Botany Rail Duplication – Innovative Methods for Bridge Construction

Authors:	Miho Mihov, Jacobs
	Level 7, 177 Pacific Highway
	North Sydney NSW 2060
	Australia

ABSTRACT

This paper covers the complexities in design and construction of two major post-tensioned concrete bridges along the Port Botany Rail Line in Sydney, including implementation of innovative materials and construction techniques under extreme time and space-related constraints.

The existing single-track Robey and O'Riordan Street Underbridges were required to be replaced with twin track underbridges for the duplication. On a horizontal curve, Robey Street Bridge consists of a 36m main span and 18m backspan. O'Riordan Sreet Bridge is a single 45m-span structure. Both bridges comprise variable depth through girders with transverse spanning precast concrete deck panels to carry the twin rail tracks. Extremely restrictive space constraints were imposed by third party easements and advertising gantries. These constraints required the through girders to be constructed offline using cast in-situ post tensioned concrete and then slid into position after the existing bridges were demolished.

The outstanding design feature of these two bridges was the use of ultra-high performance fibre reinforced concrete (UHPFRC) in-situ stitches to join the precast deck panels and the main girders. During 5-day possessions, the existing bridges were demolished and the new bridges constructed, including installation of waterproof membrane, ballast mat, ballast, track and signalling. The design team, in collaboration with the Contractor John Holland Group, developed unique details for the in-situ stitches using UHPFRC. The main benefits from using UHPFRC are very high compressive strength (130 to 150 MPa), very fast rate of strength gain (40MPa in 8 hours for early stressing), simplification of the reinforcement details due to the very small reinforcement lap length (10 bar diameter without hooks), and no requirement for shear, torsional or bursting reinforcement. The small lap lengths resulted in smaller in-situ stitch sizes, reducing the overall volume of concrete to be poured during possession, saving time as well.



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