Second Gateway Bridge, Brisbane, Australia

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Summary

The Second Gateway Bridge is part of an upgrade of the Gateway Motorway in a highly developed urban corridor of Brisbane, Australia. The bridge is 1627m long with a main span of 260m. The three river spans were constructed by the cast in-situ balanced cantilever method with segments varying from 15m to 5m deep and 3m to 5m long. The approach spans were constructed by match cast segmental construction with epoxy joints and with asymmetrical twin segments forming two spines that were stitched together after cantilevering. Approach spans are typically 71m and the box section is 3.3m deep. The bridge was designed and built with a target design life of 300 years with particular attention directed at durability planning, materials selection and detailing to ensure a very long life for this landmark bridge.

This paper provides an insight to the design of this major bridge, covering the philosophy of the bridge form and articulation, the design of the superstructure of both the main spans and the approach spans, design of substructure and foundations design and testing, including Australia's first use of Osterberg Cell type load testing for test and production piles, and protection against vessel impact. The paper also describes the background to the selection of a 300 year design life target, and provides an explanation of the design process for addressing durability, and briefly describes the outcomes for 300 year design life.

Keywords: cast in-situ balanced cantilever; match cast segmental; post-tensioning; durability planning; ship collision; design life; bridges.

1. Introduction

The Second Gateway Bridge is constructed just 50m to the east of the existing crossing and was required to have substantially the same appearance as the existing bridge. It was also to have:

The same structural form;
Piers of the same form but the width could match the width of the box girder;
All piers aligned with the piers of the existing bridge;
A river navigational clearance (53.1m) that matches the existing bridge;
A bridge height that sits below the obstacle limitation surface of the nearby Brisbane Airport;
A 300 year design life for durability; and,
Provide for six lanes of southbound traffic and a 4.5m wide shared pedestrian/cycle path on its eastern edge.

These requirements were specified in the Project Scope and Technical Requirements (PSTR). This document implied the new bridge would be constructed using similar techniques to the existing bridge and was directed at achieving a continuous prestressed concrete bridge with no joints and with continuity of reinforcement (which is thought to be the most durable bridge form), and one more able to achieve the long 300 year design life target. Although the existing bridge remains in excellent condition, replicating this form was not considered appropriate for the Second Gateway Bridge because of the abundance of bearings and the resulting maintenance and replacement issues, and also because the structural form has a fundamental lack of redundancy. Advances in technology

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