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The German Institute of Structural Engineering (DIBT) awards approval of a new lining for wastewater pipe. Test results show “reliable corrosion protection in composite concrete-plastic pipe on the test bench.”

Several renown German test institutes have recently been involved in testing individual components of Schlüsselbauer Technology’s new Perfect Pipe system and the system as a whole. The ultimate goal of the institutes was to test whether or not Perfect Pipe, an innovative composite concrete-plastic pipe, is suitable for the wastewater industry. Even during the early stages of product development, tests were done to optimize the production system, and the results of these tests were used, in part, as a basis for approval by the German Institute of Structural Engineering. Throughout the testing stages, both the chemical and physical suitability of Schlüsselbauer’s Perfect Pipe needed to be proven in all relevant aspects, since the pipe and its connection to the HDPE liner had not previously been granted approval. And since the strong and permanent connection of the two materials is what ultimately constitutes the essential characteristics of Perfect Pipe, in addition to its durable corrosion resistance and high static load capacity, the connection of the liner to the concrete pipe was deemed especially worthy of observation and testing.

What force must be exerted to accomplish the removal of the liner’s anchors from the concrete? This question was addressed in two ways. The adhesive tensile strength was tested by pull-out tests on individual anchors and on groups of anchors. The required minimum pull-out strength, based on the German Committee for Reinforced Concrete (DAFStb) repair guidelines, is 0.05 N/mm^2 . With a measured 0.5 N/mm^2 , the pull-out strength of the Perfect liner was 10 times greater than the required minimum. Furthermore, in contrast

to loosening the anchor by pulling it out internally, the effects that groundwater pressure would have on the exterior of the liner was also investigated. Following the approval criteria of DIBT, the specimens were subjected to external water pressure tests where they were pressurized with 1.5 bar over a period of 1,000 hours. The pressure was then raised to 2.5 bar for one hour. The end result was that all specimens passed the test in a sealed and watertight manner and without any visually detectable changes.

Perfect Pipe meets standard pipe requirements for water drainage areas

In addition to other numerous positive watertight tests for the pipe liner, its components and connectors with stretched KLP seals, a separate test was conducted to prove the suitability of the pipe for use in water drainage areas. The pipe specimens were pressurized with a test pressure of 2.5 bar in a string of tests in accordance with DIN V 1201. The German PÜZ testing centre, which executed the tests, was clearly able to



The new Perfect Pipe wastewater pipe combines the advantages of corrosion-resistant HDPE with the static load of flexurally rigid concrete.



The HDPE liner is manufactured into cylinders and shows a wide range of anchors on the outside – for firm anchoring in concrete.

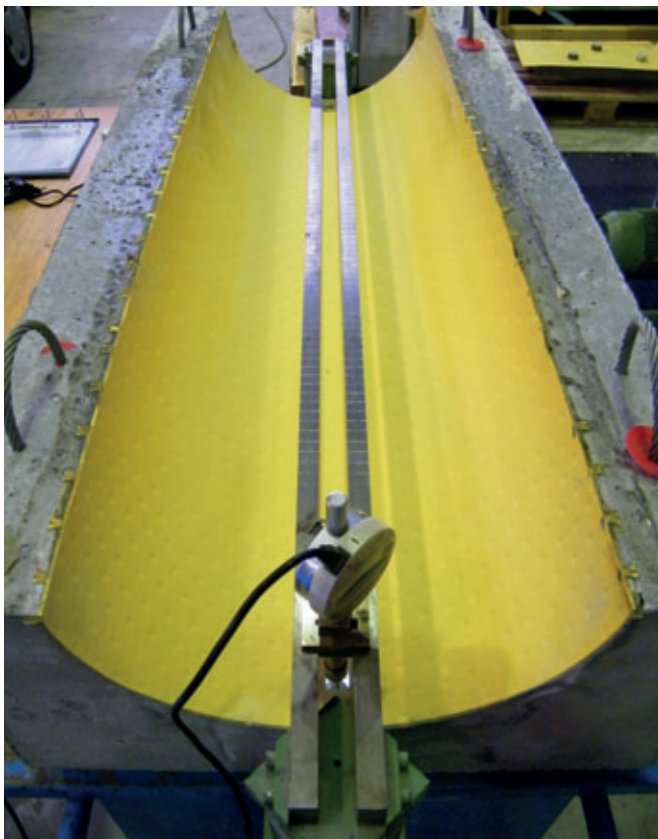


The liner material was successfully subjected to numerous tests during the development and structural approval.

prove and confirm that Perfect Pipe meets, without limitation, standard pipe requirements for water drainage areas.

Perfect Pipe is abrasion-resistant and easy to maintain

In addition to the aforementioned liner anchoring tests, the new HDPE liner was also subjected to an abrasion resistance test by IKT Gelsenkirchen. Since there is no generically accepted or scientifically deduced reference of absolute or relative abrasion of pipe materials over its life cycle, it was appropriate to compare empirically ascertained abrasion values and standard requirements in this area. DIN EN 598 shows maximum permissible abrasion of 0.6



The high abrasion resistance of the HDPE surface was proven using the Darmstadt tipping trough test.

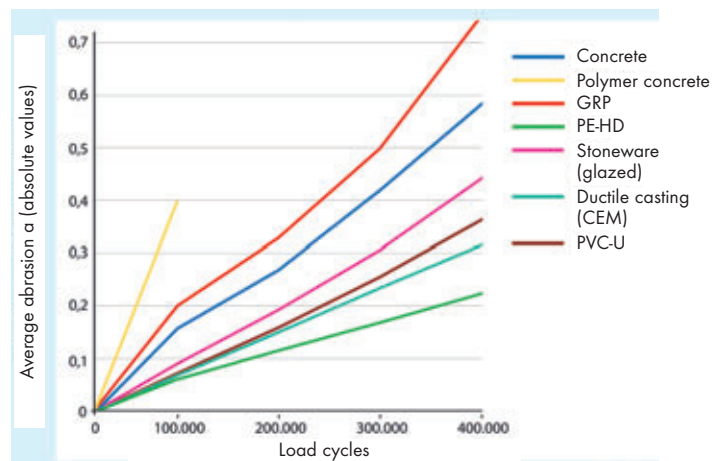
mm at 100,000 cycles for cement mortar linings of ductile cast iron pipe. For epoxy resin or PU linings, the maximum permissible abrasion is 0.2 mm with the same number of load cycles. In turn, DIN EN 295-3 cites values of 0.2 to 0.5 mm at 100,000 load cycles for values characterizing the average abrasion of clay pipe. With this in mind and in accordance with DIN EN 295-3, Schlüsselbauer’s concrete-plastic composite pipe was then tested for abrasion resistance under the same test parameters. The difference, however, was that 200,000 load cycles were performed and then the bed line abrasion was measured. The result was that an average abrasion of 0.22 mm was measured in the Perfect HDPE lining specimen. Despite twice the number of abrasion cycles, the ideal value in accordance with DIN EN 295-3 was achieved. Taking into account the higher number of cycles, the requirements of DIN EN 598 for non-concrete linings were more than fulfilled. The accuracy of the dial gauge used was +/- 0.03 mm.

The Darmstadt-based tipping trough test procedure used on Perfect Pipe is also used for other pipe materials. Glass fiber-reinforced plastic pipe, for example, is tested in the same way in accordance with DIN 19565-1. And although the PP (DIN EN 1852-1) and PVC (DIN EN 1401) pipe materials are considered abrasion-resistant in accordance with the standards, under certain conditions the actual abrasion resistance can be detected using the same test setup. In the “Abrasion Resistance Guideline,” published by the specialist association Betonrohre und Stahlbetonrohre e.V. (FBS), absolute and relative abrasion values related to the pipe wall thickness are outlined, in addition to the characteristic values for concrete. Conclusion: the HDPE liner stands out as the material with the lowest absolute abrasion depth. The solid and permanent connection of the HDPE lining to concrete makes Perfect Pipe a pipe system with a forecasted lifespan exceeding 100 years without change to its static properties.

Other essential qualities for the long-term operation of wastewater systems include the ease of cleaning and its ability to withstand high-pressure cleaning. This was also clearly demonstrated in practice by IKT Gelsenkirchen in tests.

Perfect Pipe creates added-value at the concrete plant

For a sewer system owner and operator with a long-term vision, Perfect Pipe is a sound investment due to its anticipated product lifespan, as evidenced by the almost invariable, high static load capaci-



On the FBS abrasion resistance guide, HDPE is certified as the lowest absolute abrasion material (Source: Fachvereinigung Betonrohre und Stahlbetonrohre e.V.)



Perfect Pipe concrete-HDPE composite pipe have been manufactured on an industrial scale since 2013.



In addition to the chemical and structural suitability, the new pipe system is also characterized by its simple and safe installation and correspondingly high installation performances.

ty of the concrete pipe and its durable corrosion resistant HDPE liner. For a manufacturer of Perfect Pipe, on the other hand, this innovative wastewater pipe also provides added-value to one's own plant because Perfect Pipe permits a manufacturer to serve a market which would not otherwise be supplied by a conventional concrete pipe without a lining. Perfect Pipe, therefore, does not threaten to supersede traditional concrete pipe. Rather, manufacturers of concrete products can use Perfect Pipe to penetrate



The wet-cast pipe made of self compacting concrete is subjected to a leak test in fully automated production before final approval.

market segments where non-concrete materials have been used by the majority. Both for the trench construction and also for pipe jacking, future, worldwide use of Perfect Pipe concrete-plastic composite pipes is already on the agenda. From a manufacturer to the user, all of those involved in viewing the lifespan of sewerage systems can benefit from the use of high-quality wastewater pipe systems. ■

FURTHER INFORMATION

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