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Construction of a V-Shaped Rigid-Frame Bridge with High Piers

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Summary
Nadagawa bridge is the V shaped rigid steel-frame bridge with five continuous spans having total length of 276 meters. The V shaped pier is 45.7 meters high and the highest one among similar type bridges in Japan.
The huge girder block erection method or the inclined cable erection method is generally used for construction of these types of bridges. However, for the erection of this particular bridge, the staging method providing cranes were used, and in order to stabilize the V shaped piers at correct position, the steel wires were provided. This paper presents outlines of this erection method, in particular of wire tensions control.

1. Outline of bridge
This bridge is located in Awaji Island on Kobe-Naruto route of the Honshu-Shikoku Highways, and is designed as to harmonize well with surrounding landscape. The type of this bridge is the V shaped rigid steel-frame bridge as shown in Fig.1 and 2.

2. Construction Methods
For the erection of this bridge, three construction methods were used. The staging method providing crawler crane was used in P6 (V-pier and girders), and the staging method providing tower crane in P7 (V-pier and girders), and the launching method in girders between P7 and A2 (Fig.3).

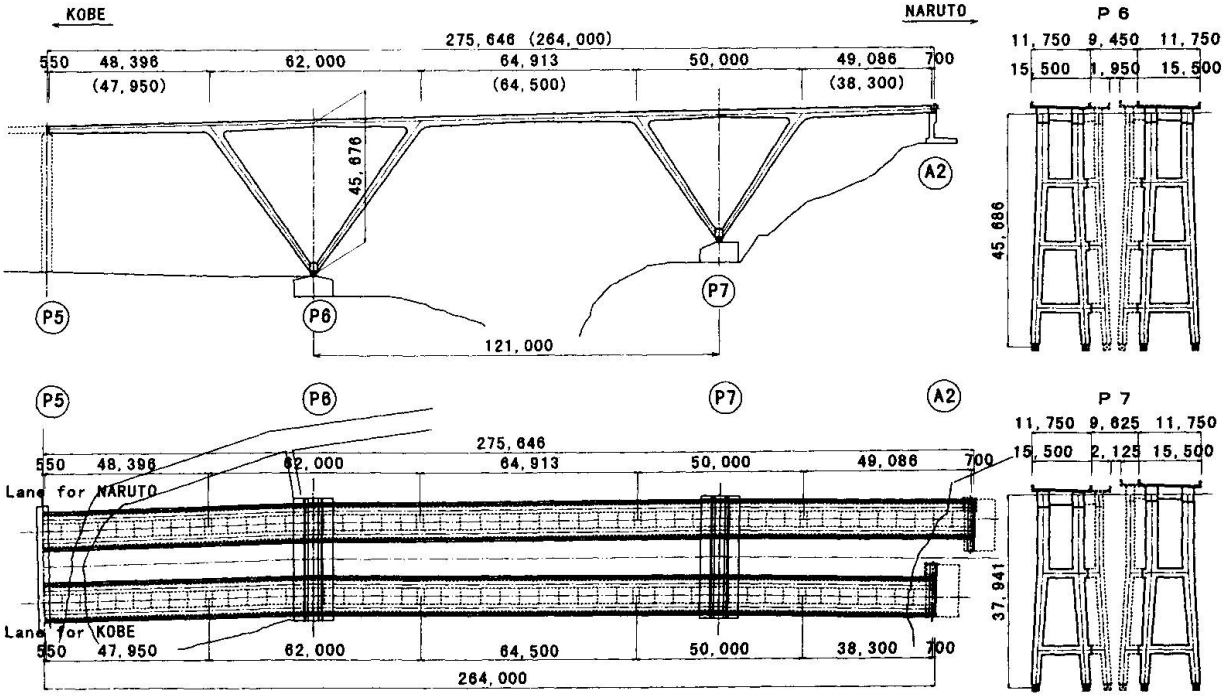


Fig.1 General View

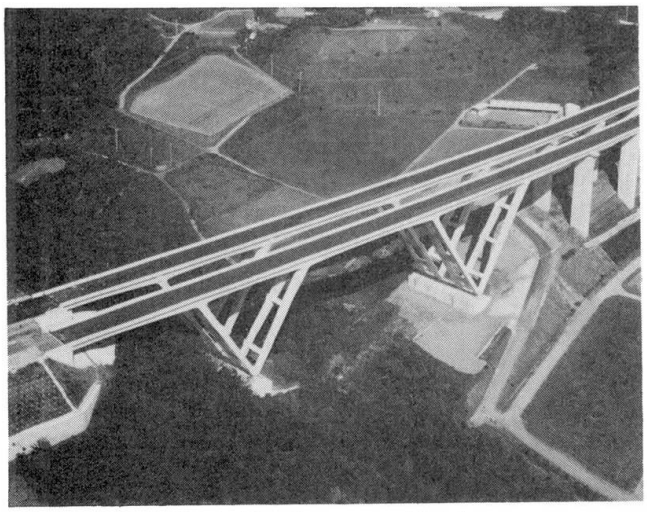


Fig.2 Nadagawa Bridge

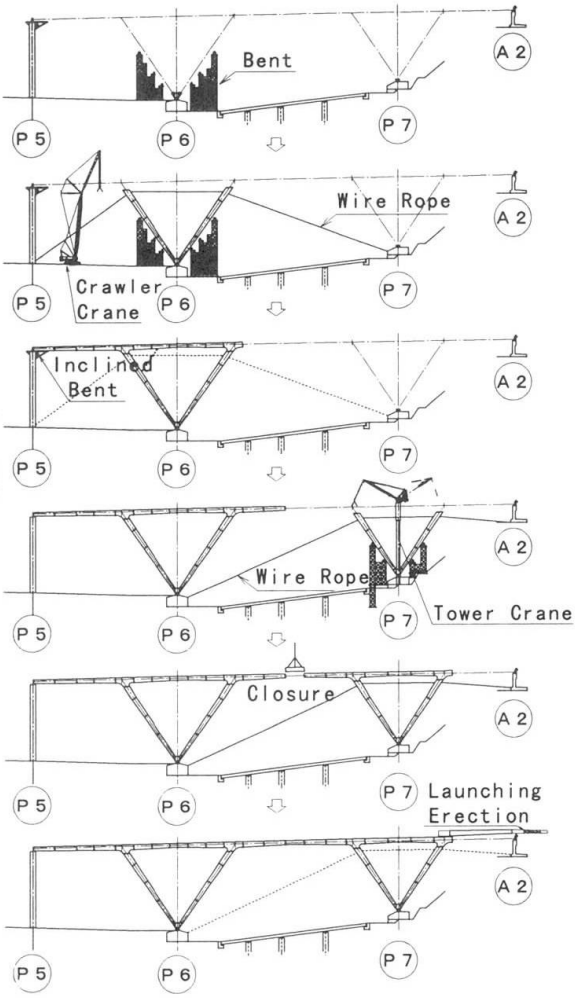
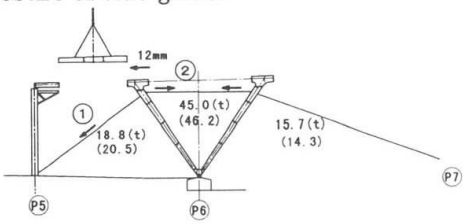
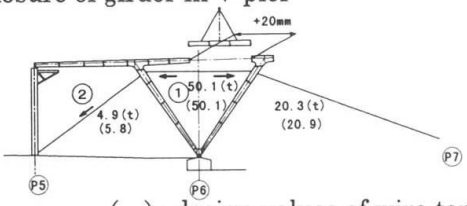


Fig.3 Stages of Construction

(1) Closure of side girder



(2) Closure of girder in V-pier



( ) : design values of wire tensions

Fig.4 Control of wire tensions

In first stage, the V pier was supported by bents, and then supported by wire ropes. In order to stabilize the V shaped piers at correct position, the steel wires were provided. The top end of these wires were anchored to the V shaped column and the bottom ends were anchored to the concrete foundation of adjacent piers. The stringent wire control was required in order to maintain wire tension at accurate values.

The shape of V pier were measured by 3-dimentional theodolite as coordinates and wire tensions were measured by strain gauges at tension bars in a pulling apparatus. The computer monitoring system which can constantly measure the wire tensions was introduced. It was controlled at each erection step so as to ensure the wire tensions and the shape of V pier within the design values. The controlling system of the wire tensions was useful to adjust the elevation and the gap of each girder at the stage of the closure erection(Fig.4).

3. Conclusion

This construction method has the advantage as shown below.

(1) This method is capable of erecting girders even at the site where the bents erection is difficult.
(2) It is possible to adjust the elevation and the gap of each girder at the stage of the closure erection with the help of wire ropes.
(3) It is unnecessary to build the temporary steel towers and the huge foundations of cable anchors as used in the ordinary cable erection method.