Engineering and Architecture unite for Railway Bridge

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Frank Rapattoni, born 1950, received his Bachelor of Civil Engineering from Swinburne Institute of Technology. He joined Parsons Brinckerhoff in 2006 after extensive experience in the design, construction and development of bridges in VicRoads, BHP Steel and Cardno.

Eli graduated from RMIT University in 1983 and became a director of MGS architects in 1990. Eli has received many design awards and has participated in national and international exhibitions and publications. Her work has been published widely.
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John Dauth, born 1946, received his civil engineering degree from the University of Queensland in 1968 and his Master of Engineering Science from the University of New South Wales in 1975. John has worked for 32 years as a designer with consultants and the last 10 years as a design manager with constructors.

Summary

The duplication of an existing railway bridge over an urban creek valley in Clifton Hill, a Melbourne suburb (Australia), presented a number of challenges and opportunities to improve an environmentally sensitive area with an inspired design of the new bridge and the surrounding landscape. The concept design for the bridge was developed by MGS architects who were engaged by the Department of Transport. The John Holland Group won the tender for the detailed design and construction of the bridge and associated works. PB carried out the detailed design of the project.

The existing structure is a multi-span steel girder bridge built in the 1880's. The new bridge consists of steel girders with a composite concrete slab supporting a ballasted railway track and has been detailed to complement the existing bridge whilst adding art motifs and heritage elements in the design. The spans are three times longer than those of the original bridge hence the girders are much deeper. In order to reduce the visual bulk of the deeper girders the architect proposed numerous circular holes in the web with patterns reminiscent of air bubbles in water. With no guidance in any of the published bridge design standards this unprecedented design required fast-tracked research and in-depth analysis to ensure the structural adequacy of the girders subjected to high rail loads.

This paper discusses the design process and the inspiration for the various architectural treatments, the structural analysis and considerations which led to the final design of the girders and the safe, fast construction methods which overcame the limited access and restrictions imposed by rail operations.

The delivery model for the project was successful in meeting the expectations of the key stakeholders and contributed to safe, fast construction on time and on budget. The careful consideration of both the function and context of the bridge has produced an innovative union of engineering and architecture.

Keywords: Steel girder, holes, composite concrete slab, precast decking, architecture, reinforced holes, fatigue.

1. Introduction

The Clifton Hill Rail Project involved the duplication of 750m of existing single train track between Clifton Hill and Westgarth stations in suburban Melbourne, including the construction of a new bridge over the Merri Creek. The project removed a major rail bottleneck and delivered service reliability improvements to the 60,000 daily commuters who use the Epping and Hurstbridge suburban lines and allows the introduction of additional services to Melbourne's rail network. The

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