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Autor: Kadotani, T.
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7. Hachimantai Bridge

Owner: *Japan Highway Public Corporation, Tokyo, Japan*

Engineer: *Japan Highway Public Corporation Staff*

Contractors: *Kajima Corporation and Tekken Corporation*

Dimensions:
span length: *from 74.4 to 188.0 m*
bridge width: *9.75 m*
skew angle between expressway axis and river, national highway and national railway axis/overcrossing: *30°*
maximum grade: *2.737%*

Quantities of materials used pro m^3 of bridge: *86.7 kg/m^3 prestressing steel for superstructure (down line)*
80.5 kg/m^3 reinforcing bar for structure (down line)
118.2 kg/m^3 reinforcing bar for P2 pier

Construction Period: *3 years and one month*

Service date: *1983*

Introduction

The Tohoku Expressway approximately 680 kilometers in length links Tokyo metropolitan area with main cities in Tohoku located in northern Japan. Since the expressway has to pass over steep valleys surrounded by beautiful countryside, harmony of structure and scenery was a main theme of the project. The Hachimantai Bridge, of the three span prestressed concrete type, is one of those. The piers were given special consideration to avoid monotony.

Design

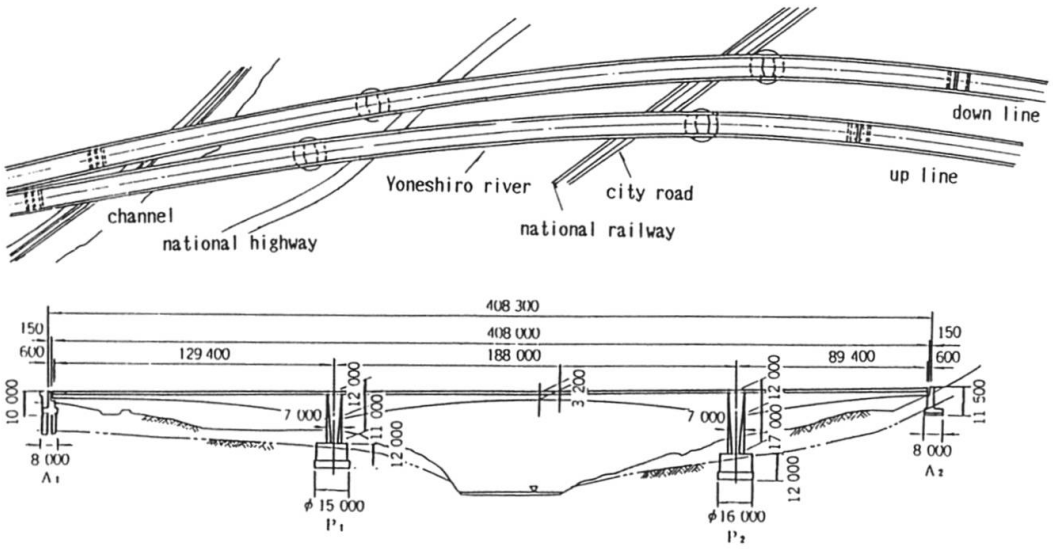
Since the maximum span is 188 meters long, a design cross sectional force due to dead load is 91 percent of the total. A possibly advantageous cross section was determined in order to reduce the weight. The section, a trapezoidal box, has a depth of 12 meters at the pier head and 3.2 meters at the center. The girder depth varies according to a sine curve. The minimum thickness of the bridge deck is 30 centimeters.

Piers P1 and P2 were not so flexible that the center-hinge was avoidable. An replaceable surface-to-surface touch system was applied to the center-hinge for easy rotation and small abrasion.

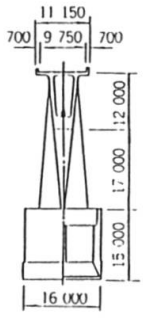
As foundation type for P1 and P2, open caissons with horizontal resistance were adopted in order to withstand a maximum 18000 ton-meter overturning moment at limited sites (15 m × 15 m). The vertical soil bearing power was determined to be 150 ton/m^2 during normal time according to extensive ground survey.

Erection and construction

The caissons were sunk into the rock using power-limited blasting in order to avoid an excessive vibration to the railway and highway. After the installation, grouting was carried out around the caisson to ensure the bearing power of the ground.



Sideview (down line)

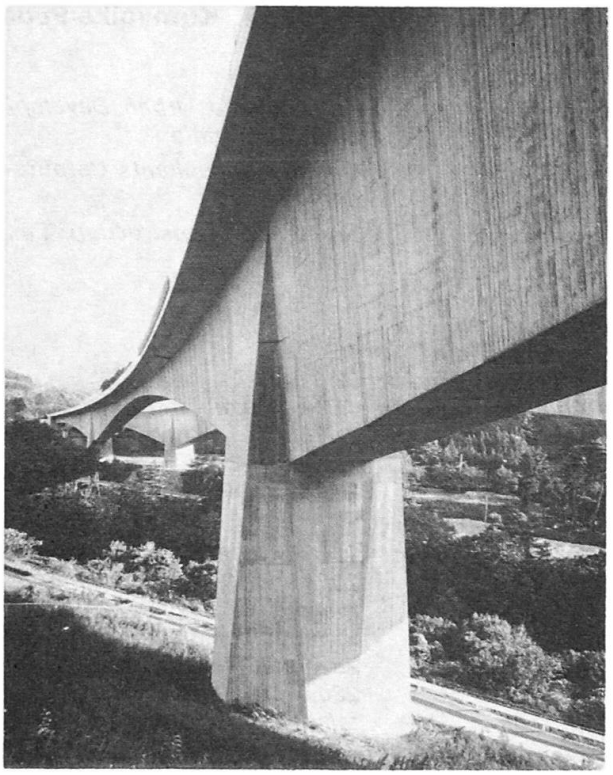


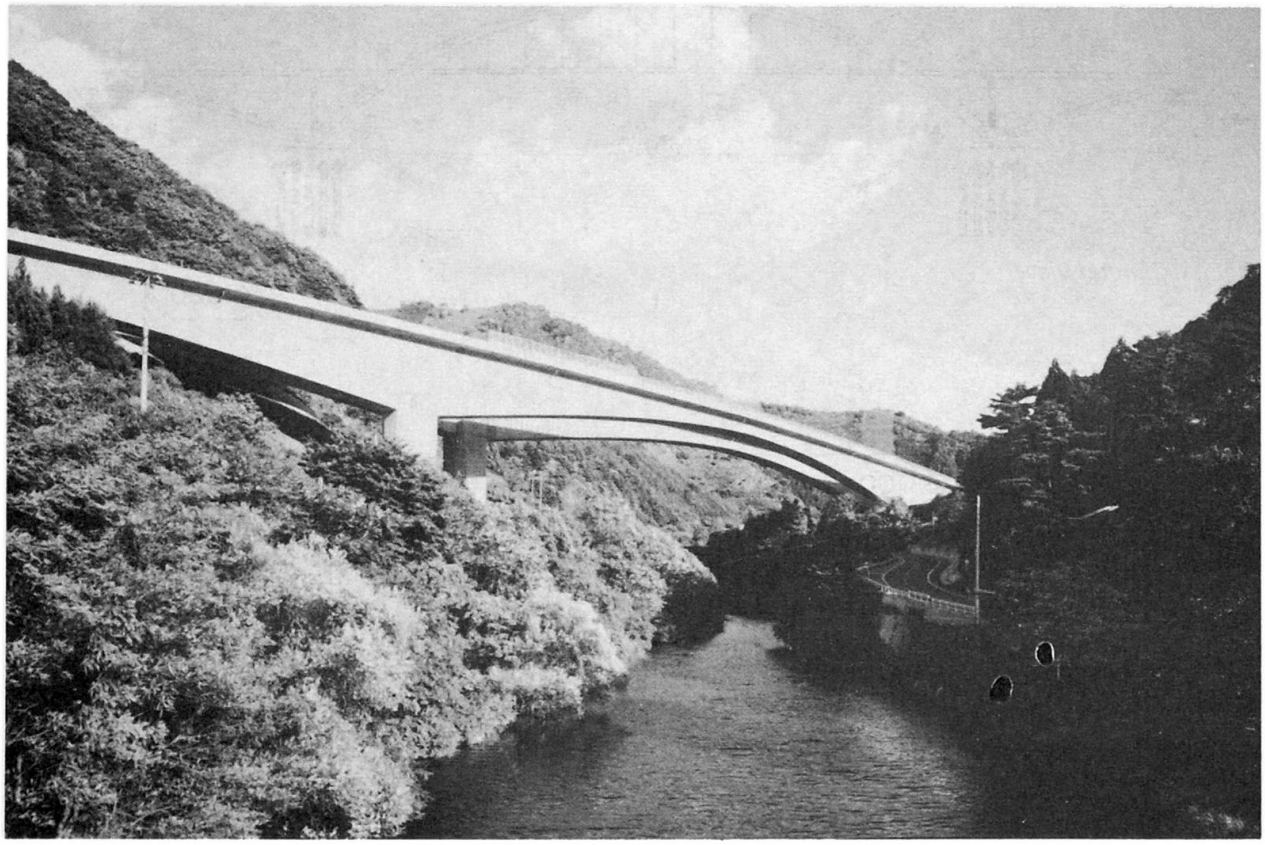
up line (P2)

The balanced cantilever method by traveller with movable forms was applied to the construction of the superstructure. A segment length is from 2.5 to 5 meters. High rapid hardening cement was mainly used for the design standard strength of concrete 400 kg/cm^2, while normal cement was used for the bottom slab thicker than 1 meter to avoid temperature cracks.

The segments were prestressed three days after pouring the concrete. Since the center-hinge was installed in this bridge, the camber during and after the construction was calculated as accurately as possible.

(T. Kadotani)





Views of the bridge