Optimization Process of Railway Segmental Bridges Constructed by Balanced Cantilever Method

Jindrich Potucek, P.E., S.E.

COWI, Prague, Czechia

Vojtech Kolinsky, P.E.

COWI, Prague, Czechia

Contact: jipk@cowi.com, voko@cowi.com

Abstract

This paper highlights the challenges faced in large urban bridge infrastructure projects, including excessive material consumption and negative environmental impact. It focuses on the optimization process conducted for a new pair of railway double-track bridges in Tel-Aviv, Israel, featuring continuous prestressed concrete box girders. The design works began in late 2020, with construction currently underway. COWI was responsible for the superstructure design packages, optimizing the box section, resulting in increased post-tensioning design efficiency and a 30% reduction in materials. Through careful planning and teamwork with the contractor, the project achieved lower carbon footprint, decreased cost, and increased speed of mobilization.

Keywords: bridge, railway, post-tensioning, box girder, balanced cantilever, segmental

1 Introduction

The infrastructure projects of large and complex bridges in urban environments present a significant challenge in terms of quantity consumption, negative environmental impact around the area of the construction site and consequently increased carbon footprint of the project. A careful assessment of the adequacy of the proposed tender design meeting all durability and design requirements combined with good construction planning eliminating bottlenecks in the construction schedule, can result in building more economically, more rapidly and with less impact on the environment. It is the role of a bridge engineer to always consider the above regardless of the phase of involvement.

This paper presents the optimization process conducted for the new pair of railway double-track bridges BR-05 and BR-06 (total lengths 516 and 762 m) spanning over a complicated area of the Ein-Hakore intersection in the southern suburbs of Tel-Aviv, Israel. Each bridge features a continuous prestressed concrete box girder of variable depth (7.2 to 2.6 m), designed as segmental cast-in-place structure constructed by the balanced cantilever method. Design works began in late 2020 and construction of the bridge is currently underway.

2 Design Optimization

COWI was responsible for the superstructure Value Engineering Design and Construction Engineering

https://doi.org/10.2749/manchester.2024.1303
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