Large-scale 3D printed bridge heralds new era in sustainable construction

Collaboration between Royal HaskoningDHV, CEAD and DSM has delivered the first lightweight 3D printed pedestrian bridge prototype using a glass-filled thermoplastic composite material. This collaboration demonstrates how large-scale additive manufacturing paves the way for fast, efficient, cost-effective and sustainable construction solutions.

Customer

Royal HaskoningDHV, CEAD and DSM

Challenges

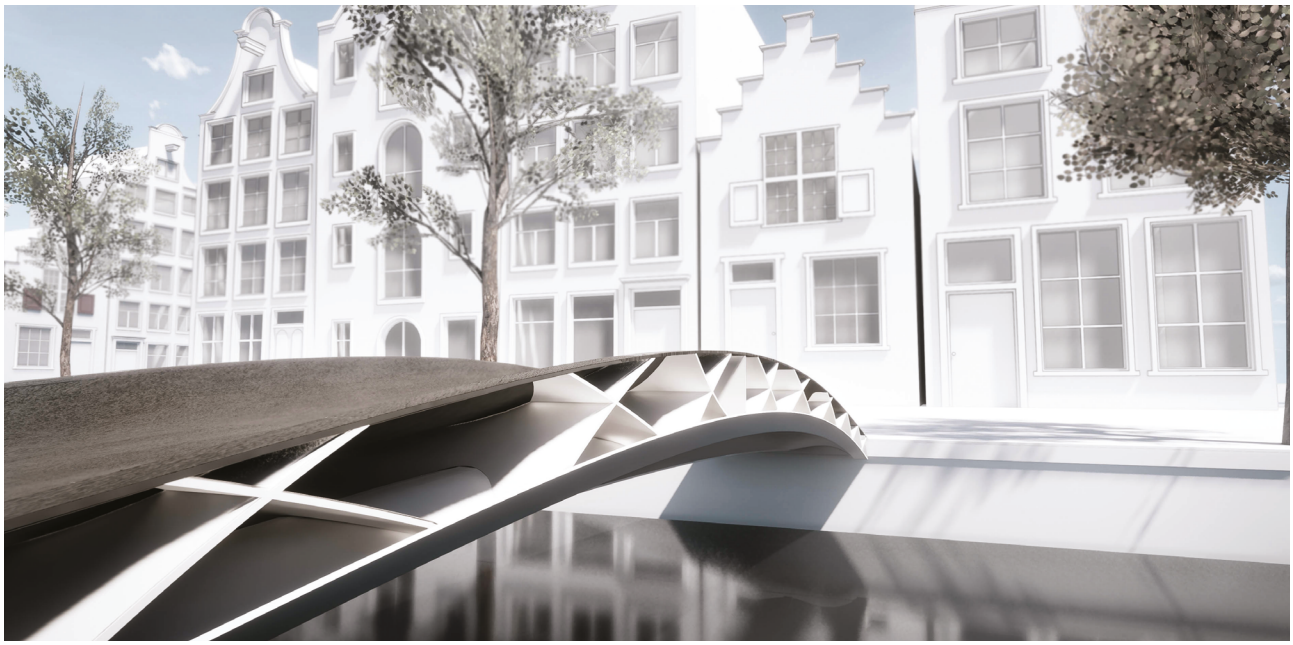
- Reduce environmental impact of traditional construction materials and processes
- Drive for fast, low-cost, efficient construction techniques

Solution

- Structural engineering and 3D printing partnership
- Arnite® AM8527 (G) fused granulate fabrication (FGF) material

Benefits

- Reduces construction time by weeks
- Increases sustainability, cuts carbon footprint
- Reduces maintenance burden and increases lifespan
- Delivers a fast, simple construction solution ideal for multiple applications



“The partnership between us, CEAD and DSM is bringing about a paradigm shift in the way we think about the form and function of bridges in our society. Fiber-reinforced polymer bridges are already well known for having a longer lifetime expectancy with lower life cycle costs compared to steel bridges. What’s new here is the use of a new 3D printing technology, enabling us to print large-scale fiber reinforced thermoplastic parts.”

Maurice Kardas, Business Development Manager, Royal HaskoningDHV

Challenges

As in many industries, construction and structural engineering are under pressure to cut costs, improve efficiency and reduce carbon footprint. These industries are constantly looking for new and innovative materials and processes to improve construction and make it more sustainable.

This prompted three companies to pool their knowledge and lead a revolution in bridge construction and design.

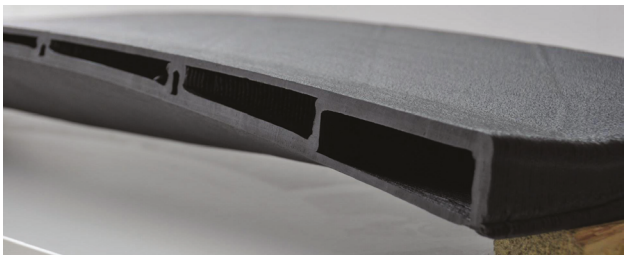
Solution

To build a 3D printed bridge Royal HaskoningDHV, an international engineering and project management consultancy, partnered with DSM and CEAD, supplier of market-leading, large-scale 3D printing equipment for composite additive manufacturing.

The result is a prototype bridge that is four meters long and 60cm wide. Designed by Royal HaskoningDHV, the bridge was printed on the AM Flexbot, a modular robot-based solution for composite 3D printing from CEAD (time lapse video).

Maarten Logtenberg, CEO of CEAD says, “3D printing has evolved dramatically over the years. This 3D printed bridge prototype demonstrates the huge strides that we are making which will transform the future of this industry, not only speeding up construction, but also making the process more cost and time efficient.”

DSM’s Arnite® AM8527 (G) is a fused granulate fabrication material that was used to make the bridge. This produces a very strong, versatile and sustainable material. The bridge has been modeled parametrically which enables optimization of bridge design and internal web structure. Finite element analysis software combines material characteristics with advanced 3D print technology for more efficient bridge design and build. Applications for this type of bridge construction include permanent structures like cycle bridges or bridge deck replacements, as well as temporary structures for events, construction sites, marine and disaster situations.



“Using a material such as Arnite® AM8527 (G) has huge benefits for the construction of bridges. Rather than using traditional materials such as steel or concrete, these bridges can be much more sustainable and offer greater flexibility in design using recyclable materials,” says Patrick Duis, Segment Leader at DSM.

Benefits

The bridge is one of the first of its kind in the world and it paves the way for more sustainable, cost-effective, efficient and fast construction processes. Because the bridge is printable it only uses the right amount of material where it is needed. This reduces the need for stock, cuts transport costs and minimizes environmental impact. It also speeds up construction time by weeks. The bridge is an example of circular manufacturing. The bridge material is non-corrosive and recyclable so that at end of life it can be used to make a new bridge. In addition, everyday materials like household PET packaging can be recycled and used in this kind of bridge construction.

Royal HaskoningDHV is currently developing sensors within the bridge design used to build a digital twin in order to evaluate safety and maintenance. The sensors also monitor wear and tear and impact due to weather to predict and optimize ongoing maintenance, ensure safety for users and extend the bridge’s lifespan.

Royal HaskoningDHV, CEAD and DSM are transforming bridge construction for the future. Together, these companies are fueling innovation and creating more sustainable solutions.

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