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Autor: Nakashima, Eiji / Sakate, Michiaki

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NIHON DORO KODAN

J APAN
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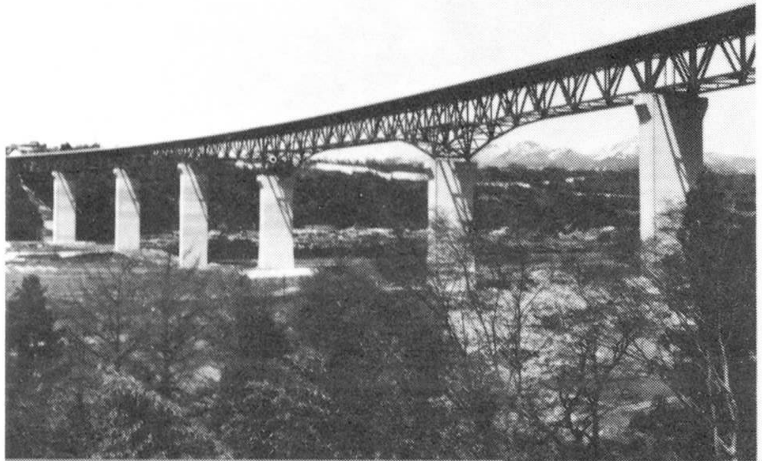
C ORPORATION

QUALITY ASSURANCE OF BRIDGE CONSTRUCTION WORKS AT NIHON DORO KODAN



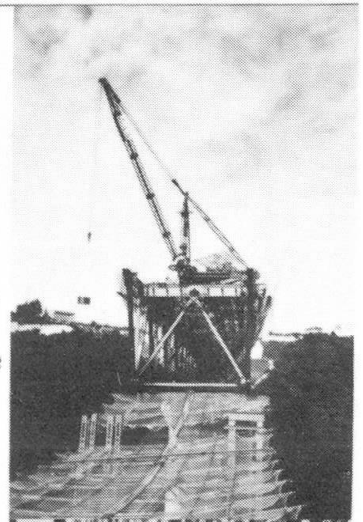
KATASHINA - RIVER BRIDGE

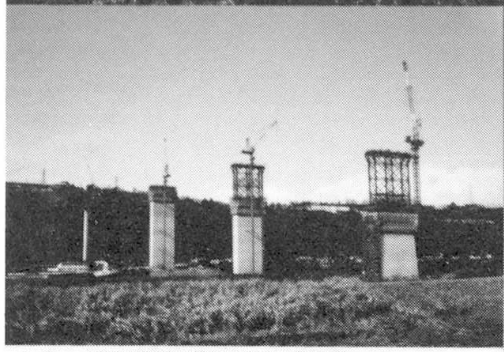
◀1.

Bridge length: 1033.85m
Span: (74.5+104.3+83.5)+(116.9+168.85+116.9)+(116.9+130.0+116.9)m
Width: 20.0m
Girder depth: 14.0m
Steel weight of superstructure: 9963t

CANTILEVER ERECTION BY TRAVELLING CRANE 2.▶

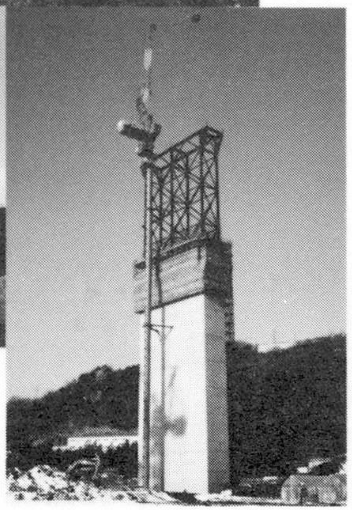
Superstructure was erected by travelling crane cantilever method from both abutments.
In order to absorb elastic and temperatural deflections during erection, temporary pedestal frames with sliding surface were employed on piers.





▲3. CONSTRUCTION OF HIGH PIERS

High piers were constructed by tower cranes and self-climbing forms. The highest pier is 69.4m. Seismic shaking test was conducted after the completion of piers.

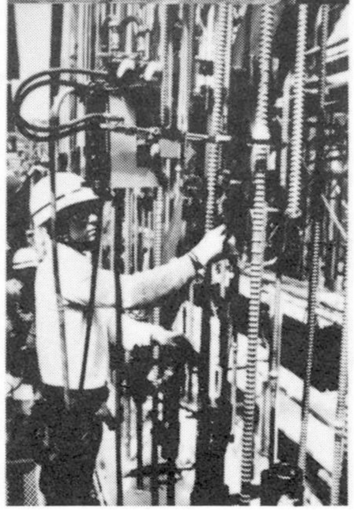


◀4. INSTALLATION OF STEEL

Reinforcing steel block was installed by tower crane. Both steel and bars were used as reinforcement of piers in order to assure ultimate strength and execution efficiency.

AUTOMATIC GAS-PRESSURE WELDING 5.▶

Automatic gas-pressure welding for reinforcing bars was employed in order to assure quality and execution efficiency. Ultrasonic inspection was used to test the quality of the joints.



Quality Assurance of Bridge Construction Works at Nihon Doro Kodan

Eiji NAKASHIMA
Head of Struct. Eng. Sect.
Nihon Doro Kodan
Tokyo, Japan

Michiaki SAKATE
Deputy Head of Struct. Eng. Sect.
Nihon Doro Kodan
Tokyo, Japan

1. Introduction

Nihon Doro Kodan (Japan Highway Public Corporation) has constructed about 3,700km length of expressways all over Japan until now and been operating the constructed expressways. Moreover, it is constructing or surveying about 2,000km length expressways at present.

As more than 70% of Japanese land is mountaneous, high technology is required in bridge construction. High piered bridges of the Kan'etu Expressway , which were granted Tanaka Award (Award for Bridges) of 1985 from Japan Society of Civil Engineering, are a good example of this. The bridges were constructed over various technical difficulties.

In this paper, we will introduce concept and method of Nihon Doro Kodan's bridge quality assurance as an owner when the construction works are contracted.

2. Standard for quality assurance

Nihon Doro Kodan specifies the following quality standards and mannuals for quality control relating to bridge construction works.

(Material and Construction)

a. Test Mannual for Construction Control

b. Standards of Material Application

c. Painting Standards for Steel Bridges

d. Execution Instruction for Arc Stud Dowel Welding

e. Standards for Expansion Joint of Bridges

f. Standards for Non-Shrink Mortar

(Supervising and Inspection)

a. Mannual for Supervising

b. Inspection Standards for Structures

All of these standards are meant for practical execution of contents which are stated in the contract document, the standard specification and the design mannual.

3. Methods for quality assurance

The difficulty of bridge construction works is that it is not easy to reform the completed structures. It is crucial to decide clearly how far the owner attend and inspect during construction, how far the owner submit the quality control to the contracter, namely, the roles of the two. Moreover, the roles should be reconsidered as time passes.

The current basic concept of Nihon Doro Kodan for quality assurance is that the assurance should be achieved through the approval, direction, attendance, test and inspection by the owner.

Materials used in our bridge construction are generally those which are standardized by Japanese Industrial Standards, but for non-standardized materials, Nihon Doro Kodan specifies its own quality standards. In such a case, material tests are carried out under the attendance of the owner.

Construction work is executed after the approval of the execution plan which is submitted by the contracter. In all stages of the construction work, Nihon Doro Kodan gives necessary directions to the contracter. Daily and periodic quality control tests specified by Nihon Doro Kodan are carried out on the contracter's responsibility and, if necessary, they are attended by the owner.

4. An example of quality assurance

The three bridges of Katashina-river, Nagaigawa-river and Numao-river have the largest scale among bridges which have been built in mountaneous areas of Japan.

Therefore, from the planning stage, an committee on their design and construction was established and various analysises were executed mainly as to their structure type and aseismicity for three years.

As a result, steel reinforced concrete hollow flexible structures with box-sections were adopted for high piers. Two metal bridges, Katashina-river and Numao-river, were decided to be types with multi-fixed support on high piers in order to assure aseismicity. On the contrary, Nagai-river bridge adopted elastomeric bearings which transmit seismic horizontal force of 4,000 ton to an abutment.

Based upon the recommendation of the committee, various dynamic analysises and shaking tests of 1/100 scale model, a completed pier and the whole structure were executed in order to verify the the design procedure.

On the construction side, automatic ascending forms with scaffoldings were newly developed. Placement of concrete more than 80m high above the ground level, which had not been achieved before, was done by specially modified concrete pumps. Moreover, for numerous large-diameter reinforcing bar joints, new methods such as automatic gas welding were developed.

In the case of Numao-river bridge, the whole girder of 600m was continuously erected by lauching girder with computer-aided center control system and after that the entire girder of 3,000 ton was transformed transversellly. This method was adopted due to the height of the erection site and lack of the space.