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Pumping technology for precast element production

With the further development of formwork solutions for precast concrete element production, especially for volumetric elements (e.g. room modules), intelligence solutions for filling these formworks are required to enable high surface quality and efficient production. In addition to its formwork solutions, Ratec has developed a practical pumping technology for filling closed formworks that is specifically tailored to the requirements of the precast plant. The pump solution emerged from the upcrete technology developed by Ratec, which represents a procedure for production of particularly complex and structured flat or volumetric precast concrete elements that has been established in the market for over ten years. Centrepiece of the upcrete procedure is the UPP100 concrete pump, which has been continuously developed and optimised for diverse applications in numerous projects and test series.

In the pumping process from below in the upcrete procedure, the air is pressed out of the top of the formwork and air inclusions in the concrete are almost excluded.

One significant advantage of the UPP 100 is its design as a rotor pump. This permits precise, fine dosing of the concrete delivery and optimal adjustment of the filling pressure. One of the substantial differences is that the piston pumps frequently used on building sites generate a jerky pressure. This creates a risk that the formwork may warp and built-in components, such as cavity pipes that are not fixed in place, could move. This can make the element unusable or cause unnecessary additional expenditure.

Two project examples from the recent past illustrate different Ratec pumping technology application possibilities in precast concrete element production.

Production optimisation for box culverts in Ireland

In Ireland, upcrete pumping technology is used for production of box culverts. The elements are used as path bridges or for channelling watercourses under streets and railway lines. As one of the largest manufacturers in the country, the customer produces over 60 metres of structure per day. The request for an upcrete pumping solution arose due to the problem of air void inclusions occurring on the inside of the elements. This can lead to corrosion of the reinforcement, which impairs the long-term bearing capacity of the element. The elements were previously reworked at great expense. An



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Box culverts that were produced by pumping the concrete from below

economically more efficient solution now had to be found to increase surface quality in the production. Secondly, filling formworks using buckets required too much crane capacity, so an alternative was also sought for this and filling from below using a pump was pursued. The UPP is tailor-made for use in the precast concrete plant and, depending on the production concept, integrates very well into existing processes. The pumping station can also be designed as a mobile solution for this purpose. In the current example, the customer made a trolley available for the pump.

Precast columns for the new Sky Rail in Melbourne

A new Sky Rail is currently being built in Melbourne, the capital of the Australian state of Victoria in the southwest of the continent, to fundamentally unburden the traffic situation in the city. The route runs above an existing ground-level sub-

urban line. Lengthy traffic jams occur regularly at the numerous intersections with the road network, especially at peak times. After commissioning the Sky Rail, the old track will be demolished and the resulting open areas will be put to a practical new public use.

As with other equally demanding projects, the Ratec upcrete pumping technology is used in the production of precast columns for the new elevated railway. Installation of the first of a total of 350 support columns began in early 2017. The shell construction for the route should be complete at the end of 2018.

The customer uses formworks that can be adjusted to different heights by means of a movable floor for the technically demanding production of support elements that vary in height. This prevents filling with concrete through the side of the formwork. There are also complex recesses in the upper face of the elements, so filling from above is also impossible. A solution was required for these uncommon challenges.

Ratec had already carried out tests of concreting through the floor formwork and refined its concrete filling connection accordingly. So a proven solution was available. To produce different element heights, the distances between the concrete filling connection and raised floor formwork are bridged with suitable PVC pipes. Concrete delivery is carried out with the aid of a Ratec UPP100 concrete pump, which ensures even filling and optimal spread of the concrete in the formwork.

The results were so qualitatively impressive that the customer is considering the use of upcrete technology for subsequent execution of the horizontal elements.



UPP100 and formwork for a support element

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It was not possible to fill from above due to the diverse recesses in the upper face of elements.



Installation of elements along the route

Principal arguments for use of upcrete pumping technology

The two projects show the various advantages and benefits of using upcrete pumping technology in the manufacturing of precast concrete elements. The main arguments for use of upcrete pumping technology are optimisation of surface and element quality, more efficient design of production processes and the release of crane capacity.

The UPP pumping station is customised for the application in the plant, but can also be used on the building site.

The customer's formwork is examined beforehand for its suitability for pressure filling and does not normally present an obstacle. A suitable concrete filling connection that can be easily installed in any form ensures a smooth formwork finish on the element. The pumps are suitable for both self-compacting concretes and all other pumpable concrete mixtures. Very mobile solutions can be prepared using a pump cart and accessories for hose handling. The focus is on smooth integration into the customer's existing production process. ■

FURTHER INFORMATION

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