Innovative Construction Engineering for Stonecutters Bridge

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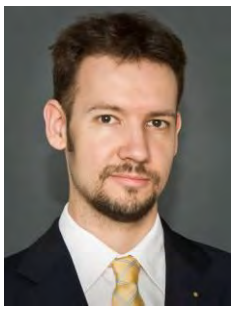

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Summary

With a main span of 1018m Stonecutters Bridge is the second longest cable-stayed bridge in the world. The construction of the bridge has been an unusual challenge and required innovative solutions to enable an efficient and safe erection. This paper outlines major construction engineering schemes and the solutions developed to harness the challenges of construction.

Keywords: cable-stayed bridge, construction, concrete, steel, heavy lifting.

1. Introduction

Stonecutters Bridge is a high-level cable-stayed bridge with a main span of 1018m and 298m high towers. The towers are single shafts with a tapered cross section. The deck features a twin-box arrangement with the two girders running either side of the tower. The main girders are interconnected by cross girders to form a grillage structure. The backspans are monolithic concrete structures with spans of around 70 meters. The main span steel deck extends about 50m beyond the towers into the backspans. There are 8x28 parallel wire strand cables supporting the deck and anchored at the upper part of the tower.

2. Backspan Construction

The concrete backspan superstructure was built on a purpose-designed falsework system which holds the deck in place until the stay cables are stressed. The main supporting members of the falsework are 60m high concrete columns made up of precast blocks, equipped with three levels of steel bracing for lateral and transverse stability.

3. Tower Construction

The all-concrete shaft of the lower tower was built using a jump form system which could change shape to cater for the tapering geometry of the tower.

The Upper Tower, the 118m long section where the stay cables are anchored, is a composite structure with a stainless steel skin of 20mm thickness at the outside and carbon steel anchorage boxes at the inside. The skins and the anchor boxes were pre-fabricated in a yard where a rigorous match assembly was executed to ensure a correct overall geometry and a fit of the individual segments. On site, the anchor boxes were placed first, then the skins, followed by rebar works and inner formwork before casting of the concrete walls.

4. Heavy Lift

For the installation of the 88m long steel deck section around the main towers a Heavy Lift procedure was developed, which provided cost and time savings compared with the original scheme utilising a falsework system and an assembly at deck level.

https://doi.org/10.2749/222137809796068028

A total weight of 4000 tons was lifted from stand jacks located at the tower and the end of the concrete backspan.

5. Mainspan Erection

Main span erection is performed in free cantilevering where lifting gantries located at the cantilever tips hoist the newly delivered segment from the delivery barge.

Matching the newly lifted segment to the cantilever end required special measures because of the low transverse stiffness of the twin-box deck. A significant vertical mismatch occurs between the construction front, which sags under the gantry reactions and the almost stress-free lift-in segment. This mismatch was overcome by applying a specially developed transverse bowstring device, which is stressed in order to bend the lifted segment down into a shape akin to the deflection of the cantilever tip.