Zeitschrift: IABSE reports = Rapports AIPC = IVBH Berichte

Band: 52 (1986)

Artikel: Construction of cable-stayed bridges in Honshu-Shikoku bridges project

Autor: Matsuzaki, M. / Ohnmachi, T. / Yasuda, M.

DOI: https://doi.org/10.5169/seals-40347

Outline of Iwakurojima Cable-stayed Bridge

Weight	(Tower)	8,340ton
	(Cable)	2,230
	(Girder)	24,530
	Total	35,100

CONSTRUCTION OF CABLE-STAYED BRIDGE

Honshu-Shikoku Bridge Authority

Erection work and Quality control

Field quality control for erection of girder and stay cable is roughly classified into followings

(1) Quality control of welded joints

Field welding quality control is classified as follows

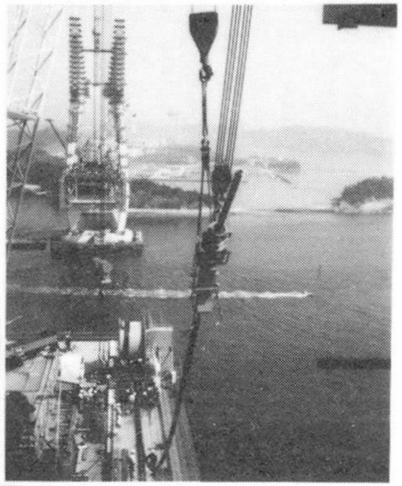
- Welding procedure test under similar conditions to actual erection site.
- Control of welding conditions and groove geometry
- Inspections by N.D.T (X-ray and P.T.)

(2) Erection accuracy control

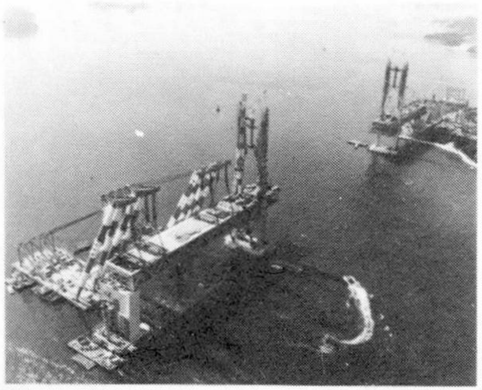
Regarding bolted joints, the pilot holes into which drift pins are driven during shop assembly are used in erection of main truss at the site to reproduce the figures in shop.

(3) Configurations and stress measurement

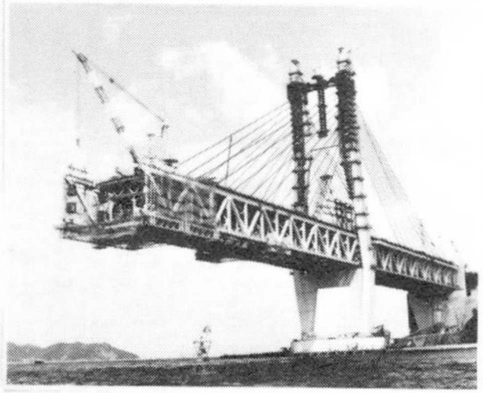
To confirm accuracy during erection and after completion, configuration and stress are measured on following items, girder figure, cable tension, tower tilt, girder stress, and support reaction.



Erection of cable



Erection of large block



Erection of main truss

Construction of Cable Stayed Bridges in Honshu-Shikoku Bridges Project

M. MATSUZAKI
Honshu-Shikoku Bridge Authority
Japan

T. OHMACHI
Honshu-Shikoku Bridge Authority
Japan

M. YASUDA
Honshu-Shikoku Bridge Authority
Japan

T. OHTA
Honshu-Shikoku Bridge Authority
Japan

1. Control of erection accuracy

The control method for erection accuracy is described in another paper of this final report. (c.f. Quality Control at Erection Site of Iwakurojima Bridge.)

2. Field welding of steel deck

As this bridge employs the composite steel deck, and joining of the steel deck was performed by field welding, it was considered possible that contraction due to welding could affect the erection accuracy of the main girder. The erection of the main girder was performed by use of the "bolt hole control method to secure sufficient accuracy. Therefore, when examining the root opening measured for the purpose of quality control of welding, the difference in values between the site and the shop could be considered to be due to the contraction as a result of welding, and of root detection errors. Therefore, the verification of the effect on the main girder camber due to the contraction of field welding based on the value of the root opening is performed, as follows:

(1) Comparison of root opening difference between shop assmbly and construction site.

Fig-1 shows the root opening in the shop and on site.

Apparently the transverse root opening in the site bridge axis is larger than that in the shop. This is a result of the welding contruction, because the drift pins and the temporary bolts at the bolt joints between the main girder and the steel deckplate were removed, releasing the residual stress caused by welding. Therefore the main girder camber was not greatly affected by the contraction due to the welding.

The longitudinal root opening tends to be smaller at site than in the shop, although the difference is small.

Also the longitudinal root opening did not appear to have any effect on the width of the main girder because stress releasing was performed as in the case of the transverse opening, with the floor truss keeping the width of the main truss.

(2) Quality of welds (Fig-1)

33 - 46 show larger root openings than 19 - 32. This is due to the fact that the standard values of the root opening differ depending on the method of welding (Submerged arc welding-CO_2 gas automatic arc welding).

The transverse root openings in the direction at right angles to the bridge axis were larger at the site, but the results of X-ray tests show that the quality of welding was satisfactory, presenting no problems.

3. Girder configuration and cable tension at the time of closure

Fig-2 shows errors between the planned values and the measured values at the time of closure of the girder. In the figure, the planned values were calculated according to the loading at the time. The error at the center of the central span is + 34 mm and that on the side spans is - 34 mm, and the tolerance on the central span being 118 mm and 59 mm on the side spans, respectively. These prove that the accuracy is satisfactory.

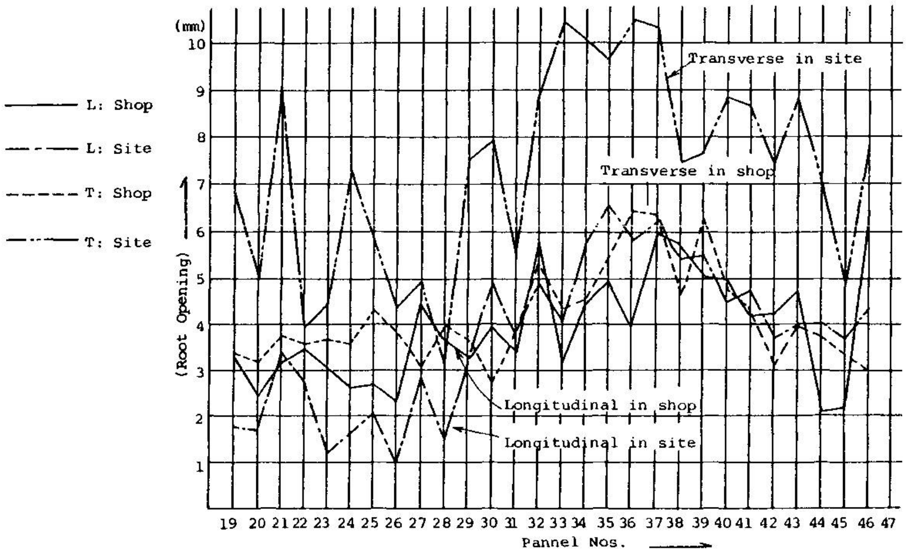


Fig. 1 Root Opening Difference between Shop Assembly and Construction Site

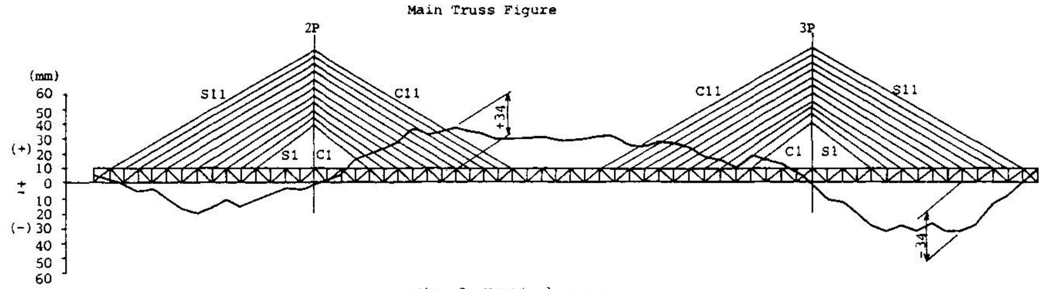


Fig.-2 Vertical error

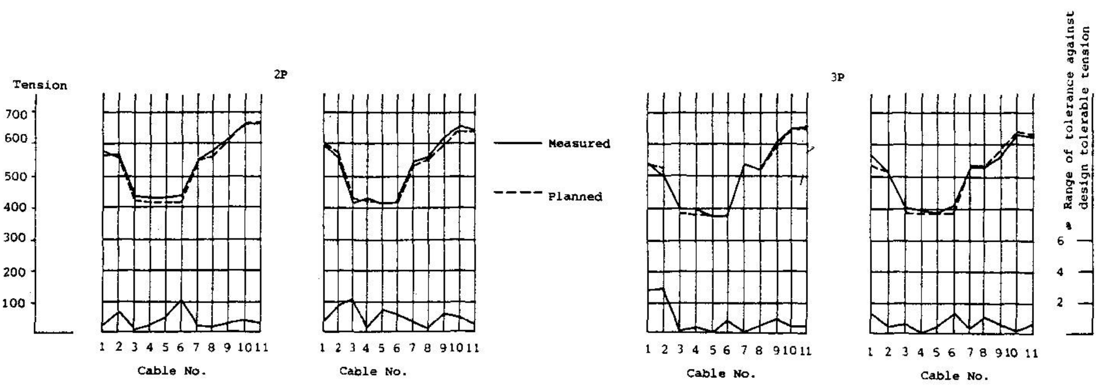


Fig. -3 Cable Tensions

Fig-3 shows cable tensions at each tier at the time of closure. The difference between the planned value and measured value according to the loading condition at the time was smaller than 5%, showing that the erection was performed with an extremely high accuracy.

However, as the allowed designed erection error was ±5% of the allowable design tension at the time of completion, it is judged that the range of errors at this stage was to be made ±2,8% of the allowable tension, taking into account the errors in the measurement. Therefore, shim plate adjustment was performed only on the cables at the 6th tier of the left side span, and at the 2nd tier and 1st tier on the right side of the center span.

4. Measurement of stress

At each point of measurement a strain gauge was attached and the stresses at each erection stage were measured. The axial forces were calculated from these values and the planned values were compared. Fig-4 shows the condition of the axial force acting near the tower column on the 2P side. The axial force of the upper chord member of the composite steel deck plate is the resultant force of the axial force of the chord member alone and the axial force of the steel deck, but the difference in calculation between the planned value and the measured value is deemed to have resulted from the fact that the stress in the steel deck-plate includes the bending stress of the direct loading of erection machines, etc. However, since the values for the lower chord member match with the planned values, the erection can be judged to have been completed with a satisfactory accuracy.

5. Conclusion

It is judged that the contraction caused by field welding was thoroughly released by arranging the welding sequence and by releasing the stress by removing the drift pins and temporary bolts etc. In addition, thanks to the bolt hole control method, which aims at the reproduction of the shop assembling accuracy at the site, a high erection accuracy was obtained without having to adjust the cable shim and the camber during erection.

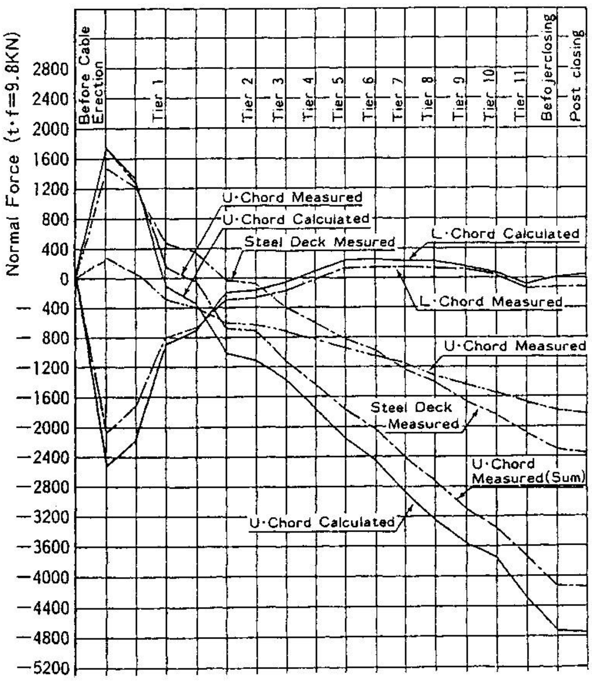


Fig-4 Trasition of Main Truss Stress