3



The 3 production halls in phase 1 have an area of approximately 650 x 220 feet (about 200 x 68 meters).

In the first half of 2021, what is currently probably North America's most modern pallet circulation plant for the production of precast concrete elements for residential housing started operation in Florida.

The name "The Villages" stands for one of the largest housing communities 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. 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 INCREASING SHORTAGE OF SKILLED LABOR IS ALSO BEING NOTICEABLE IN THE CONSTRUCTION INDUSTRY, MAKING IT NECESSARY TO DEVELOP LESS LABOR-INTENSIVE OPTIONS FOR THE FUTURE. "

The mostly single-family houses were built so far conventionally using timber frame construction or brick-on-brick, which has been a very successful concept for decades. Conventionally, an average of 10 houses per day were completed with a crew of about 2.500 workers.

The Villages and the companies involved in the planning, DZ Block and DZ Concrete, considered the switch to precast concrete elements for various reasons.

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 attractive to many U.S. residents.

GOOD REASONS FOR THE BETTER SOLUTION

- The goal was to be able to operate with a smaller workforce
- to reduce construction times,
- at the same time to obtain an even better quality of the completed houses.
- Prefabrication in a protected and controlled environment with the possibility of automation
- Reduction of manual errors

New retirement homes for the growing community at The Villages

So far – as of April 2022 – around 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 construction system is also being further optimized. Reymann Technik continues to support the customer.

PRODUCT LINE MAINLY COMPRISES OF SOLID WALLS, INSULATED EXTERIOR WALLS AND SUPPLEMENTARY COLUMNS / BEAMS

With natural disasters in mind, such as hurricanes, tornadoes, floods or wildfires, concrete as a material alone brings great benefits. Combined with prefabrication and corresponding house designs, residents can minimize the damage caused by such severe weather hazards.

The Villages could rely on experienced advisers: Preconco, the leading precast manufacturer in Barbados, provided consulting services to develop the building system.

Preconco's precast production facilities have already been designed and realized by Reymann Technik in the past. It was their recommendation to The Villages to take Reymann Technik on board for the further consulting and planning process.

For a project of such scope, cooperation with an experienced and independent plant designer offers several advantages.

ADVANTAGES OF AN EXPERIENCED AND INDEPENDENT PLANT DESIGNER

- **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 due to independence from machine suppliers**
- **Quality assurance and controlling of key figures**

Fully automatic steel processing including mesh welding plant

CHALLENGES AND SUCCESS FACTORS:

- Suitable construction system
- Automation and reduction of manual effort
- Trained personnel
- Long-term planning
- The right partners

The project was implemented in close coordination with the customer and its architects, Preconco's consultants, and the machine suppliers who were later contracted.

The plant went into operation with Phase 1 in the spring of 2021. The plant, located at Governor Rick Scott Industrial Park, is currently the most highly automated precast concrete production facility in North America. A further expansion phase 2 is already planned.

On-demand concrete supply

Three pallet lines are inluded for smoothing

SUCCESS FACTOR 1: CONSTRUCTION SYSTEM

From the very beginning, the construction system was developed and refined by an experienced precast concrete manufacturer, Preconco, together with Reymann Technik and the customer. 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 plant 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. Wall-to-wall connections are done with loop boxes and grouting grooves. Exterior walls are produced with insulation. For this purpose, the reinforcement was adapted to a two-stage lattice girder system in which the insulation is integrated. Currently, primarily standardized wall heights of 8 feet and 10 feet are produced, including required sloped gable walls. Flexibility to variable wall heights up to 12'–1" is possible.

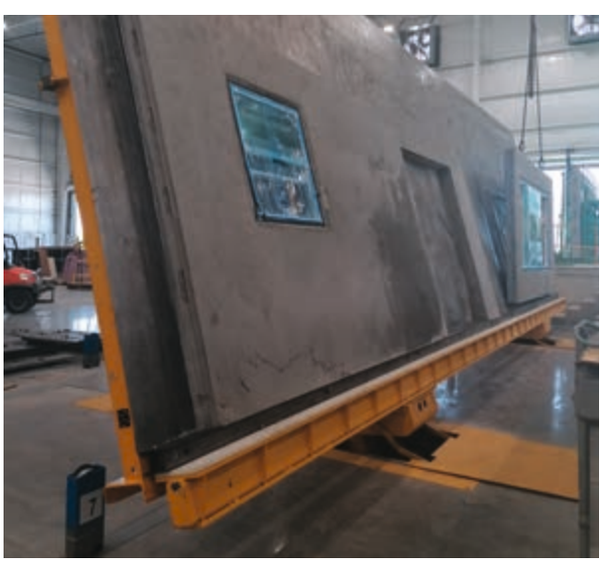
SUCCESS FACTOR 2: AUTOMATION AND REDUCTION OF MANUAL WORK

The plant machinery combines state-of-the-art technology with a high grade of automation, with fully robot-supported formwork logistics, a fully automatic steel processing system including a mesh welding plant and automated exit area. 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 gradually optimize the production process together with the new production management on site and to achieve the targeted capacity.



SUCCESS FACTOR 4: LONG-TERM PLANNING

"It's not a sprint, it's a marathon." Two additional halls are included in the current planning. The expansion stages have also already been taken into account in the concrete logistics. Specifically, this means that the mixing plant for phase 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 therefore worthwhile to plan step by step and in the long term for projects of this size.

The plant output is being increased gradually, 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 increased further to 30 houses per week.

SUCCESS FACTOR 5: THE RIGHT PARTNERS

Intelligent planning and a supplier team, that works well together, form the foundation for the smooth realization of such a project. This applies in particular to the supplier(s) of the core plant machinery and concrete supply components. Reymann Technik ensures, that all parts of the plant from the different suppliers, are perfectly coordinated with each other. In this project, Progress group was the supplier of choice for the plant machinery, while Wiggert was selected for the concrete logistics machinery.

At the tilting station, the finished elements are lifted off and loaded onto transport frames

The handling in the outside area is done by a mobile gantry crane, which stores and retrieves the wall transport racks.

"OUR WORK DOES NOT END WITH COMMISSIONING, WE WANT TO ENSURE THAT THE PROCESSES ARE DESIGNED IN SUCH A WAY THAT OUR CUSTOMER BENEFITS AS QUICKLY AS POSSIBLE AND IS ALSO SUCCESSFUL IN THE LONG TERM."

RATEC AMERICA

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, grout tubes and the like.

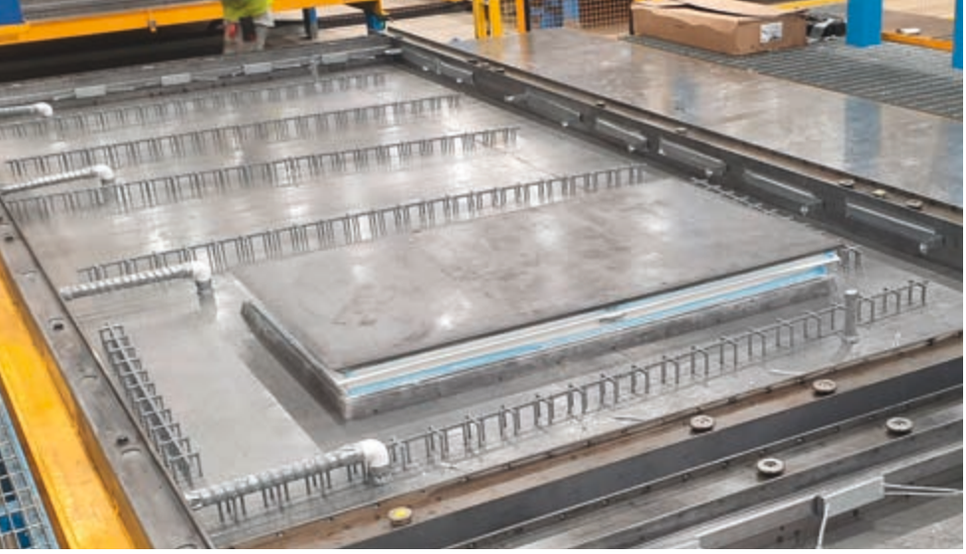
Completely automated formwork logistics from storage retrieval and placing up to cleaning

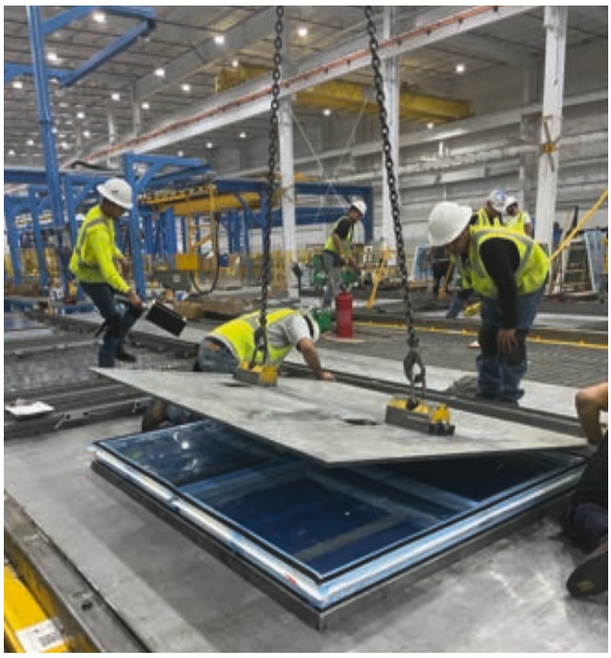
SPECIAL FEATURES OF THE FORMWORK TECHNOLOGY

As basic formwork for the variable wall profiles, robot-compatible steel siderails (SAS Standard Automatic Siderail) from RATEC are used on the circulation pallet. These are perfectly tailored to completely automated formwork logistics with demolding, storage and formwork robots, as well as automatic cleaning. The SAS siderails are protected by cover plates during concreting to protect the magnet buttons (switching mechanism) from concrete. The cover plates are placed before concreting and can be removed again after smoothing.

However, for an effective production, supplementary manual work is almost unavoidable. These manual procedures include setting and removing special formwork for doors, windows or standardized recesses.

For door openings, a shrinkable steel recess is used, which has already been field-proven for windows in both vertical and horizontal production. Handling is done by crane and lifting magnet. The advantage of this solution is the handling of relatively few individual parts. The recess body is set and lifted off in one piece, so that here, too, the manual effort for the plant personnel is reduced.





CAST-IN WINDOWS UNIQUE AND TIME-SAVING

The requirement for window recesses was that they should be directly cast-in concrete and therefore a secure solution for fixing was needed. 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 proposal. 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 installed with the glass segments are protected from dirt and damage by the special formwork throughout the production process. Currently, block-out formwork is used for eleven window types and five door variants. Handling is carried out by crane.

For both doors and windows, 2 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.

The sliding windows are completely embedded in concrete. For accuracy, the formwork robot sets placement magnets to indicate the right position and size of the window. This ensures, that the manual placement of the recess form and windows later is error-free and 100% reliable.

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