

World's first 3D-printed steel bridge unveiled at Dutch Design Week

Gunseli Yalcinkaya | 22 October 2018

Dutch robotics company MX3D has completed the 3D printing of a steel bridge, which will be installed across a canal in Amsterdam next year.

Designer Joris Laarman worked with the robotic manufacturing technology start-up to build the 12-metre-long pedestrian bridge, which is being previewed at Dutch Design Week between 20 and 28 October.



Yalcinkay, Gunseli. "World's first 3D-printed steel bridge unveiled at Dutch Design Week," *Dezeen*, October 22, 2018.

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First proposed in 2015, the structure has been constructed by robots from layers of molten steel. Its span was completed earlier this year. Now its deck has been built, marking the final stage in the construction process.

World's first 3D-printed steel bridge completed

Six-axis robots built the six-metre-wide structure from layers of molten steel, which involved programming robotic arms to control large-scale welding machines.

The ambitious project has gone through several iterations in its development to strengthen the structure against potential boats collisions and to adhere to the local council's regulations.

"The initial design changed significantly due to the engineering concerns," said MX3D. "The lightweight tree-like structure is built on four main bearers. The concern was that if one of these bearers gets hit by a boat, the structure could critically fail."



"Therefore a totally new concept was created that took into account everything we learned until then about the material, the local specifications and regulations," explained the company.

World's first 3D-printed steel bridge completed

MX3D originally meant for the robots to print the bridge on site, beginning with the four structural bearings and working inwards, but the plan had to be abandoned because of budget restraints and as it was "just too dangerous".

"We have set a vision in which robots would be able to autonomously 3D print infrastructural interventions in our built environment," said a spokesperson.

"Over the last three years, we have been able to create the technology required for this plan but we did not get permission to do it by the city government."

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"Our timeline and budget also made it hard to realise this vision so we focused primarily on 3D-printing a fully functional pedestrian bridge, including a sensor network," they continued.

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The project, which is described as the world's first 3D-printed bridge, is expected to be installed on the Oudezijds Achterburgwal in Amsterdam's red light district once the renovation of the canal is complete, "no later than mid-2019".

"We hope it will be installed in summer. We just started the permit process as we have now all the positive results from the tests," said MX3D.

"The city just started the renovations work on the canal wall we have been waiting for two years. This work could be done in six months."

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To add to its high-tech design, mathematicians from The Alan Turing Institute and engineers at Arup worked with MX3D to create a smart sensor network on the bridge.



The sensors are designed to record the bridge's performance, collecting data such as strain, rotation, load, displacement and vibration.

The data will be used to show how many many people are crossing the bridge and at what speed, structural integrity and the surrounding environment.

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"This data will also allow us to teach the bridge, to understand what is happening on it, how many people are crossing it and how quickly," said MX3D.

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This information will also be input into a "digital twin" of the bridge – a computer model that responds to the data as it is collected in real time. Performance and safety will be assessed between the two and the information will be fed back to inform future 3D-printed metal bridge designs.

"The work on this 3D printed bridge will contribute to the future of safe, efficient and data-driven engineering by monitoring the structure as thousands of people and bicycles traverse the bridge hourly once in place," explained MX3D.

Dutch Design Week is taking place in Eindhoven. Also in the city Eindhoven University of Technology is planning to 3D print a series of concrete houses that will be made available to rent.

The "world's first 3D-printed concrete bridge" was also built in the Netherlands last year, and completed last year.

Photography is by Adriaan de Groot.

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