The Benefits and Practical Implementation of Parametric Design

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Summary

The tools used by engineers and architects to design, collaborate on and construct bridges have been evolving rapidly in recent times. The change from 2D to 3D design platforms has allowed for greater exploration of detail as well as increased complexity of design. Today, a further evolution of those tools is occurring – the move towards ‘parametric’ design.

This paper looks the three bridges of ‘Campusbrücke’, in Opladen, Germany, ‘Ruckholt Road’ and ‘Bridge One’, in Stratford, London. It focuses on the way in which three bridges were designed, the benefits of their various design strategies, and how the use of parametrics allowed the teams to respond well to their varying constraints.

Keywords: Parametric, Bridge, BIM, Grasshopper, Railway, Footbridge, CAD,

1. Introduction

The three bridges all have a lot in common – they are all pedestrian bridges over railways, built in weathering steel, with a similar ‘design language’. They all have had to respond to tight, unyielding and occasionally onerous constraints on design, led by the security and safety requirements of the rail authorities beneath. Whilst initially the bridges may appear to be similar, the commonalities in their completed appearance contrast to differences in how they were actually designed. The projects had very different timeframes, procurement routes, budgets and goals. As such, these three projects were designed using very different methods, ranging from traditional two-dimensional CAD through to innovative parametric systems.

Whereas 2D or 3D CAD is a derivation of traditional draftsmanship, 'Parametric design' is based on rules or ‘parameters’. It is a term which is being used ever more frequently, to describe the idea of flexible models based on spreadsheets and mathematical functions which allow the rapid optimisation of a digital model. This allows the design to be developed much more freely, responding and adapting to changes efficiently, and permitting seamless integration between architect engineer and fabricator. During the latter stages of design valuable optimisations can be more easily incorporated, and the design intent can be more accurately conveyed.

However, the increasing complexity of structures in the built environment, alongside the growing number of specialists working on the same project slowly pushes the traditional design-route to its limits. The computing power of today's hardware and software packages permits revolutionary design possibilities which dramatically deviate from the traditional orthogonal grid. As the complexity of these CAD designs increases, so too does the challenge of translating them into built structures. Parametrics can be viewed as both a cause of, and solution to this problem.

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