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Accuracy Control On The Construction Of Tatara Bridge

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Abstract

F Tatara Bridge is a world's longest steel-concrete hybrid cable stayed bridge, constructed by Honshu-Shikoku Bridge Authority on the "Onomichi- Imabari" root. The center span is 890m long, and a part of side span is concrete. Deck girder section is structured by 3-chambers.
This bridge is much flexible, and it was difficult to complete the bridge accurately with controlling cable tension. Because the geometric error would be large with only controlling the tensions.
So, for the accurately erection, we gave account on the geometrical controlling included length of each member. By those controlling, Tatara Bridge was completed accurately.

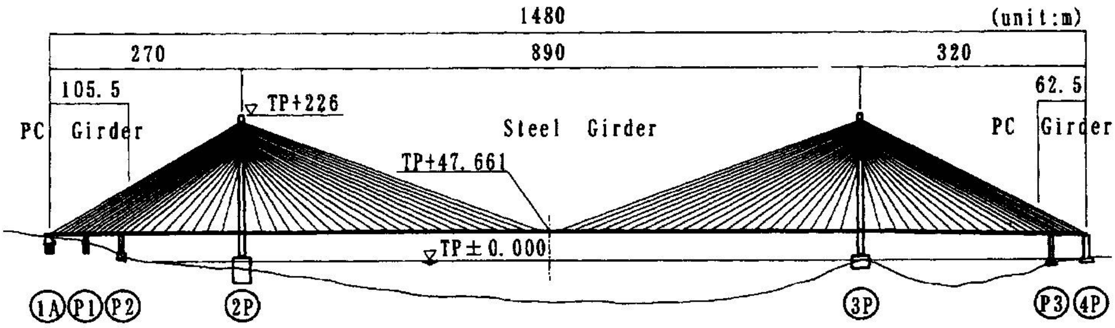

Figure 1. General view of the Tatara Bridge

Outline of erection of superstructure

The side span was consisted by steel and PC deck. Immediately after the completion of the tower, steel deck between P2 to 2P was erected by F.C. by large block.

For the erection of side span of 3P side, at the first stage of the erection near the tower, balancing erection method was applied. It was the method erecting deck by each short block alternatively adjusting the balance between center and side span. When the distance from the edge of erected deck to the PC deck became 100 m, then large steel deck block was erected by F.C. The deck of center span was erected by traveler crane in short block. The deck was jointed by welding in upper flange, bolted by high tensile bolt in web and lower flange.

2. Basic philosophy for accuracy control

By the calculations for the sensitivity of geometrical accuracy against any parameters, structural characteristics are found as below.

a)the tolerance of member length effect high
b)other tolerances(dead weight, stiffness, deck and tower's section forces) effect few
c)if controlling of cable tension neglecting tolerance of deck weight, deck deform largely

We decided the basic philosophy for accuracy control of erection of deck.

a)the controlling of length of member are emphasized. Data were measured in workshops.
b)at site, geometric of deck are mainly controlled, not cable tension.

3. Actual result of accuracy control

workshops: the length of each member was measured and controlled with cumulated tolerance. The cumulated tolerance were under 10 mm in total length of tower and deck, high accuracy. Because of it's length, measuring of length of stay cable were impossible. So they were controlled by the length of gage wire. It was estimated that the major uncertainty factor of tolerance of geometry was originated by stay length because the tower and deck were measured accurately.

Balancing erection in site: In balancing erection of 3P side, the total structure leaning leftward(center of bridge). It was caused by the weight of traveler crane on the edge of deck of center span. The state was easily deform by small load, so the estimation of factor caused the tolerance was difficult. So the controlling of length of stay cable were never done in balancing erection.

Cantilever erection in site: after the side span was jointed with PC girder, the structure lean outer side of bridge, both 2P and 3P.

The length of stay cable were controlled by the erection of stays anchored in PC deck, installing the spacer plate. The thickness of spacer plate were calculated based on the tolerance of deck level.

The calculation considering tolerances (dead weight of steel deck, temperature of bridge, weight of erection facility and creep of PC deck) were included carried out. Tolerance by uncertain factors were controlled. The tolerance caused by the factor already had been cleared were left without any controlling. By the calculation considering those effects, the deck would be deformed upward about 150mm at just before the closing and actually measured.

Closing work in site: After the closing of span, the tolerance was decreased about 100 - 150 mm locally around the center. It was assumed gas cutting done in site cause the error of angle of welding face and then the tolerance decreased.

Conclusions

Tatara Bridge is much flexible and this flexibility caused the large deformation. The accuracy control was difficult by it's flexibility. From the phase of fabrication in workshops, the length of every member were measured and the tolerance was controlled severely. By those endeavors, Tatara Bridge was completed with high accuracy. Everyone relate for this work pride this result.

We thank everyone who related this work for the completion with high accuracy, and no accident.