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Innovative solutions for Bridge strengthening (widening and compliance to new codes) by modification of initial static scheme

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Abstract

Strengthening of bridges for compliance to new codes is nowadays quite usual, but some innovative solutions have to be found for economic reasons, when loads increase due to widening or seismic actions is huge and has a strong impact on foundations, or when other parameters such as vibrations need to be considered. Freyssinet's solution on 2 projects, Binh Trieu Bridge in Vietnam and Ayala Bridge in Philippines is a complete change of static scheme: isostatic bridges are transformed into hyperstatic bridges or portal frame mixing together: new elements of concrete, additional prestressing, dampers, change of bearing conditions, with only one goal "reduction of global cost of strengthening solution."

Keywords: strengthening; retrofitting; post-tensioning; dampers

1 Introduction

Strengthening of bridges for compliance to new code is becoming quite standard nowadays and can be insured with classical techniques such as external prestressing, shotcrete, FRP… But some innovative and cost effective solutions have to be found when loads increase due to widening or seismic actions is huge and has a strong impact on foundation or when other parameters such as vibrations need to be considered.

The paper presents 2 projects led by Freyssinet as designer and constructor.

2 Binh Trieu Bridge

Binh Trieu Bridge is one of the major bridges located in the centre of Ho Chi Minh City (Vietnam). It crosses the Saigon River and connects the industrial area to downtown. As a strategic axis, its closure need to be reduced to a minimum.

The 560 meter long bridge has been built in the 1960s. It is composed of 3 bridges [*Figure 1*]:

- 2 approach bridges, with isostatic prestressed concrete beams. The first one has 10 spans with a total length of 250 meters, and the second one has 6 spans with a total length of 150 meters.
- Between the 2 concrete bridges, the principal steel bridge, measuring 160 meters (3 spans) is composed of 2 cantilever bridges supporting a suspended span subjected to important vibration due to its lightness.

Transversally, the bridge has only 2 lanes for traffic and 2 sidewalks which is not sufficient to carry the actual traffic density. The steel bridge and the concrete approach viaducts are composed of 5 beams.

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