Zeitschrift: IABSE reports = Rapports AIPC = IVBH Berichte
Band: 82 (1999)

Artikel: Ting Kau cable stayed bridge: challenges in the construction process
Autor: Bergman, Don
DOI: https://doi.org/10.5169/seals-62124

Ting Kau Cable Stayed Bridge: Challenges in the Construction Process

Don BERGMAN
Buckland & Taylor Ltd
Hong Kong

Abstract

The superstructure concept for Ting Kau Cable-Stayed Bridge in Hong Kong represents a significant step forward in the design of cable-stayed bridges. The bridge introduces innovations in the span configuration, the pylon shape, the cable arrangements, and the girder arrangement. All of these features were introduced in a fast-track design build project to be constructed in an environment exposed to the risk of typhoons during construction. This paper examines the impact of some of these factors on the construction process for this bridge and examines how the lessons learned here could be applied to future bridges.

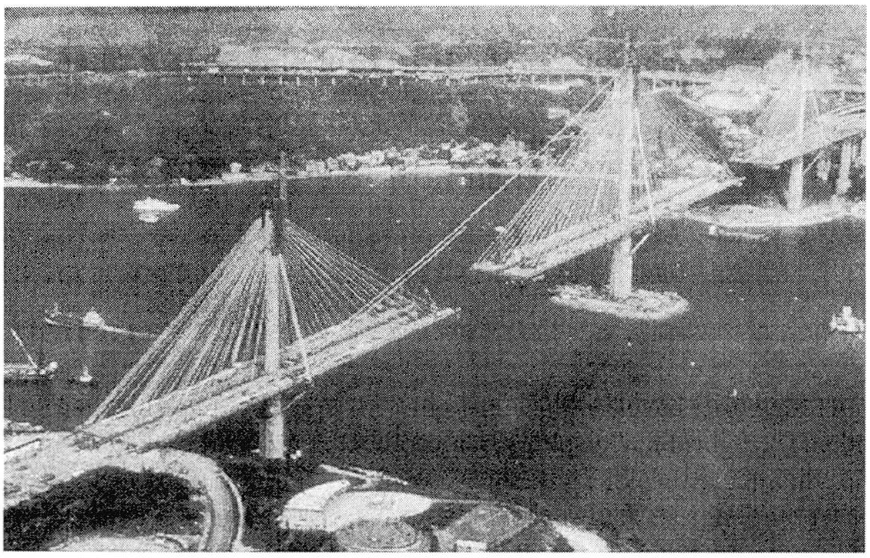

Fig. 1: Ting Kau Cable Stayed Bridge Erection

The Ting Kau Cable-Stayed Bridge is a continuous four span superstructure comprising twin three lane carriageways each with a composite concrete deck supported by two steel plate girders. A longitudinal gap between the carriageways improves the aerodynamic stability of the superstructure and permits clearance for the slender single leg concrete pylons which are restrained laterally and longitudinally by stabilizing stays to two steel anchorage boxes at their pylon head. Each of the four steel plate girders is supported by a plane of cables also anchored in the box at the tower head.

The entire superstructure in its finished form represents a sophisticated, lean and efficient structural solution which responds to the constraints of the site and the project schedule. The guyed monoleg towers result in a minimal footprint in the Rambler Channel where foundation and ship impact criteria are onerous. The most complex elements of the design could be prefabricated thus permitting fast efficient erection with relatively unskilled crews.

It is the job of the construction team to bring the bridge to its final state in a timely and efficient process, while resisting the construction phase loads on an evolving structure, which is, in general, significantly weaker than its completed counterpart.

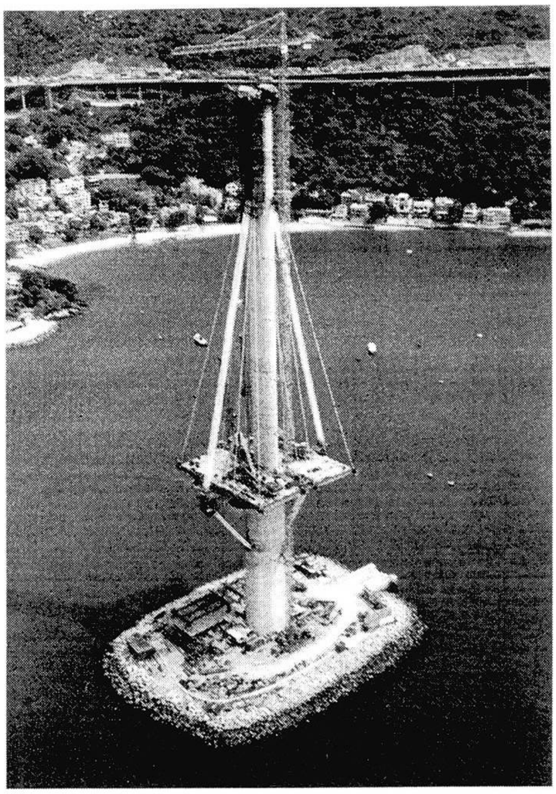
Fig. 2: Main Starter Panel

In particular the pylons have much less strength and stiffness prior to installations of their lateral and longitudinal stabilizing stays than after their installation and the uncompleted deck structure is much more sensitive to unbalanced lateral and vertical loads prior to closure than after.

In order for the superstructure erection process to be timely and efficient, construction procedures must be developed which achieve targeted cycle times for a typical deck segment. This is a key to manpower, schedule and cost efficiency for this type of construction.

Getting the high level superstructure erection process started proved particularly difficult and time consuming on this project due to a number of issues including pier access, deck elevation, space restrictions, starter panel configuration and unbalanced tower capacity. Once deck erection began to progress, stability under wind created the necessity for a complex array of temporary restraint cables.

In hindsight there exist opportunities to learn from this construction engineering exercise. The complete success of an innovative design such as the Ting Kau Cable stayed bridge must come from careful consideration of both the final product and the construction process required. In this case the design innovations produced an efficient final product. The design also presented opportunities and challenges to the construction team to optimize the construction process. While many of the challenges were met, opportunities to fully realize the potential construction benefits of the design were in some cases missed.

By examining the experience gained here, perhaps the best of the design and construction concepts conceived at Ting Kau can be retained and improvements developed to circumvent the difficulties.