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## A new era in concrete pipe manufacture enables durable wastewater piping systems and increased added value at the concrete plant

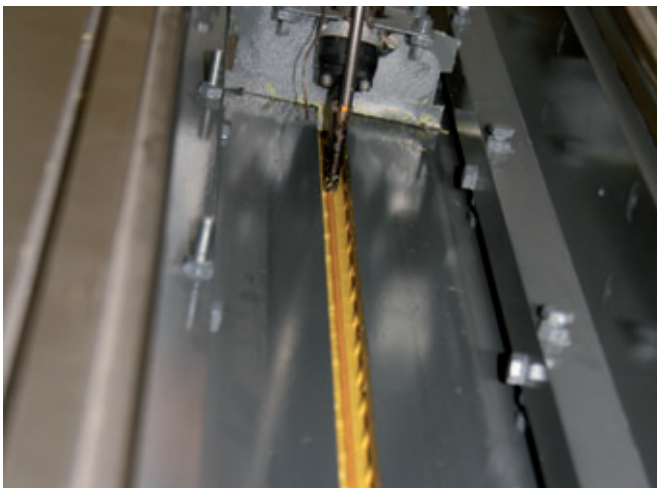
Automatic liner welding equipment, thermoplastic joint moulding, handling robots, moulding technologies which have not been available to mass production to date. These few concepts already illustrate the multitude of innovations – innovations which actually deserve recognition – which can be admired in concrete pipe manufacture, which Beton Müller recently commissioned in Baden-Württemberg. For the Müller concrete plant the foundation stone for the implementation of this completely new technology went back to the presentation of prototypes for a new wastewater piping system within the scope of IFAT 2010. The wastewater treatment piping industry is subject to constant transformation. Individual materials experience true boom phases dependent on the progression of construction practice, changes to normative or statutory basic conditions – and last but not least – the availability of new technologies.

In past decades the concrete piping industry has mostly played a passive role in the market. Alternative products using various non-concrete materials recorded gains in market share time and again – to the detriment of concrete pipe industry. This development which contributed to not only a concentration of concrete pipe suppliers but also meant an increasingly threatening future scenario for the remaining suppliers. In the search to reverse this situation, numerous product innovations were implemented which were generally focussed on very narrow market niches. A new development for concrete pipe manufacture with and without plastic lining is the start of a new era in concrete pipe manufacture and the piping industry. Beton Müller is the first manufacturer to produce concrete pipes from SCC on an industrial scale on a fully automated production plant, Perfect Pipe, at the Brei-

sach-Gündlingen site in the south-west of Baden-Württemberg, Germany.

For approximately one year, Beton Müller observed the new development presented at the two most significant specialist trade fairs for the building trade or waste / sewage industry in 2010 and analysed both the development of technical details and also the basic market conditions in depth. For Beton Müller, as an established manufacturer in manhole component manufacture, entry into pipe production would constitute a strategic step in the company's 125 year history. Different options for securing the long-term future of the family enterprise were analyzed, and it very quickly became clear that it would make no sense for the company to enter the concrete pipe manufacturing market based on conventional manufacturing methods.

If expanding the range with piping products is to be successful, current developments in concrete pipe manufacturing in general and in the overall pipe construction industry in particular, has to be taken into consideration, and these would currently be the manufacture of concrete pipes and the increased application of piping with higher resistance to chemical attacks. The concept for a new concrete-plastic composite pipe Perfect Pipe+ first presented in 2010 by Schlüsselbauer, an Austrian supplier of automated manufacturing plants for pipe and manhole components was immediately recognised as a promising option for the further strategic planning of company development. However, to complement the presented pipes with a plastic internal lining, the new type of pipe should also be manufactured as an optimised pure concrete pipe. A requirement which was in per-



By the automatic welding of the liner, impermeable liners are manufactured for further processing in Perfect Pipe manufacture.



The liner ends are shaped according to the design of the pipe joint in a thermoplastic reshaping process.



The shapes designed for horizontal manufacture are available with or without a liner for the concrete encasing process which is also automated.

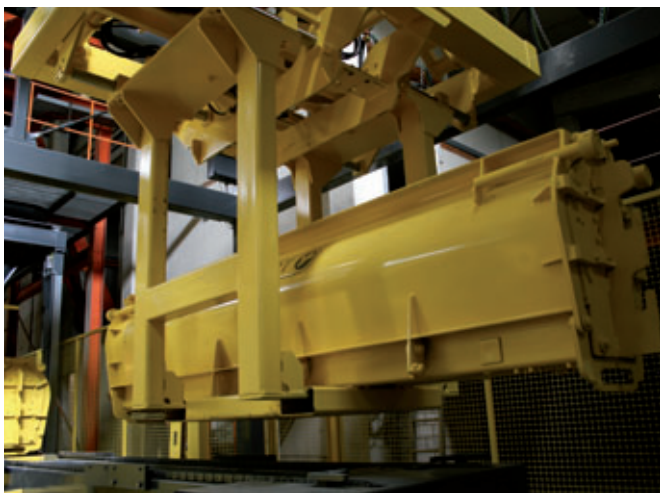


The concrete encasing station is continually supplied with SCC from the mixing plant via a transfer hopper.

fect harmony with the focus in Schlüsselbauer's current development activity. The nominal width range DN300 to DN600 represents the highest substitution for concrete products. This trend should be actively counteracted with a new concrete pipe. The benefits of the rigid material should once again become the focus of pipe planning due to the selected pipe geometry and the use of different need-based concrete mixtures. The new quality of pipes cast from self-compacting concrete and the advantages of the simple installation of the pipe together with the acknowledged advantages of concrete should increasingly be promoted for the construction of durable pipeline systems. Beton Müller places its trust in its great in-house concrete competence with both variants of the new pipe – with and without lining. The standard version of the Perfect Pipe con-

crete pipe is manufactured from C40/50 self-compacting concrete. With increased demands on the resistance of the concrete pipe C60/75 high-performance concrete is selected, using HS cement with increased sulphate resistance up to 3000 mg/l. The concrete formula optimised at Beton Müller leads to proven increased resistance to chemical attacks. In both cases the concrete pipes harden in the mould. Dependent on project-specific requirements the pipes can be executed with steel reinforcements. Where peak or permanent stresses due to chemical attack are anticipated which would exceed the reliable resistance of concrete, the new type of pipe is furnished with a polyethylene inliner which is firmly anchored in the concrete. This execution called Perfect Pipe+ can durably withstand an acid attack from pH 1 to pH 14.

In order to precisely define the pipe geometry the engineers involved determine those wall thickness models which would facilitate ideal load bearing for the new pipe by means of multi-stage Finite Element calculations. In addition to the bearing of heavy loads and the dissipation of the same via the lateral wall in the doubly shaped pipe base, the middle notch in the base should also facilitate installation in the trench. Laying of the pipe on the flat surface eliminates point loads acting on the pipe beds and at the same time the accuracy of the pipeline is increased. The individual pipes can be simply connected to those already situated in the trench. The moulding of the pipe joints which is identical on both sides and the use of connectors enable pipes without a specified direction of installation. The safe handling of the pipes from transportation from the concrete plant via stor-



A robot accepts the filled mould and deposits it in the curing area provided or a mould with pre-hardened product is accepted and placed in the plant for automatic demoulding.



An additional robot accepts the product after automatic opening of the moulds.





*The internal steel core still located in the pipe – which is equipped with a shrinking mechanism which is also newly developed – is now automatically ejected.*



*The demoulded products are placed in groups on the outfeed belt according to the nominal width after an in-line vacuum test and conveyed out of the hall for storage or delivery.*

age by the builder's merchant or on the construction site to installation is assisted by spherical head anchors which are firmly moulded into the pipe. Overall, optimum qualities for installation, maintenance and long-term operation must be attested to the selected pipe geometry.

A multitude of challenges were faced for the production of the pipes to achieve the desired beneficial qualities for civil engineering practice. A fundamental pre-requisite for the production of the pipe with an internal PE liner at the lowest wall thickness was made possible with the reliable anchoring of the lining in the concrete. The optimisation of the anchor geometry and a multiplication of the number of

anchors compared to conventional linings were necessary in order to fulfil the project specifications. For the manufacturing process this meant the development of new procedures for liner processing such as automatic welders or equipment for the automatic thermoplastic moulding of the Perfect liner in order to execute the pipe joint in the necessary geometry. In addition to liner processing, a further requirement was the moulding of the outer contour of the base pipe. A departure from the moulding technique which was customary to date for the serial production of concrete pipes was inevitable. In contrast to conventional pipe manufacture with a mould integrated into the production machinery moulds are now used which correspond to the intended production volume. In turn, in contrast to existing pipe manufacturing companies which partially or wholly operate casting manufacture even today, the new manufacturing process should be automated to a great extent, thus elevating productivity to a completely new level by horizontal manufacture and the automated handling of novel shapes and products. All in all, the multitude of new developments means for both Beton Müller and the system partner Schlüsselbauer that the test phase will be a joint experience for numerous prototypes implemented in the plant.



*The base pipe geometry facilitates construction site use and accuracy of the pipeline. The flat bottom surface also facilitates handling for storage and transport.*



*The first tests for productivity, quality, and performance exceeded the expectations of all involved.*



In the introductory phase, Beton Müller is working with approximately 50 moulds with which pipes can optionally be manufactured in a completely automated process with or without an inliner and with cage reinforcement in the standard construction length of 3 m in the nominal widths DN250 to DN600. In addition to the standard construction length products short pipes and adaptor pipes are also encased in concrete at the same plant. The entire concrete pipe manufacturing process can be operated by two employees responsible for overseeing production, including the mixing plant, and for the preparation of the moulds and, if necessary, the Perfect inliner. After completely equipping the plant with the moulds necessary for the individual nominal widths, the two workers can increase plant productivity to triple or quadruple output per shift – dependent on nominal width distribution and pipe type.

The headquarters of the B. Müller GmbH concrete plant established in 1887 is located close to Baden-Baden. Within a few months in 2008 the company, which until then had been active at the original site, relocated to a completely newly developed industrial construction area in Achern. Beton Müller has been operating Perfect manhole manufacture at this site since the relocation. The manufacturer is known and valued for supplying first class quality custom-made manhole constructions, often with the realisation of project-specific details. At Beton Müller's second current site approximately 100 km to the south of Achern in Breisach-Gündlingen concrete pipe manufacturing also took place in the past which has not been continued by Beton Müller. Standard manhole components have mainly been manufactured here in the last few years. With the commissioning of Perfect Pipe manufacture it is not only the significance of this second company site which is increasing. The geographically favourable location adjacent to the neighbouring country of France and close to Switzerland may also have an extremely positive impact on the significance of this site in future due to the new production programme.

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