Transport of precast elements using air-cushion elements

New methods in special element production

At present, different precast elements made from concrete, such as stairs (straight flights and spiral), columns, girders, flat precast elements (sandwich and solid walls) and other structural precast elements are produced using stationary formworks. The greatest disadvantage of stationary formworks is their inflexibility in production and the limitations due to the sizes that can be transported. In order to counteract these disadvantages, Christian Prilhofer Consulting has been giving some attention to the development and use of a flexible internal transport system for the precast element plants which produce these products. The design work took into consideration the prevailing needs of the European market.

By Peter Kawan

The development aimed to achieve a more flexible product mix, smaller batch sizes, greater schedule effectiveness for deliveries, improved product quality and a significant increase in production to the benefit of the customer.

One of the factors which is critical for the success of the system is its profitability. For this reason, the development was based on a payback period of no more than 5 years.

Other critical factors for success which have a significant effect on the development are the discovery of a suitable supplier or suitable technical solution, the development of the market in Europe and the location of "lead users" who will then implement the idea.

The existing pallet circulation setups with a transport system consisting of friction wheels, roller blocks and elevating truck platforms are not flexible enough to meet all the requirements of special element production in order to cover all of the customer's needs. In a circulation system, different cycle times have a detrimental effect on the throughput and so a solution had to be found to compensate for this disadvantage.
The air cushion system turned out to be the best solution for this task. Combinations of air cushion elements with a load-carrying capacity of up to 100,000 kg can be achieved, and this fulfils the requirements (**Figure 1**).

An air-cushion transport system is made up of several air cushion elements. The mode of operation of an air cushion element depends on the structure of the air cushion between the ground and the membrane. The friction between the cushion and the ground is reduced to a minimum, which makes it possible to move heavy weights with a small amount of energy.

These air cushion systems are currently being used for the transport of containers, railway carriages, aeroplane engines, generators, machines, transformers and turbines etc.

With an air cushion system, the adjustment to the load takes place independently of the centre of mass. Only small areas are required for transport and manoeuvring because of the compact dimensions. The travel speed of the air cushion systems can be continuously adjusted from 0-15 m/s. Under normal conditions, only a small number of transporters is necessary, because the individual transport units are handled by using intermediate pallets or u-chassis (**Figure 2**).

Air cushion system without load

Air cushion system with cable roller

The following kinds of air cushion systems are currently available for industrial use:

- Removal systems on air cushions for the occasional transport of heavy loads (for loads up to several hundred tonnes)
- Directly controlled air-cushion transporters (for handling lighter loads)
- Remotely controlled air-cushion transporters (for transporting heavy and large loads)
- Automatically controlled air-cushion transporters (mechanical control via inductance loop or laser navigation)

In order to keep the air demand as low as possible, an air cushion system requires a floor that is easy to clean, joint-free and coated. The air demand is determined by, among other things, the air pressure and the load.

In order to provide a cost-effective setup, the system for this special element production plant had to be designed for a maximum transport size of 8 x 4 x 5 m (LxBxH) and a maximum weight of 30 tonnes for the concrete element, formwork and chassis.

This plant is capable of producing 30 elements (spiral and straight flights of stairs and precast elements) per shift. One area of the plant is served by a corridor-bound rack-operating system and is used as a curing chamber and formwork store. The processing area (element demoulding, formwork, reinforcement and concreting) is fully flexible and is served by the air-cushion systems alone (**Figure 3**).

In comparison to the current stationary formworks, this system has the following advantages:

- An ergonomic layout of workstations is possible since they are clearly defined.
- The journey times of the staff can be minimised.

Shuttering ramp, stored on an air cushion system

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- The sources of danger to the staff are reduced by defined workstations.
- The energy demand is reduced because the curing chamber is insulated.
- The noise is less than that of a stationary production system and the quality of the products is improved – which means that less time is needed for reworking and cosmetics.
- Special elements can be produced.
- The workload for the overhead cranes is reduced by this design of travel-out car
- Because of the floor-level transport equipment, it is no longer necessary to take into account the manipulation of high loads by crane when designing the production hall.
- The cycle time can be optimised by using several floor-level units.
- The curing chamber is also used as a pallet store for special formworks

Finally, this flexible production system also provides a good opportunity for producing special elements economically. ■

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Hollowcore machinery in Mexico

Spancrete Hollowcore machinery and products have had a long history in Mexico. Since it first sale of equipment to Sistemas Preforzados, S.A. (SIPSA) in 1966, Spancrete hollowcore floor slabs and wall panels have been successfully utilized in many different applications in Mexico.

Spancrete is proud to announce that virtually all of its machine types are currently operating in Mexico. Currently, their Low Profile (LP) single bed system is producing 1.2 meter wide hollow core for ITISA in Puebla. The larger Gantry Type (GT) multi-bed machines are producing both 1.2 and 2.4 meter for Constructora Moyeda in Monterrey and for ITISA's newest facility in Mexico City.

Spancrete Gantry Type (GT) in Mexico City, ITISA's newest facility

„We are very pleased about the long standing success of our Spancrete producers in Mexico and we definitely consider Mexico a high growth market that our machine systems fit well" says Joe Dugan.

Spancrete Machinery Corp. (SMC) manufactures its slipform equipment in Waukesha Wisconsin. The slipformers are capable of producing prestressed hollow core floor slabs and insulated/non-insulated wall panels with a variety of textured finishes (standard thicknesses of 10cm to 40cm). SMC also manufactures all of the accessory equipment needed for the total production of Spancrete hollow core products.

Spancrete floor slabs and wall panels are also certified under the new ICBO seismic standards for earthquake zones and are fully approved for all applications throughout Mexico.

1.2 and 2.4 meter multi-bed machinery in Monterrey, Constructora Moyeda

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