Ambercon A/S, 9530 Støvring, Denmark

Stationary manufacturing plant for facade and wall elements in Denmark

Following many years of very limited investment within the precast industry in Denmark, a remarkable new project was realised last year. The Danish family-owned company Ambercon, from Støvring near Aalborg, erected a plant for top quality manufacturing in a record time from planning to realisation. A total of 32 tilting tables in the newly erected production halls can manufacture up to 1500 m² of façade and wall elements daily – an order of magnitude that is unmatched anywhere in the world. At the same time, the higher demands with regard to quality, productivity and logistics at Ambercon (formerly S.E. Concrete) led to the necessity of replacing the existing decentralised capacities by a new production plant.

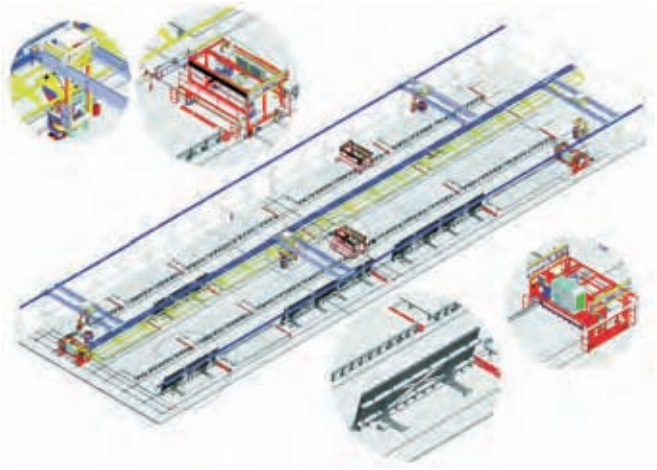
One of the largest tilting table production plants in Europe was taken into operation at the Ambercon company in Denmark

The existing equipment at S.E. Concrete had for the most part grown old and an extension on the existing site was out of the question. Hence initial consideration was given to a new building on a 'greenfield site' in 2005.
Once a suitable site was found with perfect motorway connections close to the existing manufacturing facilities, planning was intensified. The basic question was whether to build the new production plant as a circulating pallet plant or, as up to now, as a stationary production plant. The widest variety of production plants were thereby inspected and their advantages and disadvantages compared.
The decision was finally made in favour of a classic tilting table production plant, but using powerful machines for cleaning/oiling/plotting of the tables as well as for the concreting and subsequent smoothing of the concrete elements. The deciding factor was in particular the high demands with regard to the desired flexibility.

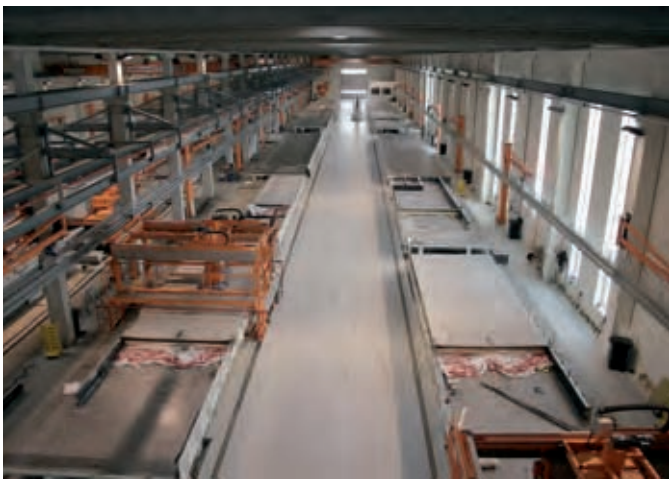
Planning/building phase

Avermann Maschinenfabrik was involved in the planning of the plant right from the start, together with its Scandinavian distribution partner CPT (Concrete Plant Technology). A basic concept was developed at an early stage that satisfied Amber con's wishes and expectations at first go and only needed to be specified more precisely in the details.

Contract negotiation with the various suppliers began in May 2007. First of all, Avermann were awarded the contract for the supply of all production equipment. Immediately afterwards the contracts were awarded for the reinforcement equipment (Progress), the mixing plant equipment with bucket tracks (Skako) and the recycling plant (Bibko) – to name just the main trades. The earthworks began immediately and the



Overview of Ambercon's new plant



View of one of the two production halls

Concrete disributor being coupled to the crane

new pr oduction facilities wit h w arehouse area and office building were erected. Both the of fice and t he pr oduction halls hav e been designed to be br ight and fr iendly. One clear ly senses t hat people ar e mos t important her e. Accor ding to Amber con's Managing Dir ector, Torben Enggaar d, t he well-being of every single employee is part of t he cor porate cultur e, wher eby team spirit is consciously pr omoted and bor ders between t he dif ferent pr ofessional gr oups are blurred.

In all, jus t one single y ear passed betwee n the ground breaking and the opening ceremony for t he concr ete pr ecast w orks on 8/8/2008.

Concrete precast element production on tilting tables

The lar gest par t of t he equipment w as supplied b y A vermann Masc hinenfabrik, which is based in Osnabrüc k, Ger many. Use w as specif ically made of A vermann's extensive kno w-how and man y y ears of experience in the concrete precast industry here.
A wide variety of façade and wall elements are concr eted on a total of 32 h ydraulic tilting tables, some of which are implemented as tandem groups. All tables are fitted with an edge for m that is inf initely adjustable in height as w ell as per manently ins talled vibration equipment, so t hat w alls in t hicknesses up to 500 mm can be manufactured from SCC and nor mal concrete.

A total of 8 double-gir der gantr y cr anes, each wit h a load capacity of 20 metr ic tons, are available for transporting the concrete elements fr om the production area to the adjacent, spacious w arehouse. Four of the cranes were supplied in a special version for bear ing t he concr eting equipment. In order to also be able to use t he cr anes alternatively for fur ther task s, t he concr ete distributors ar e mer ely hook ed onto t he crane and guided on t he tr olley of t he crane via appropriate adaptors. The attachment and detac hment of t he concr eting equipment to and fr om a cr ane, including the automatic po wer supply line, tak es just 2 minutes.
The delivery of concrete inside the works is accomplished via buc ket tr acks. Af ter t he operator has or dered concrete, the correct mixture is manufactured in the mixing plant via a cor responding contr oller and tr ans-

Radio controlled power trowel with 2 smoothing units

ported by bucket track to the respective crane with the concrete distributor. In this manner, concrete can be transferred at any place in the hall, saving a great deal of time. Each of the concrete distributors has a capacity of 2.5 m^3. The concrete is delivered precisely onto the tilting table via a dedicated lifting unit in conjunction with a rotating unit. All functions are radio remote controlled.

Two power trowels accomplish the smoothing of the concrete element surfaces after concreting. Depending on the dimensions of the concrete element, two smoothing units can be operated separately or in parallel on each machine. However, it requires quite a bit of intuition to determine the correct time for pre-smoothing (with a disc wheel) and repolishing. The experience and skills of the operator are called for here.

The power trowels are movable on the ground with longitudinal and transverse chassis and can therefore be used at any time and in any place inside the two production halls. So that no cables lie on the floor and in order to eliminate the associated risks of damage, a clever current collector system was developed especially for Ambercon. Thanks to this flexibility – the ability to access every concrete element at any time – waiting times in the production sequence can be avoided. Since the number of products that need to be smoothed is growing continuously, this flexibility of the power trowels was an important criterion. All functions are radio remote controlled here also.

Two additional cleaning/plotting/oiling machines (CPO) enable the work preparation processes to be designed very effectively. The machines are driven analogously on the ground like the power trowels. However, all procedures take place automatically here.
After the concrete elements have been lifted off, the tilting tables are subjected to high-quality mechanical cleaning. The residual concrete is removed from the table and the edge form by means of scrapers and cleaning brushes driven by electric motors and transported into the residual rubble container at the end of the table. A vacuum unit installed on one of the machines removes fine-grained residual particles (which accumulate in particular when washed concrete is manufactured) via an appropriate filter.
The oiling of the cleaned table surfaces/edge forms with release agent is accomplished reliably and in the desired intensity by special rotary nozzles. These nozzles practically never become blocked. Oiling can take place in direct combination with the cleaning process or as a separate process.

After cleaning (oiling), the new concrete contours, cut-outs, built-in components and the like are plotted precisely on the table surface and the concreting process starts again from the beginning after shuttering and installation of the reinforcement.

The mixing plant

The mixing plant was planned and implemented jointly by Ambercon and the Danish company Skako. Great importance was thereby placed on high flexibility, both in relation to the different requirements in daily production and in the long-term in relation to later requirements.

The complete plant that Skako ultimately supplied and commissioned offers a capacity of 125 m^3 concrete per hour. The main components of the plant are

- 24 aggregate silos for storing the raw materials, each with a capacity of 60 m^3.

CPO machine in its home position

Distribution of aggregates to the 24 silos

- A special loading and dosing system for the aggregates with two movable trolleys, which ensure that all 24 different raw materials can be delivered to the three mixers and that two mixtures can always be produced simultaneously.
- Three Apollo countercurrent mixers, each of which can unload the concrete into two different concrete bucket tracks. In this manner each mixer can serve the concrete requirements in one of the two production halls.
- Two Conflex bucket tracks, which, with a speed of 4.5 m/s, ensure that the internal transport of concrete in the works does not represent a weak point in the production sequence. The bucket tracks take the concrete directly to the above-described Avermann concrete distributors in the two production halls.

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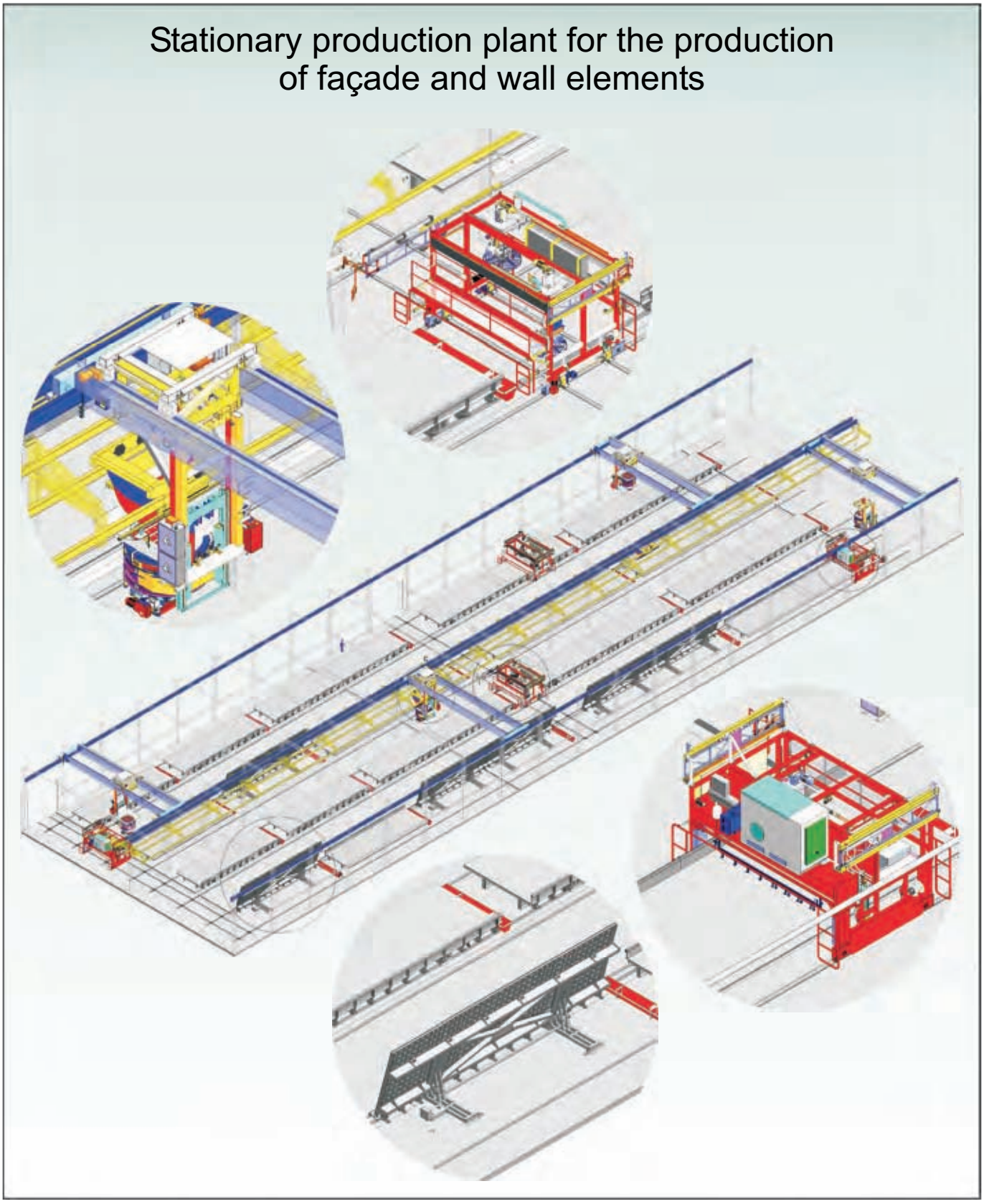
Stationary production plant for the production of façade and wall elements



circulation plant • shuttering • tilting tables • vibrating lines • pallets • special machines

Avermann Maschinenfabrik GmbH & Co. KG
Lengericher Landstraße 35 • 49078 Osnabrück • Germany • Phone +49 (0) 5405.5050 • Fax +49 (0) 5405.6441 • info@avermann.de

Transfer of the aggregates to the three inclined bucket elevators

The mixers are equipped with Visco Probe measuring systems by Convi ApS, which enable online measurement and monitoring of the concrete consistency and viscosity during the mixing process.

There are automatic cleaning programmes for both the mixers and the bucket tracks, so that various changes of dye during production do not pose any problem. A dosing system by Finke is installed at Ambercon for dosing the dyes. The overall control of the dosing and mixing plant is organised by a Skakomat 600 controller.

Reinforcement plant

The Progress company from Italy supplied Ambercon with an M-System Evolution mesh welding plant for the manufacture of reinforcing meshes with various grid sizes, dimensions and wire diameters, as well as a machine for bending the reinforcing meshes. In this plant both the cross bars and the longitudinal bars can be arranged with complete flexibility, without having to comply with specific grid sizes. Not only that, particularly large meshes with dimensions of up to 6 m x 12 m can be manufactured and can even be bent subsequently if required.

Production planning system

For the first time in stationary production on tilting tables, a control system – LEIT2000 by SAA - was also used in this project for production planning and the control of the machines. The production planning system, with schedule adopted from the ERP system and the LEIT2000 pallet allocation, enables in this case simple planning of the tables, the taking into account of edge forms that have already been constructed and the different element types and element heights. Depending on the size of the element, the production planning system also provides for two tilting tables to be coupled together in order to also be able to produce larger parts. By means of the printout of component preparation lists and table allocation plans, the employees in the production halls are supported effectively before and during production. The work preparation process is rounded off by the automatic, optimised generation of production data for the fully automatic manufacture of bent meshes by the aforementioned reinforcement machines and for the effective driving of the SAA plotter controllers. The data connection to the SAA controllers of the CPO units takes place via a wireless network that covers the entire hall area.

An overview diagram displays the tables on the control centre and shows their coupling and allocation situations. The schedules for production are received and the statuses and manufacturing times for the individual concrete elements are fed back to the ERP system for processing via a modem database interface. The CPO units equipped with the SAA-IPC controllers can be used flexibly in the hall and receive the pre-planned data matching the respective table from the con-

Three Apollo mixers are used at Ambercon

Cleaning station for the bucket tracks

The Skakomat 600 controller organises all mixing processes

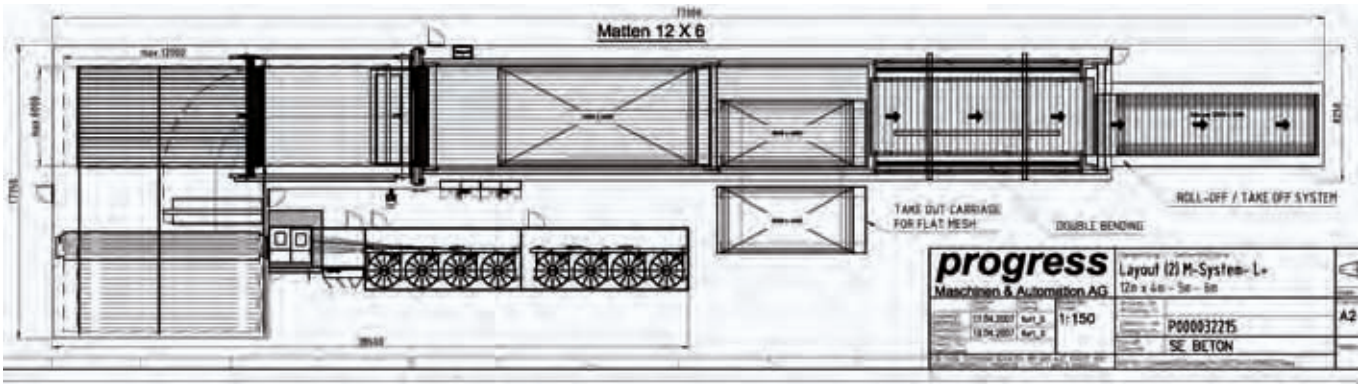
Meshes with dimensions of up to 6 m x 12 m can be produced on the mesh welding plant

trol system. The LEIT2000 heating controller was also integr ated in t his plant. The heating valves on the tables are activated accordingly via dif ferent heating pr ogrammes assigned to t he v arious element types and the table heating cur ves are regulated via the feedback from temperature sensors.

After the concrete worker gives the signal to start, t he appr opriate heating pr ogramme can be executed for each table. The actual temperature curve is detected and t he heat input to t he placed elements is r ecorded graphically.

Residual concrete recycling system

The Ger man compan y BIBK O® Umwelt - technik und Ber atung GmbH planned and implemented a compr ehensive r ecycling concept for Amercon. Since the wall surfaces at Amber con can be manufactur ed as washed concr ete or nor mal concr ete sur - faces depending on requirements, the recycling plant is divided into tw o areas:
Area 1: BL ANDE ANL ÆG. The concr ete mixing plant wit h a total of 3 concr ete mixers is located here. Following the mixing process the concrete is transferred to one of the two bucket tracks and transported to the necessary place in t he works.
Area 2: V ASK FINISH HAL. The pos t-treatment of w ashed concr ete elements tak es

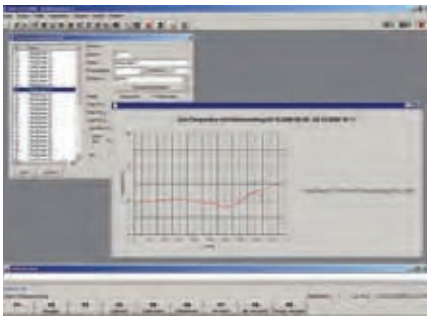


Layout of the reinforcement plant

Bent meshes are also possible at Ambercon

Table allocation with adjacent Gantt diagram.

Plant diagram occupied by data



Heating programme window, temperature curve of an element

place in this area using high pressure water lances. Since the demands on the recycling process or the recycling plant respectively are different in the two areas, a separate concept was developed for each area. However, these two systems are connected to each other via an interface.

BLANDE ANLÆG

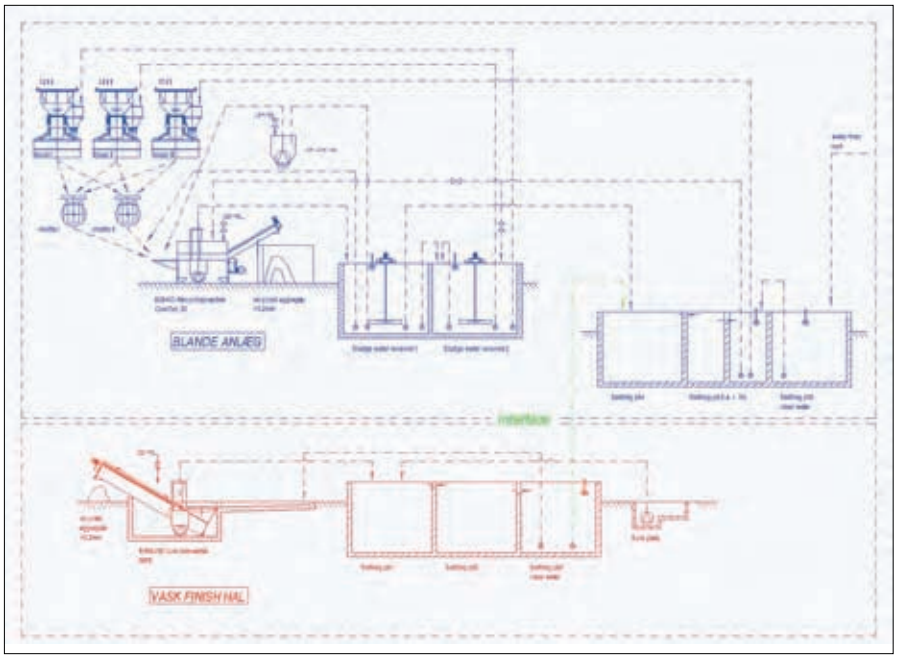
Since the largest quantities of residual concrete accumulate in the area of the mixing plant, a recycling plant of type ComTec 20 was provided here. Quantities of residual concrete can be fed directly to the plant from the three mixers or the bucket tracks. Washing water accumulating during washing of the mixers and bucket tracks is similarly fed directly to the recycling plant. The costs of treating residual concrete are reduced significantly as a result.

The actual recycling or washing process then takes place in the recycling plant, whereby aggregates > 0.2 mm (sand, gravel) and water with cementitious fines with a grain size < 0.2 mm are produced. Whilst the aggregates are discharged via the screw conveyor attached to the ComTec recycling plant, the fines and the excess water (residual water) run into the pump sump via the machine's water overflow. In this pump sump there is a pump that pumps the water with the fines into agitation tank 1. The agitator mounted in this tank prevents the sedimentation of the fines, so that they are kept in suspension. Residual water from this tank is used on the one hand to wash the hopper that receives the washing water and residual materials from the bucket track and mixer washing process and, on the other, to supply the Bibko material transport system with water.

In order to make residual water available for the actual mixing process with the most uniform, specific properties possible, a second agitation tank was provided in these works. Whilst tank 1 serves to accept the unevenly accumulating residual water and to buffer it intermediately, the residual water is pumped into tank 2 after a certain time, mostly in the morning on the following day. Fluctuations in the density of the residual water and differences in the degree of chemical reaction (hydration) of the cement particles during the course of daily production are compensated in this way. Following the transfer pumping process, agitation tank 2 then contains residual water with a uniform density and uniform chemical properties.

The volume of the agitation tank is dimensioned so that the water requirement for one day's production can be covered by this tank. The adjustment of the concrete recipes or compliance with the prescribed specifications is hence simplified considerably. Submersible motor-driven pumps installed directly in the agitation tank serve to pump the residual water to the mixing plant or to the water weigher.

The density meter installed in agitation tank 2 represents a further component for quality-assured concrete production. The current measured density value is made available to the plant controller continuously so that corrections can be made if necessary. The quality of the end product can hence be



Schematic overview of the BIBKO® recycling plant

ensured at all times. In order to make the cleaning of concrete distributors possible, a second pump sump was provided in the floor of the factory hall in the BLANDE ANLÆG area. This is part of the Bibko material transport system and collects all of the material produced by the concrete distributor cleaning process. Using water as a transport medium, the residual material is fed to the ComTec recycling plant for treatment. If the above-described recycling process should result in an excess of water in the BLANDE ANLÆG area, there is a possibility to pump this excess water into a multi-stage sedimentation tank. Sedimentation of the fines is desired in this sedimentation tank, so that the last chamber of the sedimentation tank contains clarified water. This clarified water serves the refilling of agitation tank 1, as washing water for the recycling plant and, if necessary, can be used directly in the mixing plant as mixing water.

VASK FINISH HAL

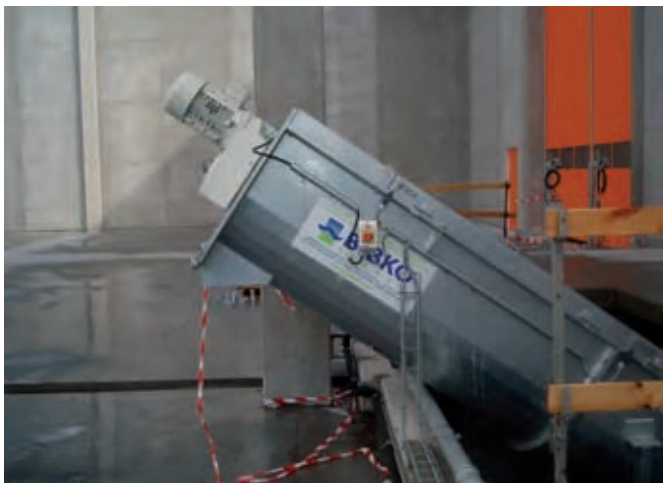
In the post-treatment of washed concrete elements using high pressure water lances, the concrete surface, which has not yet set due to chemical retarders, is washed out. This uppermost layer, which is composed of cementitious particles, sand and small aggregates, is thereby loosened. This material is collected in a gully together with the water used. The material moves from there into the Bibko type RWS recycling plant, where the actual recycling process then takes place.

Recycling plant, type ComTec, with pump sump

Overview of the Bibko plant equipment in the BLANDE ANLÆG area. Agitation tank 1 can be seen above, agitation tank 2 below

Gully for receiving the material

Gully to RWS plant transfer area



RWS delivery (during installation)

First concreting during the opening ceremony on 8/8/08 at 8.08 am

Aggregates with particle sizes > 0.2 mm are discharged via the plant's screw conveyor, whilst the excess water (residual water) with the fines < 0.2 mm runs into a pump sump via the machine's water outlet. In this pump sump there is a pump that pumps the water with the fines into a multi-stage sedimentation tank. The pump for transfer to the BLANDE ANLÆG plant section is installed in the last chamber of the tank alongside the rinsing pump for the collection gully for the washed-out material. In addition to the aforementioned process for the manufacture of washed concrete elements, there are some processes in the VASK FINISH HAL area in which acid is used. The water/acid mixture produced here is similarly collected and fed to the first chamber of the sedimentation tank. This mixture thus leads to a reduction in the alkaline pH value of the residual water of 11 – 13.

Interface between the BLANDE ANLÆG and VASK FINISH HAL areas

The transfer pump or transfer pipe represents the interface between the two systems. If there is a lack of water for concrete production in the BLANDE ANLÆG area, it is refilled with water from the sedimentation tank in the VASK FINISH HAL area. In this way it is always ensured that there is sufficient mixing water available for concrete production.

FURTHER INFORMATION

Ambercon A/S
Juelstrupparken 23 · 9530 Støvring, Denmark
T + 45 70 216060 · F + 45 98 372386
ambercon@ambercon.dk · www.ambercon.dk

Avermann Maschinenfabrik GmbH & Co. KG
Lengericher Landstraße 35 · 49078 Osnabrück, Germany
T +49 5405 5050 · F +49 5405 6441
info@avermann.de · www.avermann.de

CPT A/S
Concrete Plant Technology
Bygmestervej 8 · 5600 Faaborg, Denmark
T +45 6265 2070 · F +45 6265 2080
hk@cpt-as.dk · www.cpt-as.dk

SAA Software Engineering GmbH
System Analyse & Automation
Gudrunstraße 184/4 9 · 1100 Wien, Austria
T +43 1 641424713 · F +43 1 641424721
office@saa.at · www.saa.at

Progress Maschinen & Automation AG
Julius-Durst-Straße 100 · 39042 Brixen, Italy
T +39 0472 979100 · F +39 0472 979200
info@progress-m.com · www.progress-m.com

Skako A/S
Bygmestervej 2 · 5600 Faaborg, Denmark
T +45 6361 6100 · F +45 6361 6200
skako@skako.com · www.skako.com

Bibko Umwelttechnik & Beratung GmbH
Steinbeisstraße 1-2 · 71717 Beilstein, Germany
T +49 706292640 · F +49 7062926440
info@bibko.com · www.bibko.com