

■ Preuksa Real Estate Ltd., Bangkok, Thailand

Commissioning of largest precast plant worldwide

In autumn 2003, initial contacts of German companies to Preuksa Real Estate in Bangkok were made. Preuksa clearly defined its objective: the establishment of a new precast plant for the production of wall elements as early as possible, a

plant that would not only top production in Thailand itself, but on a worldwide basis to make the company second to none as a producer of top quality prefabricated elements.

Dr. Holger Karutz,
CPI worldwide, Germany

Currently, the Thai real estate market is skyrocketing, with demand being especially pronounced for residential homes for the low and middle income groups.

For Preuksa as a provider of real estate homes, the market situation is such that with existing capacities the demand could not be met at all. The challenge of planning and implementing these high expectations on the part of Preuksa was taken up by Christian Prilhofer Consulting, Uni-technik, Vollert, and Weckenmann, that had jointly worked on several projects before.



Preuksa casting yard

Initial situation

The existing concrete plant was producing in open space. The result of this production method was a quality that often turned out to be unsatisfactory. The surfaces of the produced elements very often did not fulfil the required standards. Too often it happened that elements were damaged either during tilting processes or during intermediate transportation, and even when the elements were fixed on the construction site, several other damages would occur.

On the construction site, several other problems could be observed. Refinishing the buildings was an undertaking that required a lot of effort, dimensional tolerances and poor joints being the main problems. Apart from the vertical connections between individual elements, horizontal connections, where apart from the walls also



Typical Preuksa house

the floors were put together, were especially critical areas in terms of penetrating dampness. After the buildings were completed, they had a very appealing appearance, but the refinishing procedures were not acceptable in spite of the fact that Thai labour wages are rather low.

These problems defined Preuksa's new quality requirements on the system to be projected: on a daily basis, 12 to 16 single-family homes comprising one or two storeys were to be built. This type of buildings was supposed to be designed in such a way so as to ensure that they could be built depending on the requirements of the market and the sales chances in a given situation. Apart from lower cost, the quality of the buildings had to be substantially improved. To ensure this, a plant had to be set up that matched the degree of automation and the current conditions prevailing in Thailand. Also, the plant design had to ensure that at a later stage this automation level could be increased and optimized until deficiencies that would become noticeable in the course of production could be minimized and finally even totally remedied.

The introduction of a CAD system laid the foundation stone for modern precast production

A first, however, important step for quality enhancement was the use of a corresponding CAD system developed by Nemetschek to arrive at precise production drawings. The drawings had to mirror the entire building model. This way, dimensional discrepancies leading to the need of refinishing work and quality problems would be eliminated. This step was undertaken as early as October 2003. For about ten different types of buildings, the production documentation was created via this new CAD system. Additional negotiations with the companies involved then eventually led to a joint offer for the entire plant and constructional system development, realization, and the introduction of the system. On February 6, 2004, the agreements with the company consortium were signed.

Already three weeks later, the first project planning phase was completed. Christian Prilhofer Consulting was able to support Preuksa with all necessary information on soil replacement and subsoil enhancement.

In spite of the unfavourable conditions prevailing during the rainy season and the necessity of pile assemblies with about 1,000 piles installed at depths of about 25 to 30 centimetres, Preuksa and the contracted building company succeeded in completing the hall in such a fashion at the beginning of August 2004 that the production systems could be set up that very month. Regular meetings on site would guarantee the appropriate cooperation of all companies involved.

The agreement signed with the company consortium around Christian Prilhofer Consulting included, apart from the planning jobs and the commissioning of the plant, also an upgrading of the constructional system.

To achieve rapid progress when upgrading the constructional system, Mr. Johannes Bürkle, CEO of Bürkle GmbH & Co. KG in Sasbach, Germany, was also included in the planning team. The



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+49 (0)72 43-9 00 91
Telefax:
+49 (0)72 43-9 06 45

Internet:
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Email:
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Production hall overview

requirements for constructional execution had been posed by Preuksa. Two-storey buildings were to be erected as solid-wall houses. The first floor walls had to have a thickness of 120 mm, those of the second floor 100 mm. Only some parts of the garage section were required to have a wall thickness of 200 mm.

Against this background, an upgrading of all building types was performed, making sure that all precast elements were optimally arranged. In doing so, all jobs vertical and horizontal joints were upgraded and included in the production system.

The factory was opened and the first elements were produced just 10 months later on 4th December 2004. Dr. Leopold Halser has been the manager of the new plant since then. However, the short time required for completing the factory was only possible through concentrated and optimised collaboration between all of the companies involved.

The precast plant

For the new plant of Preuksa Real Estate Co. Ltd. a new building with three wings was built. The overall size of the building is 118 x 80 meters. The location of the plant is Bangkok, Thailand.

The factory is used for the production of solid house types designed by Preuksa Real Estate Co. Ltd. The houses consist of

wall elements with 100 mm and 120 mm thickness and a height up to 3,190 mm.

The production plant is set up as a pallet circulating system. The moulding area is realized by steel pallets 13.50 x 3.50 m. This system enables the definition of fixed working and transport areas. Furthermore, areas with fully automatic operation for pallet transports can be defined. The factory is equipped with 90 pallets.

After the house design is finished, it is split

into single wall and floor elements. For each element, a set of data according to the Unitech CAD/CAM interface description is prepared. Each file contains all information about the dimensions of the element; its geometry, volume, reinforcement, cut-outs and all other production-relevant details. A master computer organizes the pallet laying – the arrangement of single elements on the pallets. The master computer also serves to do a print-out of the paperwork required for the workers in production and for work preparation.

The plotter

The production process starts with a cleaned and oiled-up pallet. The first station in the circulation system is a large-scale plotter. The plotter outputs the geometry of all elements of this production unit onto the pallet including all positions of windows, doors, cut-outs and inserts like electrical boxes.

Window and door frames are built in as wooden parts or ready-made plastic frames. For these parts, the outline has to be plotted onto the pallet.

After all lines have been plotted, a pair of cross-lifting trucks transports the pallet to one of the next free positions for placing



Plotter

the steel moulds. The cross-lifting trucks are designed as scissor-type units and can lift the pallet from the level of the roller blocks into the second level of +2,500 mm. The mezzanine has three workstations with openings in the size of the pallets. Therefore these pallets are free to choose positions. The opening in the mezzanine is safeguarded by telescopic railings.

Placement of moulds

The positions in the mezzanine level are set up for placing the steel moulds with integrated magnets according to the plotted geometry of the elements. To handle the moulds, special handling cranes are installed at each of the three positions. By means of these handling cranes, the moulds are taken from the conveyor belts and placed on the pallet to form the element to be produced.

A conveyor belt which is acting crosswise to the pallet is transporting the moulds from the cleaning machine into the positioning area for placing the moulds. The moulds are automatically identified according to their length, height and shape after cleaning.

Steel moulds which are not needed for the actual production unit can be taken from the conveyor and be placed in the stocks.



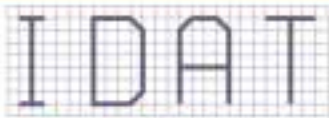
Placement of moulds

Completion of formwork

After all required steel moulds have been placed, the cross-lifting trucks lift the pallet out from the opening in the mezzanine, let it down to the level of the rollers and transport it into the line of one of the next free positions. The pallet circuit offers three

parallel lines for finishing formwork, building in reinforcement, casting and screeding.

Furthermore, window and door frames or the formwork are placed to the marked positions. Electrical inserts like boxes for outlets are placed on the pallet by means of hot-glue or magnets. ▶



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Formwork supplements

Reinforcement

Reinforcement is prepared in a separate bay. Three working tables are installed and a laser system is displaying the outline and cut-outs of the required reinforcement. The laser system is working parallel on the tables. Synchronisation between the pallet circuit and the laser system is performed via the master computer of the pallet circuit.

A storage area for standard meshes and single bars is planned. In a next step, meshes from coil will be used. A mesh straightening machine with related cutting unit will be installed.



Concreting stations

After completion, the reinforcement meshes or cages are picked up by an overhead crane. The crane travels from the bay where the reinforcement is prepared to the bay where the waiting pallet is on one of three available positions.

Casting

For casting, the pallets are transported to a concrete spreader which can work over three pallet positions. The concrete is supplied by a bucket conveyor system.

When the formwork is filled with concrete, the compacting unit can be started and the concrete is compacted. All three pallet positions are equipped with compacting units.

Screeding

After casting and compaction, the pallets are transported on to the next positions. At these positions, a screeding device is installed. With the help of this screeding device, the surface of the concrete is levelled to the exact required thickness of the concrete element.

Transport to helicopter smoothening

After screeding, the pallet is transported to one of the stations for helicopter smoothening. The smoothening stations are located on two different mezzanine levels. Each level is equipped with a helicopter smoothening device.

The smoothening device finishes the con-



Rack operator and curing chamber

crete elements in such a way that they have a very fine and smooth surface, ready for painting.

Curing

After smoothing, the pallets are picked by the rack operator and transported to the curing chamber, where the hardening process of the concrete elements takes place under controlled environmental conditions.

Removal of moulds

When curing is finished, the pallets are picked up automatically from the curing chamber by means of the rack operator and are transported to the demoulding line.

In these positions, the steel moulds are removed from the pallet with the help of special handling cranes and are placed onto a conveyor system which transports the moulds to an automatic cleaning and oiling unit. Also, all complementary moulding material is removed and, if reusable, transported back to the moulding area by means of a single girder crane. ▶



Mould removal



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Shuttering removal



Transport to the tilting stations

After all shuttering material has been removed, the pallet is transported to one of the two tilting stations.

Unloading wall elements

At the tilting stations, the pallets are tilt and the wall elements can be unloaded with the help of the overhead cranes. The wall elements are placed in transport racks waiting at the unloading positions. When all elements have been removed,

the pallet is travelling in automatic mode to the pallet cleaning and oiling machine. The finished transport units are picked up by a run-off truck and are transported out of the building where a gantry crane takes them over. Stockyard handling and loading trucks is carried out by the gantry crane.

Cleaning and oiling of pallets

The empty pallet passes a stationary cleaning unit with scrapers and brushes. Behind the cleaning unit, an oiling unit is

installed. This oiling unit sprays a fine layer of separating agent onto the pallet surface to prepare it for the new production cycle.

Project Planning and Equipment

Design and Consulting

Christian Prilhofer Consulting
Pommernstraße 17
83395 Freilassing, GERMANY
T +49 8654 69080
F +49 8654 690840
mail@prilhofer.com
www.prilhofer.com

Bucked Conveyor

Dudik International
Kübelbahnen und Transportanlagen GmbH
Mackstraße 21
88348 Bad Saulgau, GERMANY
T +49 0 75818877
F +49 0 75814692
Dudik@t-online.de
www.dudik.de



Gantry Crane and stockyard

Control System and Master Computer

Unitechnik Cieplik & Poppek AG
Fritz-Kotz-Straße 14
51674 Wiehl-Bomig, GERMANY
T +49 2261 9870, F +49 2261 987510
info@unitechnik.com, www.unitechnik.com

Batching plant

Teka - Maschinenbau GmbH
In den Seewiesen
67480 Edenkoben, GERMANY
T +49 63238090, F +49 632380910
info@teka-maschinenbau.de, teka-maschinenbau.de

Transport technology

Vollert GmbH + Co. KG Anlagenbau
Stadtseestraße 12
74189 Weinsberg, GERMANY
T +49 7134 520, F +49 7134 52203
info@vollert.de, www.vollert.de

Pallet and concrete technology

Weckenmann Anlagentechnik GmbH & Co KG
Birkenstraße 1
72358 Dormettingen, GERMANY
T +49 7427 94930, F +49 7427 949329
info@weckenmann.de, www.weckenmann.de

Mesh treatment

Hambi Terhoeven GmbH & CO. KG
Hermesweg 1-7
47665 Sonsbeck, GERMANY
T +49 2838 91380, F +49 2838 3812
info@terhoeven-landtechnik.de, www.hambi-maschinenbau.de

CAD system

Nemetschek AG
Konrad-Zuse-Platz 1
81829 München, GERMANY
T +49 0 89 927930, F +49 0 89 927935200
info@nemetschek.de, www.nemetschek.de

Krane

MHE Demag Ltd.
23/110 Soi Sukhumvit 63
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