

Pallet circulation system for the production of solid walls and other flat, circulation-suitable precast concrete elements

Attacus Betonghus AB from Sweden has so far only produced wooden system houses for the Swedish market. In order to be able to manufacture concrete system houses in the future, an existing precast concrete plant in Hamnerdal was purchased in 2016. At the beginning of 2017, B.T. innovation GmbH was commissioned with the planning for the construction of a modern "upgradeable" circulation system. A particular challenge was to design the desired circulation system for the existing hall, since a large part of the hall was or is built with a basement.

The pallet circulation system was to be designed for special products for the Swedish market. These are primarily sandwich walls with completely installed windows, doors and ventilation units. In addition, all circulation-suitable precast concrete elements that are required for the system houses are to be produced in the plant.

The focus of the investment was therefore on the most economically expedient equipment of the plant for the portfolio

described above. Should there be shifts in the product mix or increased demands on quality or capacity during later operation, individual circulation stations can be retrofitted with automated machines and/or robot technology.

The production plant was housed in a largely existing hall with two hall aisles. Next to the two production halls there is a much lower hall aisle which was to be used for the production of reinforcement and for work preparation (Fig. 1). All three halls were extended by approx. 13 m. An area for a curing chamber with two towers and an upstream storage and retrieval machine was provided at the side of one of the two production halls. Due to the deadline pressure, the plant had to be realized in two or three sections.

In the first phase, two tilting tables were purchased and installed to gain experience with the new products. In this phase many optimisations were developed and tested on the different products. However, for the later sections, these two tilting tables also had the additional task of producing parts that are not very suitable for production in a circulation system.

Fig. 1: Exterior view of the production halls





Fig. 2: Production halls with circulation system



Fig. 3: Recycling tank in the cellar

The second phase included the construction of the entire circulation system, without the storage and retrieval machine and the curing chamber (Fig. 2). In addition, the entire mixing plant control system was renewed and a modern residual concrete recycling plant was installed during this phase. Due to the very long and cold winter periods in Sweden, the recycling tank was integrated into the existing cellar of the production hall (Fig. 3).

In the third construction phase, the storage and retrieval machine, the curing chamber, two additional working stations and the necessary cross-lifting trucks were retrofitted and integrated into the existing circulation system (Fig. 4).

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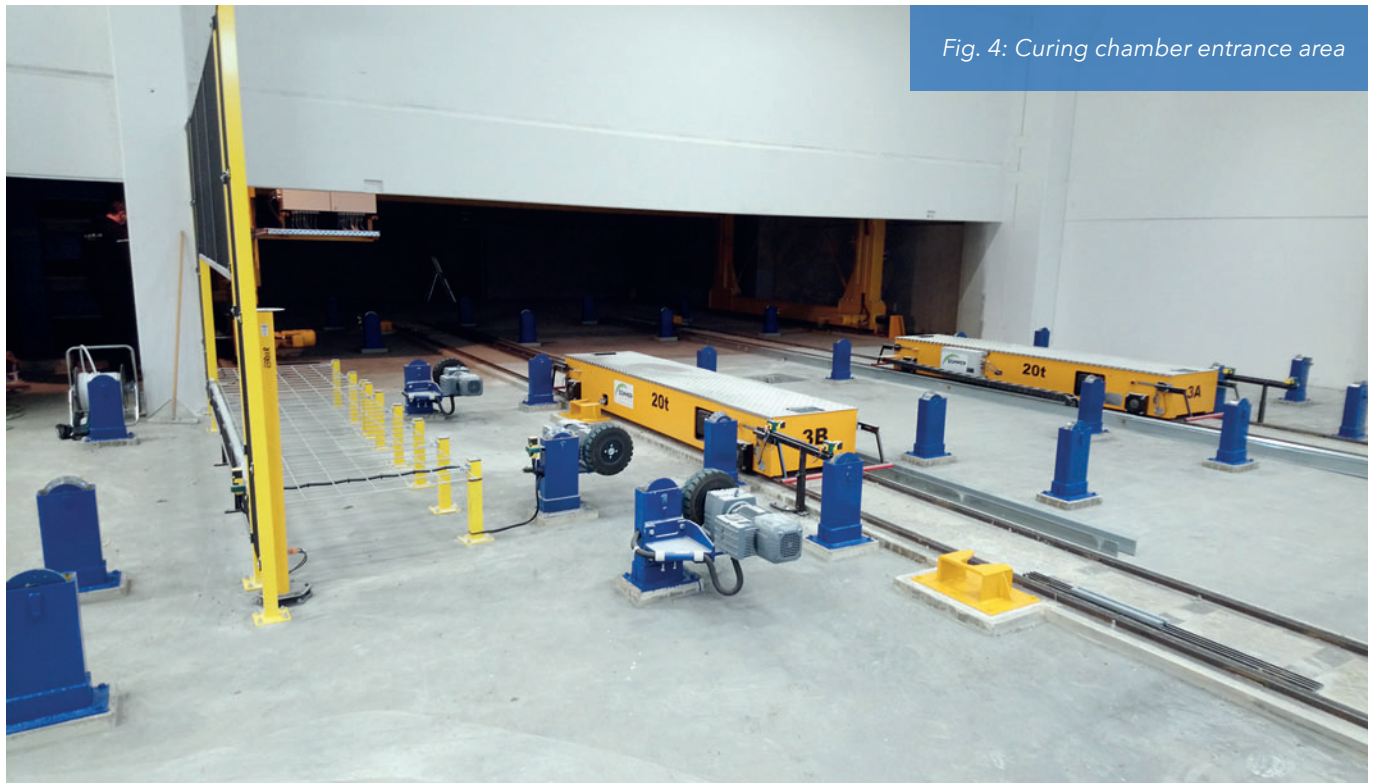


Fig. 4: Curing chamber entrance area

The production process begins at the shuttering station with a clean pallet. Since the circulation system produces systematised components, the element thicknesses and dimensions do not change very often. Heavy steel shuttering and an expensive shuttering robot have been deliberately dispensed with. Instead, this station is equipped with a laser projection system. The shuttering and magnets are removed from the pallet at an upstream station and hung on the side of the pallets in special folding holders. This allows them to be transported with the pallet from the deshuttering station through the pallet cleaner to the shuttering station. At the shuttering station, the shuttering and magnets are then removed from the folding holders and placed on the shuttering surface (Fig. 5).

The shuttering for solid elements on the basis of the Multi-Form shuttering carrier system and the magnets are from B.T. innovation GmbH. "We liked the idea of this shuttering transport right from the start", explains Andreas Bold, production manager of the Attacus company in Hammerdal. "This solution was able to relieve our employees enormously."

The shuttering is quickly and accurately aligned with the laser lines in just a few steps. The same applies to windows and doors and the corresponding shuttering. The electrical boxes are also already installed at this station.

After the shuttering is erected, the pallet moves to the next processing and reinforcement stations. Here, if applicable, shuttering components are complemented and prefabricated reinforcement inserted. The logistics for the reinforcements also follows an idea from the automotive industry. "Just in sequence", prefabricated reinforcements, windows and doors



Fig. 5: Folding receptacles for shuttering transport

are provided outside the circulation at exactly the right time and in the right order (Fig. 6). For this reason, cycle time fluctuations in the circulation are very small despite very different degrees of difficulty.



Fig. 6: Window installation in the pallet

If, contrary to expectations, a shuttering or reinforcement should not fit or be incomplete or be delivered too late, the affected pallet can be removed in a diversion station located on the front side.

The pallet then moves into the concreting station, where a bridge concrete spreader with half width and eight frequency-controlled discharge screws operates in manual mode. The spreader is also equipped with a height-adjustable smoothing device (Fig. 7). It is fed from the central mixing plant directly above the pre-silo. The area for concrete transfer also serves as washing place. This is not only generously dimensioned, but is also equipped with a residual concrete recycling plant with a washout capacity of up to 6 m³/h. When the mixer is washed out, the washing water is fed directly into the recycling plant via a pivoting hopper.

The concrete elements are compacted with vibrating compactors. Through horizontal vibration in the x and y direction, the solid elements are compacted almost without noise emission.

At the following processing stations, the insulation is applied to the fresh concrete and joined to the concrete by means of suitable connectors. A laser indicates the exact position of the connectors to the employees (Fig. 8). "As a result, the processing time for applying the insulation has been significantly reduced," says Andreas Bold.

A curing chamber with two shelf towers and a total of 30 usable compartments is available for curing the elements. The pallets are moved into and out of the area of the storage and retrieval machine by means of cross-lifting trucks. The pallets are gripped from above by the lifting traverse, thus avoiding a pit. After being removed from the curing chamber, the pallets are moved to the other processing stations by means of cross-lifting trucks. Here, the shuttering and magnets are



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Fig. 7: Bridge concrete spreader with smoothing device



Fig. 8: Installation of the insulation by means of a laser



Fig. 9: Tilting station

already removed from the shuttering surface and hooked into the lateral, fold-out holders. At these stations further additions to the elements can be added or installed.

To lift off the elements, the pallet is moved by means of a cross-lifting truck to a tilting station with a fixed stop beam, where the precast elements are preferably tilted to about 80° and stored in storage racks in the hall (Fig. 9).

The emptied pallet travels onwards to a stationary pallet cleaner. The pallet surface as well as the stationary edge shuttering are cleaned in a continuous process in one operation. First a scraper bar removes coarse dirt, followed by fine cleaning by means of a brush roller (Fig. 10). A dust extraction system can easily be retrofitted if required. After cleaning, the

empty and clean pallet is ready for the next production cycle. "As Attacus paid great attention to standardised work processes in the previous production of wooden houses, this was a clear requirement for the planning of the new circulation system. This concerned both the optimisation of the concrete elements and many details in the circulation system and the adjacent areas of work preparation," explains Bernd Schreyer, the planner responsible for this project at BT innovation. "The climatic conditions as well as the requirements due to the existing halls, especially the partial basement, were additional challenges that had to be taken into account."

With the new circulation system, Attacus has set the course for the future at the Hammerdal site. Attacus is therefore able to offer both timber and concrete houses on the Swedish



Fig. 10: Stationary pallet cleaner

market. The significant increase in the quality of concrete houses contributes to the ability to implement demanding customer requirements in a high-quality, flexible and satisfactory manner.

Participating companies

B.T. innovation GmbH from Magdeburg took overall responsibility for the concept, planning and coordination. Sommer Anlagentechnik GmbH from Altheim supplied the production boards and the entire machine technology. The circulation plant controller and visualisation are also from Sommer. The laser projection system, the shuttering and the magnets were all part of the BT innovation package. ■

FURTHER INFORMATION



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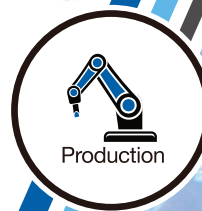
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