

Design and production automation for the A16 tunnel in Rotterdam

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1 Abstract

Within joint venture *De Groene Boog*, BESIX will design and construct a 2.2 km long tunnel in the North of Rotterdam for a new highway connection. Its design process entails the structural design of many similar tunnel sections and thousands of foundation and sheet piles, as well as the production of a detailed 3D Building Information Model and numerous technical drawings. To effectively perform these tasks and efficiently cope with design changes, an automation strategy has been developed that benefits from the tunnel's repetitive geometry. The digital models are set up parametrically, while software innovations allow to dynamically transfer data between and combine the strengths of multiple software packages. Through standardization we aim to automate structural calculations and drawing production.

This paper will present the proposed automation strategy for the ongoing design process of the tunnel and will evaluate its benefit during the detailed design phase compared to traditional methods. The present project forms the first application of parametric design and automation of such magnitude being developed in-house at the BESIX Engineering Department. It reflects our ambition to use these techniques for tackling the ever increasing challenges within the construction industry and simultaneously boosting productivity and the quality of the final product.

Keywords: automation; digital technology; parametric design; infrastructure; tunnel; design & build; BIM.

2 Introduction

When encumbered by the limitations of existing software packages, engineering tasks can be greatly benefit from customized and automated workflows enabled by custom tools. Though not new, the implementation of programming in construction engineering is rapidly rising [1]. The demand grows

due to the ever increasing requirements and complexity of construction projects. In parallel the possibilities increase due to growing computation power, improved availability of Application Programming Interfaces (API's) and to the rise of visual programming environments that are supported by large online communities, such as Grasshopper or Dynamo.

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