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Architecture through the looking glass: Augmenting Fabrication in the built environment

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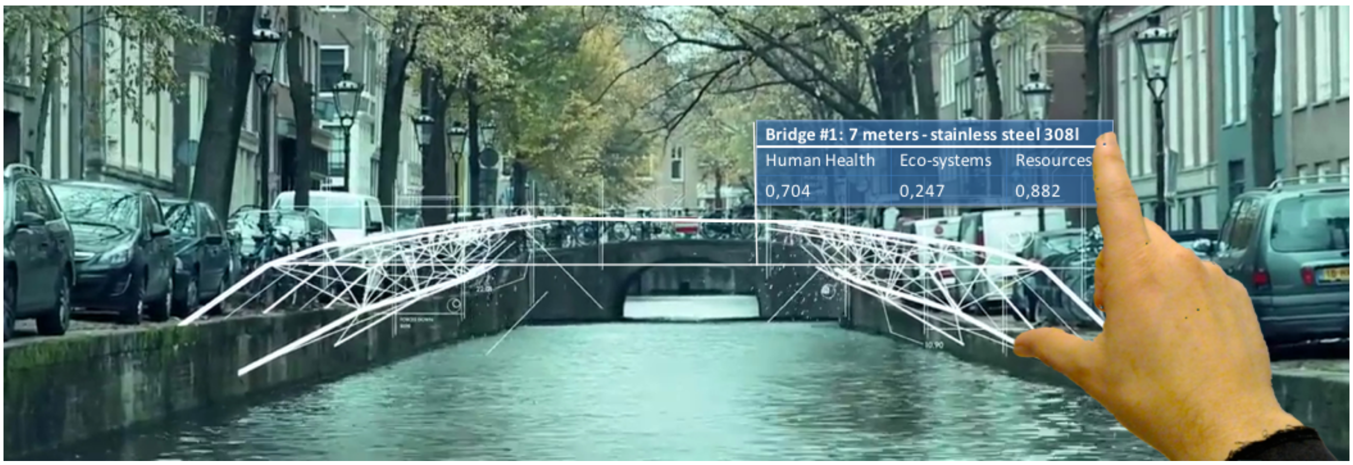

Figure 1: Impression of augmented fabrication of a WAAM bridge.

CCS CONCEPTS

• **Human-centered computing** → **Mixed / augmented reality**;
• **Computing methodologies** → *Simulation tools*;

KEYWORDS

Augmented reality, design support, additive manufacturing

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1 AUGMENTING FABRICATION: CO-LOCATING DESIGN IN THE BUILT ENVIRONMENT WITH AR

To make most out of manufacturing of the future, we need to engage stakeholders though technologies that blend the digital and physical. Through so-called Augmented Fabrication, computational precision and digital manufacturing are combined with user skills/intuition. One of such approaches is the use of co-located design in the built environment: through wearable AR systems such as the Microsoft Hololens, multiple stakeholders can conceive and consider several interventions to improve functions of a city.

The benefit of an embodied interaction with computational support is essential here: the 3D scanned situation presents a canvas for superimposing designs and key performance indicators, and allows tangible and social interaction.

We are currently prototyping such an environment for 3D printing bridges in the city.

2 WIRE AND ARC ADDITIVE MANUFACTURING

Larger-scale production has been considered since the past decade [Buswell et al. 2008], in particular for concrete and plastics. Wire and Arc Additive Manufacturing (WAAM) is a technique in which a shape is fabricated by welding layer upon layer with a robotic arm, until a desired three-dimensional shape has been formed [Dong et al. 2015]. This technique yields potential in decreasing material consumption due to its high material efficiency and freedom of shape. We investigated how environmental effects could be assessed for additive manufacturing technologies for the production of large-scale products by means of a Life Cycle Assessment, resulted in a comparison with other 3D printing techniques with metals cf. Table 1 [Bekker et al. 2016].

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Table 1: Power and cost estimation per kilogram printed metal.

	power (Kwh)	Cost
WAAM	5,2	$98
EBM	38,4	$524
DMLS	62,9	$772

These and other data can be used to interactively display a score-card while a catalogue of parameterized designs could be instantiated, based on the 3D scanned environment.

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