

Morton

# Form liner handling system for the production of architecturally sophisticated sandwich wall elements

The Morton company has built a new precast factory under the company name OOO "DSK Grad" in Kotovo, in the Narofominsk area of the Moscow region. The plant consists of several production areas with a prestressed hollow-core slab production, stationary production plants and three pallet circulation plants for the production of sandwich walls, solid walls and solid slabs. The plant has a total production capacity to manufacture precast concrete elements for the annual construction of 525,000 m<sup>2</sup> living space, which is divided into 450,000 m<sup>2</sup> residential buildings and 75,000 m<sup>2</sup> social buildings. The overall design of the factory and the production systems, as well as the site plan, traffic and logistics concepts and infrastructure were handled by Prilhofer Consulting GmbH & Co. KG.

■ Dipl.-Ing (FH) Markus Obinger,  
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For residential buildings in particular, Morton has set itself the goal of offering the market modern architecture and sophisticated, attractive façade designs.

In addition to the colour design, which consists of a permanently resistant and low-maintenance implementation of the through-dyed outer shells of the sandwich elements in coloured concrete, various surface structures were also used for the design of the buildings.

The sandwich elements are produced on a pallet circulation plant from Sommer Anlagentechnik. The pallet circulation plant is designed for an output of 3 pallets per hour and can thus produce up to 100 m<sup>2</sup> finished exterior wall elements per hour.

These are concreted with dyed concrete for the colouring of the outer shells. A dedicated mixer with mixing turbine is provided for this in the mixing plant from Teka (see report in CPI 06-2014), which supplies coloured concrete in a constantly high consistency to the concrete distributor for the exterior shells via a bucket conveyor especially intended for coloured concrete. The structured surfaces of the exterior shells are shaped by form liners from Reckli.

The major challenge in this project was to use form liners for the first time on a large industrial scale and in automated fashion on a pallet circulation plant. The plant is designed in such a way that 100% of the elements to be produced can be manufactured with a form liner without negatively affecting the performance of the plant.

There are about 150 different elements with structured surfaces in a building project. The client, DSK Grad, had demanded that up to four building projects must run in parallel on the pallet circulation plant. This means that up to 600 form liners must be directly accessible to the circulation plant and must be managed.



*Example of the architecture of the buildings erected using precast concrete elements from Morton.*



*Example of the concrete surface design*



Form liner on the "power and free" transport unit



Active form liner store (power and free)

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In order to achieve this goal, Prilhofer Consulting decided to provide for a so-called "power and free" system, which serves as a storage, supply and removal system after removal of the form liners from the circulating pallet. On top of that, the power and free system acts as a so-called sorting store. Following detailed planning of the layout for the power and free system together with the specialists from the CSF company, and after analysis of the building projects, the decision was taken to specify 3.68 m as the maximum length of the form liner. Elements with a greater length are manufactured using two form liner parts. The maximum wall height was specified as 3.65 m.

Around 150 form liners circulate on the pallets of the circulation plant, in some cases assembled from two individual form liners. The power and free system (active store) can accept up to 220 form liners. 250 to 300 form liners can be taken up by a crane-served, manually managed passive store, which is connected directly to the power and free system by a lifting/lowering station.

The form liners are attached to a frame construction with plywood for the handling of the form liners in the storage systems and for installation in or removal from the circulating pallets. For identification purposes, each form liner is equipped with an RFID chip on which information such as the article number (form liner name), the current storage location, the nominal expected number of production cycles (form liner service life) and the actual value of the usage cycles are stored.

### Production sequence

The management of the form liners in the power and free system is handled by the master computer from CSF. The system is connected to the pallet circulation plant by the master computer from SAA. In order to enable this management it is necessary for the form liners to be modelled correspondingly in the CAD system and for the associated form liner information to be transmitted to the Uni interface.

The master computer of the circulation plant always knows the current status of the storage system and which form liners are available for production. New pallet populations are initiated at the shuttering robot only after a check of form liner availability. Otherwise a pallet is pushed back in the production queue until the respective form liners are available.

Once all conditions are satisfied, the master computer of the circulation plant releases the production at the shuttering robot and calls off the respective form liners from the



*Installation station for the form liners*



*Form liner installation and refinishing stations*

power and free system. The sorting and supply process starts there immediately so that all the form liners required for a pallet are supplied in good time at the installation station in the circulation plant.

At the installation station the form liners are removed from the power and free system by means of a lowering station and set down on a roller conveyor, which takes the liners to the crane-served area of the pallet. From there the operator picks up the form liner with the crane and sets it down at the pre-

specified position on the circulating pallet. At the installation station there is a master computer terminal on which a form liner diagram for the current pallet can be displayed or printed.

In order to permit the placing of the form liners in the shuttering, the shuttering robot initially places the shuttering at the head end away from the element. After the form liners have been placed on the pallet, the shutters are placed in the intended positions with laser assistance at the downstream stations



*Element transport in the finishing area*

and other refinishing work is carried out. After that the elements with form liners pass through the normal sequence for the production of a core-insulated sandwich wall. The hardened elements are automatically removed from the hardening chamber. Before lifting off on the tilting station, the shuttering parts are removed on the so-

called pre-demoulding stations and are either fed to the automatic system via conveyor and cleaning belts or cleaned and transported to the shuttering store for the shuttering parts to be manually added.

The sandwich walls are lifted off on the tilting station; the form liners remain on the

pallet. These are lifted off by a crane at the next station in the reverse order to the installation of the pallet and fed via a roller conveyor to the lifting station of the power and free system. On being taken up by the power and free system, the RFID chip of the form liner is read and the form liner information is transmitted to the system.

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*Cleaning position and quality control*



*Delivery to the finishing area*



*Finishing area*



The form liners pass through a cleaning station on the return circuit to the active store. Here, the form liner is freed from contaminants and checked for possible damage and wear. A terminal at the cleaning station shows the worker whether the form liner has already reached the foreseen number of production cycles. The employee decides whether the form liner is OK, even if the foreseen number of production cycles has been exceeded, or whether it must be taken out of the system and repaired or replaced. To this end the operator either releases the form liner for the active store or sends it to the maintenance or removal station.

The maintenance station is also equipped with a lifting/lowering station of the power and free system. At this station new form liners can be brought into the system and the form liner information can be written to their RFID chips. Form liners can be removed here into the passive store or fed from the passive store back into the active store. This process is possible without having to intervene in the normal sequence of form liner supply at the circulation stations. The corresponding calls or requests are made by the master computer of the pallet circulation unit.

At the end of the production process the elements are brought by means of a transport system into the finishing area for the sandwich elements, where any cosmetic repairs as well as the installation of windows and doors take place before the elements are compiled into finished transport units on inloader frames.

The detailed considerations and relationships arising from the production requirements with regard to quantity and flexibility, form liner management, call-off, supply and checking, as well as quality assurance, can only be described here very superficially. The approximately one-year development

project between Prilhofer Consulting, SAA and CSF has put DSK Grad in a position, with the form liner handling and storage system installed, to be able to react highly flexibly and efficiently to the requirements of the most diverse architectural building designs and to supply the market with the corresponding precast elements.

## FURTHER INFORMATION



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