Planning and Construction of the First Cable-Stayed Bridge in Indonesia

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Summary

The first long span bridge in Indonesia was built, three decades ago, crossing the broad Musi River in Sumatra. Recently, another two new bridges have been constructed and open to traffic. These include the 918m long multi-span steel suspension bridge over the Barito River in Kalimantan, and the 642m long cable stayed bridge , linking two islands in the Batam area.

This paper will examine the planning for, and the construction methods used in the construction of Indonesia's first cable stayed bridge, the Batam-Tonton Bridge.

Special attention will be given to the Construction Engineering developed for the erection of the cable stay superstructure, and the design of the pylon foundations.

1. Planning for Construction

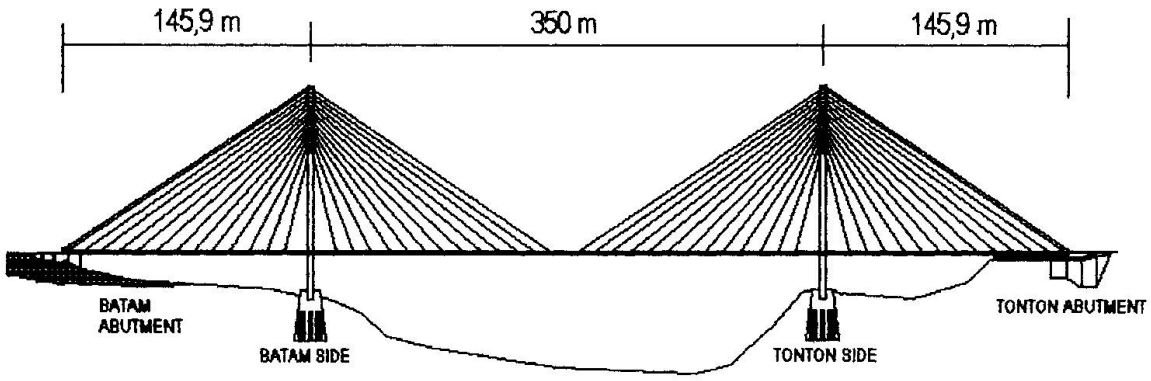
Unlike most other bridge construction, cable stayed bridges require intensive input before and during the construction phase. Critical at each stage is the control of the deck alignment and stress state within the deck and stay cables. A critical issue was the understanding of how the partially completed structure would behave at any time during the construction.

Prior to construction, the Client and Construction Management (PT Profes) recognized this fact, making the Contractor responsible for the determination and monitoring of forces and deflections in the permanent structure, and for it's intermediate static and dynamic stability during construction.

This was provided in the form of a "Construction Engineering Package" , which includes a detailed deck construction sequence, together with a step-by-step confirmation of the strength and serviceability of the structure for wind and gravity loads, as well as the effects of creep, shrinkage and temperature at each construction stage.

Monitoring of this construction engineering during construction, was then carried out on site by the Contractor and Construction Management.

2. Construction



2.1 Pylon Foundation

The foundation was based on two pile groups, each consisting of 30 bored piles, 1.5m in diameter, with average depths of 38 m to 40 m. Contract Level was determined based on rock sockets, with minimum lengths of 2.2 m, and end-bearing capacities of 2 MPa. In addition, static load tests were carried out on two piles, to confirm the load carrying capacity (1,100 tones per pile) of the as-build piles.

2.1 Pylon

The pylon was constructed two parts - the pylon legs and the pylon head. 45 MPa strength concrete was used for the pylon legs, and 50 MPa for the pylon head. The legs of the pylon, which are hollow in section and inclined at 82 3' 44", were constructed in 4m high sections, using a pair of jump forms. The cycle time for the first section was 19 days, which was reduced to an average of 6 days for the last 18 sections. At the head of the pylon, the two jump forms were joined together, and jumped vertically as a single unit.

2.2 Deck

Each deck segment is 21.5m wide, 12.0m in length, weighs approx. 500 tones and is supported by one cable in each edge beam. The construction was based on the cantilever method starting from each pylon. The side span segments were constructed on Kingshore scaffolding, and the main span segments with a 310 ton steel form traveler. Initially, the Pier Table (28.4m of deck immediately below the pylon head), was constructed on Kingshore scaffolding. The first two side span segments were then constructed, and the steel form traveler installed on the main span side of the Pier Table. The typical deck segment erection cycle then commenced, with pouring of the side span segment, pouring of the main span segment, Installation and stressing of the stay cable and launching of the traveler.

The first cycle was completed in 26 days, which was reduced to 13 days in a relatively short time. This excellent production rate was due mainly to the efficient field coordination of the organizing team, and the quick and effective adaptation of all workforce on site.

On completion of the side span segments, the 4 out-of-balance, main span segments were construction, and balanced by the backstay cables. The 2 form travelers will then approach each other at the middle of the main span, to execute the closure procedure.