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# Construction Control Practice for Panyu Cable-stayed Bridge

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## Abstract

The Panyu cable-stayed bridge(shown in Photo 1) has a total length of 702.0 meters with a main span of 380.0 meters and two equal side spans of 161.0 meters. An auxiliary pier is in between. The deck is composed with two solid edge girders with 2.2 m high and a deck plate with 28 cm thick. The width of the deck is 37.70 meter out to out with 8 traffic lanes. Spatial 264 stay cables are arranged in a semi-fan configuration with 6m spacing along the deck.

With its large width of 37.7 meters, each segment is nearly 4200.0 kN weight. The bridge deck is built using the balanced cantilever construction method and the segment concrete is cast in-situ. The height of edge girder is only 2.2 m which is flexible. Thus cable-supported carriages are used in order to provide sufficient rigidity. It brings more difficulty into the construction control. Therefore it is important to carry out careful and detailed simulation of the construction processes. In this paper the detailed simulation analysis of the erection process, the methods used in the control and adjust the deck profile and the stay of Panyu cable-stayed bridge are discussed.

From the designed final state of the bridge with a specified geometry and system of forces, a detailed simulation analysis of construction is carried out by a specifically developed software. The configuration and internal forces of the partial structure are obtained. Then the theoretical references for every erection stage are established. This provides the basic information for the erection of the bridge. The simulation calculation is also carried out in site when there is are some flight modification of the erection scheme.

During the erection procedure, there are four sets of instrument installed on the bridge to monitor the profile of deck and cable tensions. They include the elevations, displacements of pylons, stresses in the deck and pylons, and the temperature and gradient in the bridge. And material parameters such as elasticity modulus and mass density of concrete, are also measured at laboratory in site. The actual weight of form carriages and the volume of concrete used in each segment are measured too. These measurement provide the fundamental parameters for simulation of erection and construction control. The uncertainties are minimized as much as possible.

Through careful and detailed simulation calculating and continuous motoring, the results of the bridge seem very well. The deviations of cable tensions between actual with primary designed value are within 7%. Only a few stay cables are adjusted and re-tensioned after the closure of main girder. At each deck segment, the elevation of laying form is reference with the previous segment and the errors of deck elevations are within 2.0 cm. Before the closure of main span, the deviation of elevations between the two ends of deck is only 3.9cm. The final profile of deck is smooth. The inclinations of pylons agree with the designed requirement.

In cable-stayed bridges, and particularly in PC cable-stayed bridge with relatively flexible deck, the construction of the concrete cantilevers is complicated due to the use of the cable-stayed form carriages, continuous geometrical monitoring is absolutely necessary in order to obtain acceptable geometry and tension conditions for the structure. Since there are many deviations in parameters, such as the mass density, elasticity modulus of concrete etc., must be measured in the erection of each segment of deck. Such continuous monitoring and detailed simulation of erection process make it possible to reach a high level of accuracy of construction in PC cable-stayed bridges.

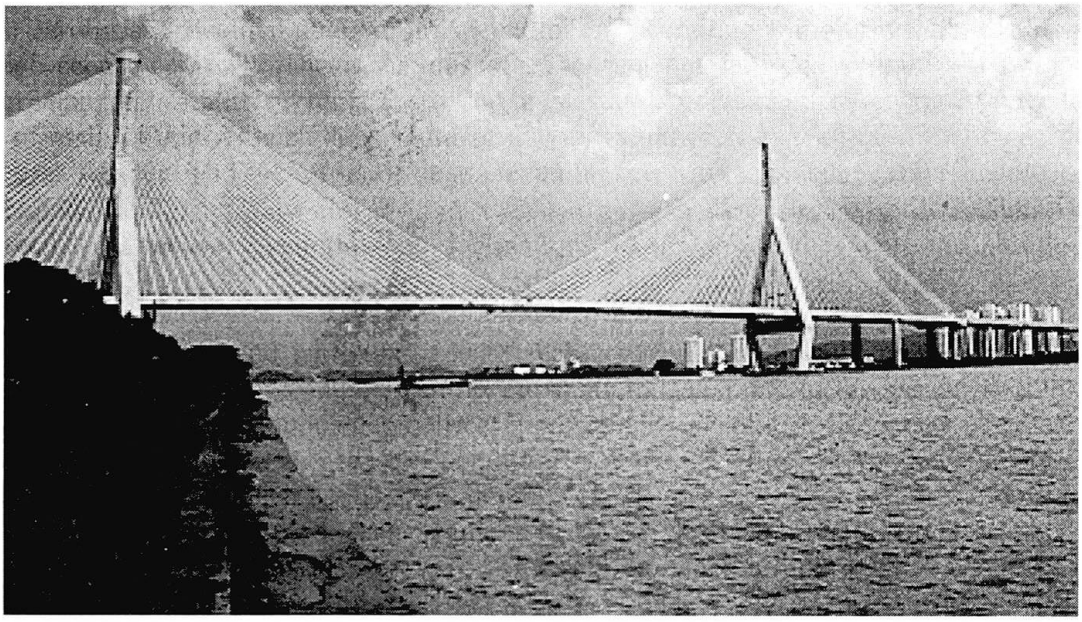

*Photo.1 The general view of Panyu cable-stayed bridge after its completion*