Structural bridge design for additive manufacturing

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As a design engineer, Bart-Jan focusses on the integration of aesthetics and structural feasibility through logic parametric thinking.

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As civil engineer Maurice has spent most of his career as international project manager with a focus on bridges and innovations.

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Joël is a young enthusiastic structural engineer with interest in bridge design, programming and innovations in the AEC industry.

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As senior structural engineering in concrete and FRP bridges. The focus of Kees is now on Digital Engineering and DFMA.

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Over 20 years experience in designing FRP footbridges and vehicular bridges. Member of CEN-TC250 WG4 working towards FRP Eurocode

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1   Abstract

Companies in the architecture, engineering and construction (AEC) industry are constantly innovating on digital engineering. Digital engineering is the collective name for engineering activities that comprise automation, generative design, parametric design, automated manufacturing and artificial intelligence through machine learning. This research investigates the possibilities of generative design and additive manufacturing as a method to automate the design, engineering and construction process for bridges. Generative design will become an important aspect of future structural engineering of bridges. Automated optimization routines will find ideal structures for a specific case. Generative design finds these solutions within the possibilities and limitations of existing production techniques. With the introduction of additive manufacturing technology, a large range of possibilities become available to the engineer, resulting in innovative structural concepts for bridges. Untill recently, generative design and automated manufacturing have mostly been used in machine factory industry for small components. This paper elaborates on the challenges that come with automated design and manufacturing of bridges. The generative design and engineering challenges are about today's available software and how they deal with bridge design. The manufacturing challenges are about material properties suitable for additive manufacturing and the possibilities and restrictions of large 3D printers.

Keywords: Generative, Automated, Parametric, Manufacturing, 3Dprinting, Production, FRP, Concrete, Design, CFAM, Bridges