Gerald Desmond Bridge – Challenges and Solutions for Vibration Control

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Summary

Gerald Desmond Bridge replacement is a 305m mainspan cable stayed bridge which is under construction and will become California's first long span cable stayed bridge, and form a distinctive landmark in Los Angeles with its elegant mono-pole towers with a unique section transforming from an octagon to a diamond. The total length of the replacement is about 3km long including 2km elevated approach viaducts built with prestressed concrete box sections.

The cable stayed main bridge carries six lanes of traffic and a bikeway attached to the edge girder with cantilever beams. The challenges of a durable solution for dynamic effects induced by seismic events, winds and traffic have been resolved by an intelligent solution with dampers and fuses. This paper focuses on the issues of aerodynamic instability during construction and in service, wind induced and vehicle induced vibrations and pedestrian comfort. Wind tunnel studies are discussed for the free standing tower during construction, full-cantilever erection stage, in-service with traffic, post-earthquake damages and behaviours with traffic. Rain and wind induced and vehicle induced stay cable vibrations, bikeway vibrations due to traffic on main girder and people running and jumping on the bikeway are also studied. The design covers a full checking of the bridge vibration and control for various stages and loading conditions, and proves the sustainable design for a high performance bridge.

Keywords: Bridge; Vibration Control; Aerodynamic stability.

1. Introduction

The Port of Long Beach in collaboration with the California Department of Transportation (Caltrans), collectively the Owner, has awarded a design and construction contract to Shimmick / FCC / Impregilo JV (SFI) for the replacement for the Port of Long Beach's obsolete and deteriorating Gerald Desmond Bridge. The project consists of the design and construction of a cable-stayed bridge and associated approach and ramp network, and an integrated Class I bikeway.

Arup North America Ltd. in association with Biggs Cardosa Associates have been performing the final design services. Caltrans is performing the design and construction independent quality assurance oversight on the project. The Project is under construction and expected to complete in 2018.

The challenges of a durable solution for dynamic effects induced by seismic events, winds and traffic have been resolved by an intelligent solution with dampers and fuses. Seismic design criteria for the project were developed by the Owner prior to award of the design-build contract. The

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