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Autor: Inokuma, Yasuo

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Planning of Steel Truss Web Prestressed Concrete Bridge

Yasuo INOKUMA
Chief Engineer
Japan Highway Public Corporation
Shizuoka, JAPAN

Summary
The Second Tomei Expressway is a new expressway with the length of 320 kilometers linking Tokyo and Nagoya. As one of the new bridge types, a steel truss web prestressed concrete bridge will be constructed. In this paper structural characteristics of this bridge is stated. Construction of the substructure will be starting from 1997.

1. Introduction

The Second Tomei Expressway is a new expressway with the length of 320 kilometers linking Tokyo and Nagoya. A section of the expressway in Shizuoka Prefecture, located about the center between Tokyo and Nagoya, runs through mountainous area. The section has the mainline length of 134 kilometers. About 33 % of the total section length, namely 44.3 kilometers, will be bridges and viaducts. As many bridges and viaducts should be constructed, various new structure will be adopted. One of new type of structures is a steel truss web prestressed concrete bridge.

2. Purpose

The purposes of adopting steel truss web prestressed concrete bridge is as follows:

i) To have a rational composite structure by utilizing material properties of steel and concrete;
ii) To have a rational combination of superstructure and substructure by decreasing weight of superstructure and width of bottom slab;
iii) To have a structure type, even with noise barriers, that gives less impression of massiveness.

3. Structure

Two unit of the steel truss web prestressed concrete bridge will be constructed. One is named the Sarutagawa Bridge and the other is named the Tomoegawa Bridge. The Sarutagawa Bridge has the total length of 625 meters and the maximum span length of 110 meters. The Tomoegawa Bridge has the total length of 478 meters and the maximum span length of 119 meters. The highest piers of the both bridges are 72 meters and 69 meters, respectively. The effective width of the both bridges are 16.5 meters.

Main characteristics of this structure are as follows:

i) The upper and bottom slabs are cast-situ concrete constructed by cantilever erection method;

ii) Section of truss members and span of upper slab are decreased by adopting 4-plane main truss structure;

iii) Fabrication cost of truss members is decreased by using box shape steels;

iv) Solid concrete section is adopted at supports;

v) Prestress during cantilever erection is given by prestressing steel arranged in upper slab and prestress that is necessary after completion of the girder is given by outer cables;

vi) Compared with a conventional 1-box prestressed concrete girder, weight of the girder and the total dead load become about 86% and 88% respectively.

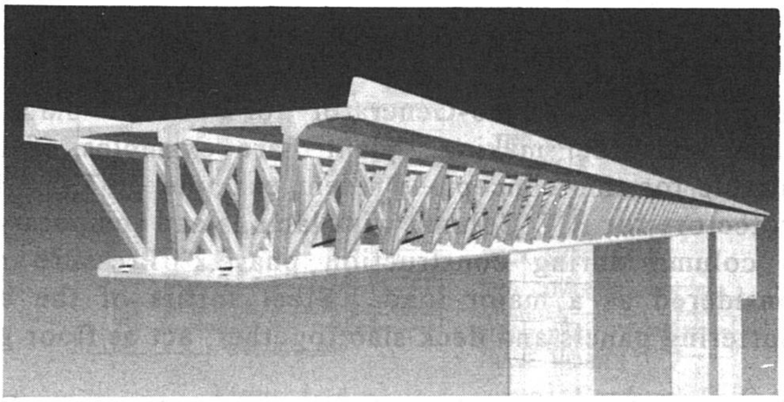

Fig. 1 Cross Section

Structural details of connecting panels are one of the important points of this structure. It is required that panels can be connected easily between concrete blocks. It is also required that the panels can absorb errors during cantilever erection. Various types of connecting panels were compared and the type with cast iron cones is proposed.

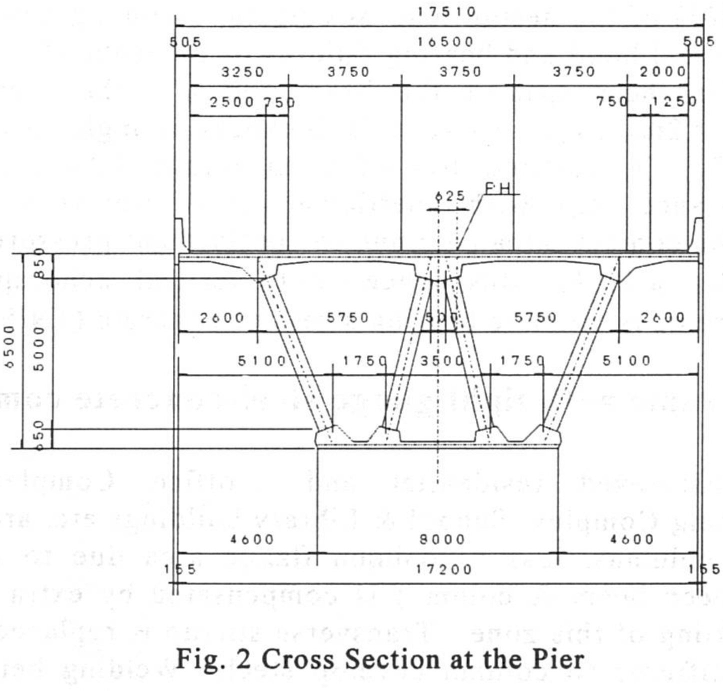

Fig. 2 Cross Section at the Pier

The upper slab is supported discretely by top ends of the truss members. This support mechanism is different from the ordinary slab that is supported continuously by solid webs. Finite element analyses were done using a finite element model and design bending moments and shear forcesfor the upper slab were determined.

4. Conclusion

In this paper design concept of the steel truss web prestressed concrete bridge is introduced. Construction of the substructure will be starting from 1997 and construction of the superstructure will be starting from 1999.