

Large Components Custom-Built in One Week

Additive Manufacturing Process Revolutionizes Process Chain in Civil Engineering

Rehau is currently developing an additive manufacturing process that can turn out large polymer manholes in single-unit batches as if they were rolling off a production line. The process enables builders to place an order for a customized manhole specific to their construction project and to take delivery of it a week later. This remarkable development decisively shortens construction times and renders work processes more efficient.



Kevin Winter (left) and Jonas Wilfert from Rehau in their 3D printing production environment. Components can have a maximum diameter of 1.2 m and height of 85 cm © Rehau

Planners and contractors often come across unusual manhole geometries in the subsoil during renovations. Often very old, the manholes pose challenges for civil engineers: pipe connections made at different heights, of different sizes and characterized by angulations and different connection gradients. Before now, such manholes had to be reconstructed by hand off detailed production drawings. This entails a huge outlay, a great deal of manual labor and long delivery times. Unfortunately, construction jobs often have to be completed speedily, especially in inner-city sites, and with as little disruption as possible for traffic and residents. So, every day saved by the customer matters.

All construction sites are different, which is why sewer manholes cannot always be planned and executed smoothly. And if the sewer also happens to be complex and changes are made at short notice during the construction phase, particularly flexible and speedy solutions are called for. The need to rapidly deliver high-precision, one-off designs inspired Rehau to devise a new manufacturing process that the potential afforded by a combination of 3D laser scanners, automated CAD (computer-aided design) and additive manufacturing as well as post-processing methods (Fig. 1).

The first process step consists in producing a 3D-printed semi-finished article from automatically generated CAD data by means of fused granular fabrication (FGF). This involves an ex- ➤

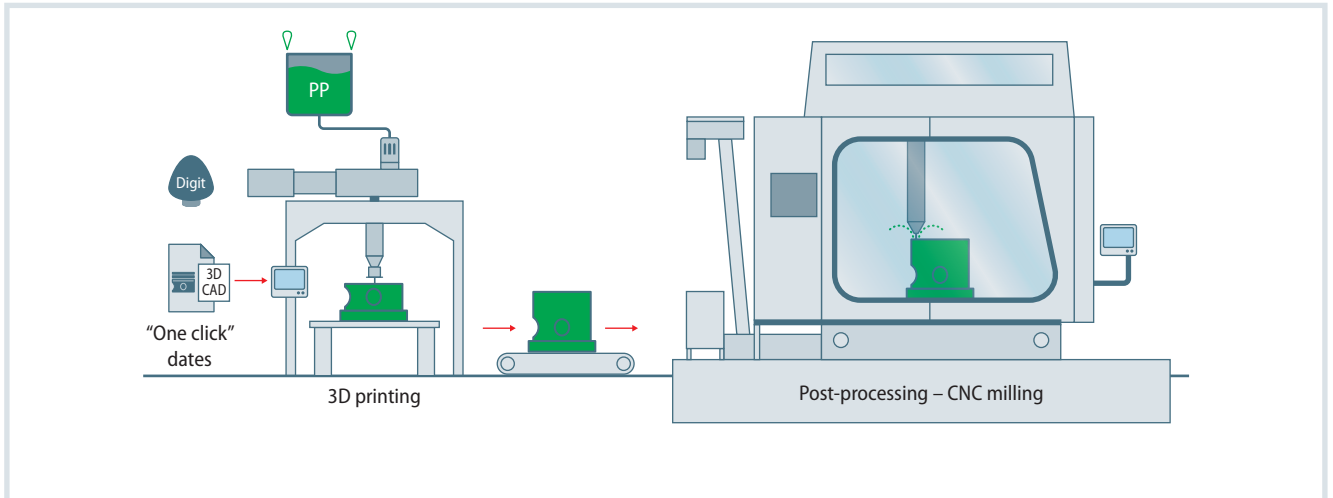


Fig. 1. Schematic representation of the production process – from digital component measurement by laser scanners to 3D printing and post-processing Source: Rehau; graphic: © Hanser

truder being moved by a linear system that tracks the component contour, building up the component layer by layer without the need for tools. Once printing is complete, the semi-finished article is reworked in a subtractive finishing process to yield the finished part. Rehau has thereby created a smart, end-to-end process chain for its customers, spanning measurement and planning of the manhole through to 3D printing and delivery to the construction site.

The Process – from Measurement to Delivery

Conventional measuring methods are not particularly accurate when it comes

to mapping out complex manhole geometries, which is why Rehau uses scanning lasers – they are capable of capturing the 3D data with the required accuracy. Customers either measure the manholes themselves or commission a specialist engineering firm to do so. Rehau can also provide support with its in-house laser scanners and measuring teams on request. The 3D scanners return a point cloud from which all the requisite dimensions can be obtained. Rehau has developed an online app that allows customers to configure their specific manholes down to the last detail and with total freedom over planning aspects. Rehau then creates a digital twin for this one-off manhole (Fig. 2).

As soon as a customer gives the go-ahead, Rehau launches the “smart production” process. The company currently has the capability to produce components with a maximum diameter of 1.2 m and a maximum height of 85 cm. The big plus for customers: Rehau’s polymer manholes are obtainable in single-unit batch sizes and are a regulated construction product, meeting all the requirements imposed on leak tightness and durability specified in ISO 13598–1.

Easy Handling

Smart also means fast: a large one-off manhole can be produced in just one week (Fig. 3). It is delivered to the con-

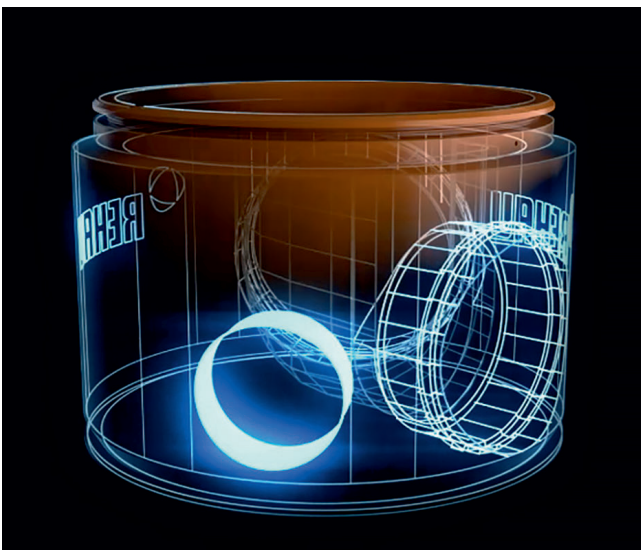


Fig. 2. 3D scanning yields a point cloud from which all required dimensions and a digital twin can be obtained © Rehau

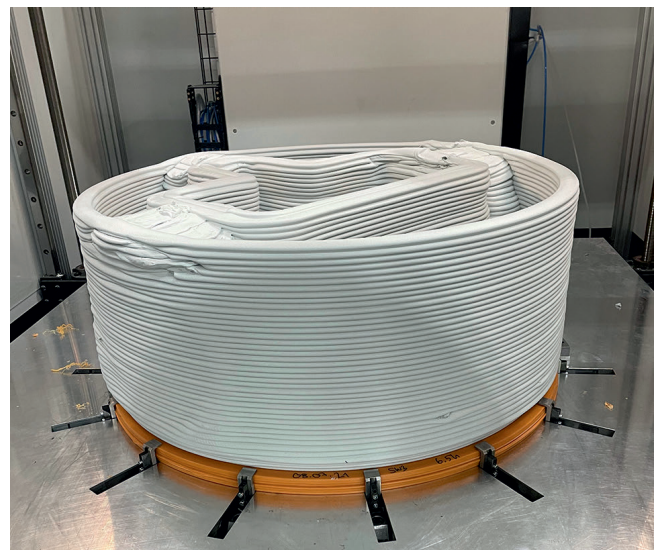


Fig. 3. 3D-printed semi-finished article in production. A large one-off manhole can be produced in just a week © Rehau



Fig. 4. Perfectly tailored to the installation environment, polymer manholes also outscore their stoneware and concrete counterparts by virtue of their lower weight © Rehau

struction site with the seals inserted and pipe connections fitted and, on request, with matching accessories, such as manhole covers. And it can be connected to all common materials.

The dimensions of the one-off design are exactly the same as those of a conventional polymer manhole and installation is equally as fast and easy. Here, too, the builder benefits from industrial-grade quality and precision. Added to which, the large polymer manholes outscore stoneware and concrete solutions by virtue of their much lower weight. This makes installation on the construction site much easier (Fig. 4) and simplifies site logistics. Not only is this advantageous for scheduling production and instal-

lation, it is also crucial for inner-city construction sites.

Pioneer in Additive Manufacturing

Rehau is a world leader in the additive manufacturing of large polymer components like those mentioned above. When setting up its production, the polymer specialist drew on existing system technologies, but adapted and further developed them to meet its needs. The area deriving the most benefit from Rehau's extensive materials experience and polymers processing expertise is production.

New material compositions had to be developed and extrusion technology and post-processing adapted before it be-

came possible for workpieces of this size to be produced economically and sustainably in this quality and with such speed. The economics and sustainability primarily stem from the additive manufacturing process: using a combination of lightweight structures and near-net-shape, tool-less, additive manufacturing makes for low material consumption and post-processing outlay.

Digital Potential in Civil Engineering

Rehau's smart solution shows the amount of potential which polymers offer in digital planning and execution processes. This is an area where they can exploit their advantages over conventional materials, such as vitrified clay and concrete. That manholes made from polymer are corrosion-resistant and durable is already a given. ■

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