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Modelling techniques and processes used on the recalculation of the Friedrich-Ebert suspension bridge in Germany

Guillermo Muñoz-Cobo Cique
guillermo.munoz-cobo@arup.com
Arup Deutschland GmbH
Düsseldorf, Germany

Markus Gabler
markus.gabler@arup.com
Arup Deutschland GmbH
Düsseldorf, Germany

ABSTRACT

The complex the bridge is, the stronger the engineer's technical knowledge needs to be to understand its behavior and lead the design towards a safe, functional, and cost-effective structure. The bridge design industry shows, however, that technical knowledge is not enough: engineers not only have to master a whole range of technical subjects, but also need to be able to manage and treat data to understand and interpret results. This is the only way to make the right decisions in a conscious way. In the case of long span bridges, management and processing of information becomes critical since the amount of data increases with the span length. This paper showcases some modelling techniques and processes used to carry out the recalculation of the Friedrich-Ebert bridge in 2021, that were found essential to capture and analyze, in an accurate way, its almost 70 years of history, including the strengthening that took place in 2000, and that enabled a precise rating of a bridge with a main span length of more than 285m over the Rhine River. Techniques touch upon input of complex geometry, consideration of shear lag, checks on plate buckling and the so-called contribution charts. Their application lead ultimately to the preservation of this beautiful landmark.

Keywords: Modelling, analysis, recalculation, automation

1 INTRODUCTION

After the end of the II World War in the 1940s an extensive reconstruction took place across Germany. Like many other structures during the war, being a key connection over the Rhine River, the Admiral-Scheer Bridge was destroyed. In the 1950s a new structure provided connection between Ruhrort and Homberg in the city of Duisburg. It was called the Friedrich-Ebert Bridge. The new bridge was designed as a self-anchored bridge, which in appearance is similar to a suspended bridge, however, behaves in a completely different way.
Given the scarcity of resources after the war, the bridge was optimized in every way technology at the time allowed. A recalculation in 2000 showed that the bridge needed to be strengthened to be able to resist load levels corresponding to bridge class BK60/30, in accordance with [4]. As a result, additional structural elements were installed in form of plates, profiles, and concrete.

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