

Modern Approach In Concrete Segmental Design

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Summary

Grudziadz Bridge is a pre-stressed concrete bridge which will cross the Wisla River in Grudziadz, Poland. The whole length of the bridge is 404.0 m, with span lengths of 110.0 m, 180.0 m and 110.0 m. The used construction method is free cantilevering. The maximum cantilever lengths reach up to 94.0 m in the side spans and 89.0 m in the central span. During the construction two temporary piers will be used which will be placed only in the side spans and will be 22.0 meters away from the pier. The cross-section is a single cell hollow box which will have a varying depth from 4.0 m at mid-span to 10.5 m above the piers.

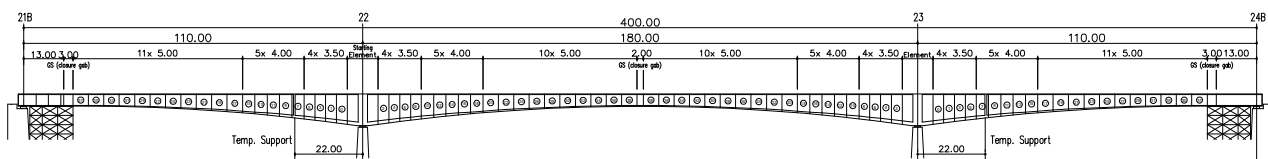


Fig. 1: Grudziadz Bridge - Elevation view.

The complex problem of the detailed design and the construction simulation required a special approach in the numerical analysis which is integrated in the modern sophisticated software solution – RM Bridge V8i. The usage of this software allowed effective modelling of the bridge geometry including the parametric representation of the cross-section dimensions. A special tool (RM Bridge Cantilever tool) facilitated the modelling of the detailed layout of the pre-stressing tendons and the construction sequence. The table oriented input allowed the designer to have full numerical and visual control over concrete segments, tendons, loading and stages.

The automatically generated stage by stage analysis allowed the simulation of the real (all loadings) construction at the construction site including the accurate calculation of the creep and shrinkage effects. The theoretical camber calculation helped the design engineer to understand the complex behaviour of the segmental bridge of such size and allowed a few optimization cycles.

Keywords: prestressed concrete bridge, free cantilevering method, modelling, structural analysis, cantilever tool

1. Basics

1.1 Introduction

Structural analyses for bridges are usually performed with beam models. The statical model, made with RM Bridge, for the superstructure of Grudziadz Bridge was also performed with a beam model. This approach allowed performing all required proof checks in accordance with the respective valid design code. The basic assumption of this approach is that we have a purely linear stress and strain state in the beam cross-section.