

Avermann Maschinenfabrik GmbH & Co. KG, 49078 Osnabrück, Germany

# 99 m long hydraulic universal formwork for the production of prestressed concrete parts in operation at HV Betonwerk Anhalt

HV Betonwerk Anhalt was founded in 1992 in Löbnitz/Köthen, Saxony-Anhalt, Germany, and employs around 200 people. Precast parts are produced for the domestic and foreign markets in a total of 9 production buildings using state of the art technology. The central location as well as the procurement of raw materials from the immediately surrounding area enables the precast concrete works to supply a large catchment area economically. Production is mainly focused on filigree wideslabs and double walls as well as solid elements and sandwich façade elements. These products are manufactured on pallet circulation plants made by Avermann Maschinenfabrik. Beyond that, various special parts such as columns, girders, beams, stairs, balconies etc. are manufactured in Löbnitz/Köthen. However, the manufacture of complex concrete structures with bar-shaped prestressed concrete parts for office buildings and industrial halls is increasing in importance.

## Planning/building phase

In order to be able to fulfil these special requirements – up to that point only untensioned concrete elements could be manufactured – initial consideration was given in 2008 to a universally usable formwork for prestressed concrete parts. Intensive discussions were held and the most diverse variants were considered. As a long-standing supplier, Avermann was involved in the planning of the plant from the outset. A basic concept was developed at an early stage that immediately fulfilled the expectations of the sole owner of HV Betonwerk Anhalt, Mr. Vedder, and only needed to be specified more precisely in the details. The universal orientation of the formwork concept in particular, but also the high requirements with regard to precision and production quality led at the end of 2009 to the placing of an order for the formwork with Avermann Maschinenfabrik GmbH, Osnabrück. The associated prestressing equip-

ment was purchased from Paul Maschinenfabrik. The existing seven buildings were already working at full capacity, which meant that a new production facility had to be built on a “green field site” opposite the existing works site. The construction work for the approx. 240 x 45 m hall (2 aisles), including the adjacent warehouse area of a further 160 x 45 m, took until the late summer of 2010 to complete. The production equipment was subsequently installed.

## Hydraulic universal formwork

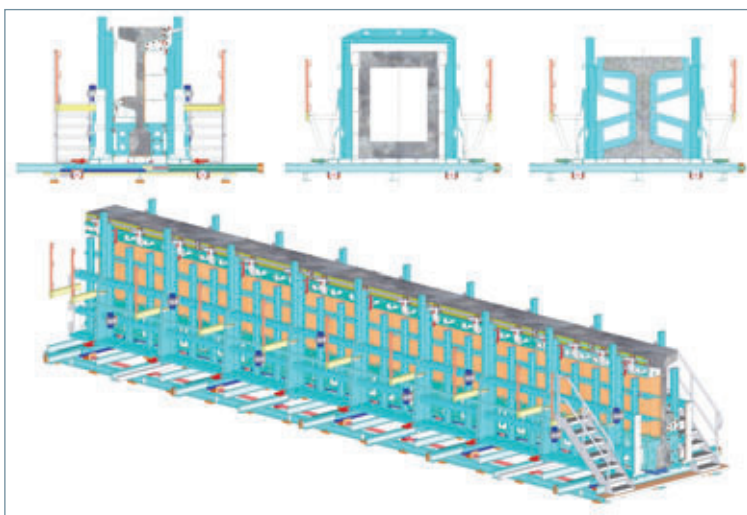
As mentioned above, the Avermann formwork was designed for the widest variety of applications. The formwork is located in a corresponding prestressing bed, which is equipped with the necessary prestressing equipment.

Hence, several concrete parts having the same geometry and prestressing can be manufactured inside the 99 m long form-

work. The formwork is primarily conceived for the manufacture of prestressed concrete parts. Untensioned concrete parts (e.g. columns) can also be produced if necessary; however, this will most probably be an exceptional case, since in this regard further formworks without prestressing beds are available at HV Betonwerk Anhalt.

The basis for the universal formwork is a 99 m long base frame formwork with hydraulically movable lateral grids on both sides. This movement is accomplished by double-action hydraulic cylinders in conjunction with a mechanical synchronising shaft. Depending upon requirements, this can take place over the entire length, or divided into 2 or 3 sections.

The load is maintained below by means of mechanical prestressing blocks; additional over-tensioning is necessary above, depending on the dimensions and geometry of the concrete parts.



Various production cross-sections using the universal formwork



Overall view of the 99 m long universal formwork



Operating station with hydraulic and vibrator control



Manufacture of the reinforcement cage

Ostensibly designed for the manufacture of single and double beams up to a maximum height of 2,400 mm, parallel beams or gable roof beams can alternatively be manufactured. The bottom and top chord geometries are implemented in steel; the ribs are adjusted to the respective size by means of Betoplan boards. This also enables the infinite setting of any angle of inclination for the gable roof beams.

Depending on the necessary geometry of the concrete part, other hook-in parts can also be positioned on the base frame formwork. Thus the most diverse cross-sections can be manufactured for the production of girders, beams, bridge beams and the like. The formwork can also be modified by the retrofitting of a central steel grid wall and used as a twin formwork.

The concrete elements are compacted by means of high frequency vibration. A total of 96 Avermann vibrators are fastened to the vibrating guide profiles of the side walls; they are controlled in six sections, each with 16 vibrators. The vibrators are driven by an 18.5 kW frequency converter controller, infinitely adjustable between 20 and 200 Hz. The commands are given by a radio remote control in conjunction with large-sized displays for displaying the set frequency and vibration group.

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*Prestressing technology by the Paul company (relaxation side)*



*Lifting out a gable roof beam*

Several 40-tonne double-girder bridge cranes are installed in order to enable the setting up of the formwork as well as the subsequent lifting out of the finished parts.

### Prestressing equipment

The plant is designed for a prestressing force of 8,000 KN in the main reinforcement and 1,000 KN in the transport reinforcement and has a prestressing torque (force over prestressing line) of 8,000 kNm.

For the absorption of the prestressing force and the prestressing torques, an abutment

type P VI from the Paul company was built, which can absorb a prestressing torque of 3,100 KNm and a prestressing force of 4,000 KN per metre width of the counter bearing. The building material requirements for this abutment amount to approx. 30 cbm of concrete and approx. 2.5 tonnes of structural steel per metre width of the abutment. The prestressing line thickness is 40 cm. It runs without joints between the two abutments.

The production sequence is as described below. The reinforcement cages are woven alongside the formwork, equipped with tensioning strands and subsequently lifted into

the formwork and aligned. The tensioning strands are coupled with single-wire couplings and tensioned after the closure of the formwork.

The single-wire prestressing jack is equipped with the TENSACONTROL measuring system, which logs the prestressing process and saves a tensioning force-elongation log for each tensioning strand. Once the structural elements have set, the tensioning force is transferred to the structural elements by relaxing the appropriate hydraulic cylinders.

The prestressing steel reinforcement is shoved into the reinforcement cage by means of an electric pushing device.

### Conclusions and outlook

After many years of low investment at HV Betonwerk Anhalt, a remarkable new project was implemented last year. The investment into prestressed concrete technology at HV Betonwerk Anhalt meets the growing demands for complex concrete structures for the manufacture of commercial buildings in particular. The ability to supply bar-shaped prestressed concrete parts has significantly expanded the company's market position.

All construction and installation work was completed in November 2010 and was immediately followed by the production of the first beams.

Due to the extreme formwork length of 99 m, 4-5 identical elements can usually be manufactured in parallel in the universal formwork, depending on the dimensions of the concrete parts. This allows even large quantities to be supplied within the shortest time.



*Formwork with hook-in parts for beams*

In addition, the short setup times and low warehousing costs allow the company to keep one step ahead of the competition. Preparations have already been made in the new production buildings for a possible extension of the manufacture of prestressed concrete elements. Thus additional pits for a further 100 m prestressing bed were already provided for in the planning of the buildings. It is also planned to optimise the filling of the universal formwork in the near future by the use of a special concrete distributor.

Mr. Vedder and the entire management of the precast works were delighted with the quality and functionality of the delivered equipment from the outset. The first large orders have already been completed and the formwork will be working at full capacity in the coming months.



FURTHER INFORMATION



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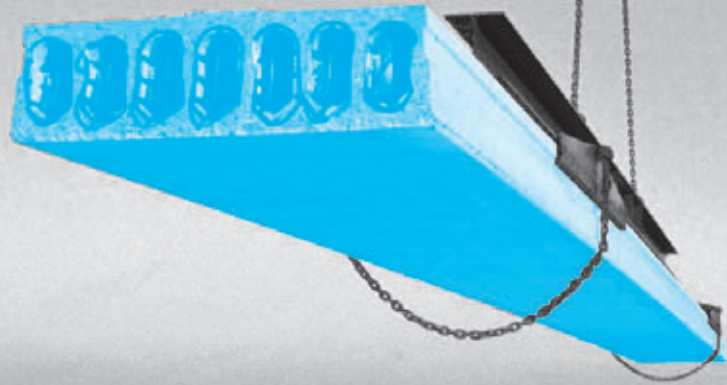


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