Construction of a Fin-Back Bridge by Cantilever Erection Method Using Launching Girder — Kakamigahara Bridge —

移動架設桁を用いたフィンバック橋の施工
— 各務原大橋 —


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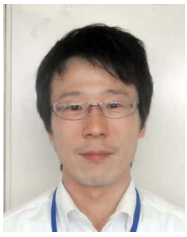
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Synopsis

Kakamigahara Bridge (**Fig.1**) is a 10-span continuous fin-back prestressed concrete bridge over Kiso river and a part of Nakakoami line connecting Jogo-cho and Kawashimakoami-machi in Kakamigahara city.
The cross section of the main girder is characteristic double cell girder with fin-back structure using many curve surfaces.
To achieve an early service for traffic, the cantilever method using the launching girder system operable even during flood season was selected.
This paper describes about the construction especially on these features.

Structural Data

Structure: 10-span continuous fin-back bridge
Bridge Length: 594.0m
Span: 54.9m + 8@60.0m + 55.9m
Width: driveway 7.5 - 10.5m sidewalk 3.0 - 5.0m
Owner: Kakamigahara city
Contractor: Shimizu/Maeda Joint Venture
Construction Period (superstructure): Jul. 2010 - Mar. 2013
Location: Kakamigahara city, Gifu prefecture

1. Introduction

After Kakamigahara city's born by the merger of


Fig.1 Over view

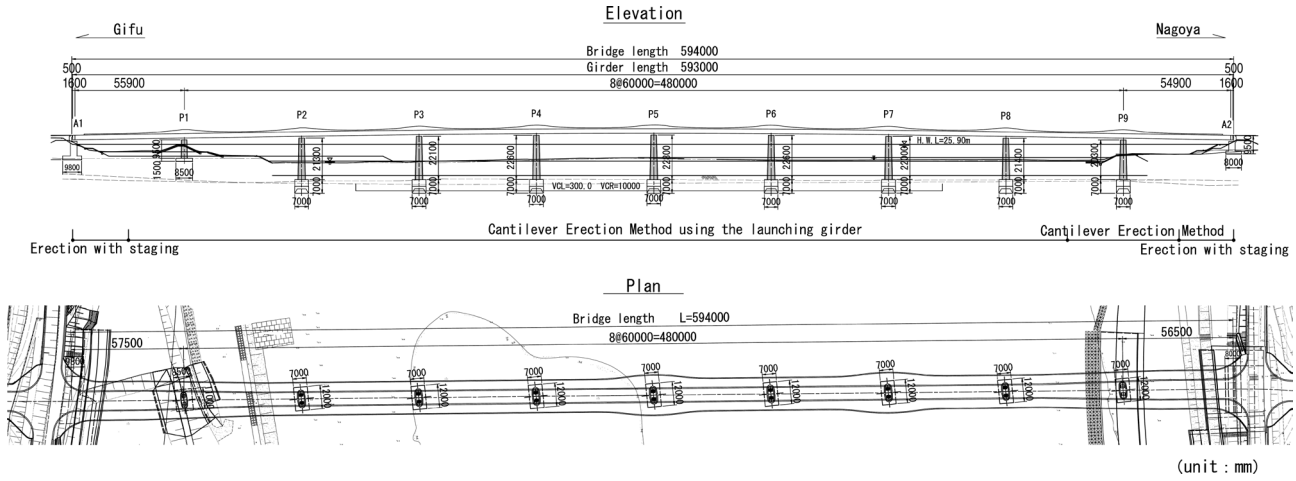

Fig.2 General view

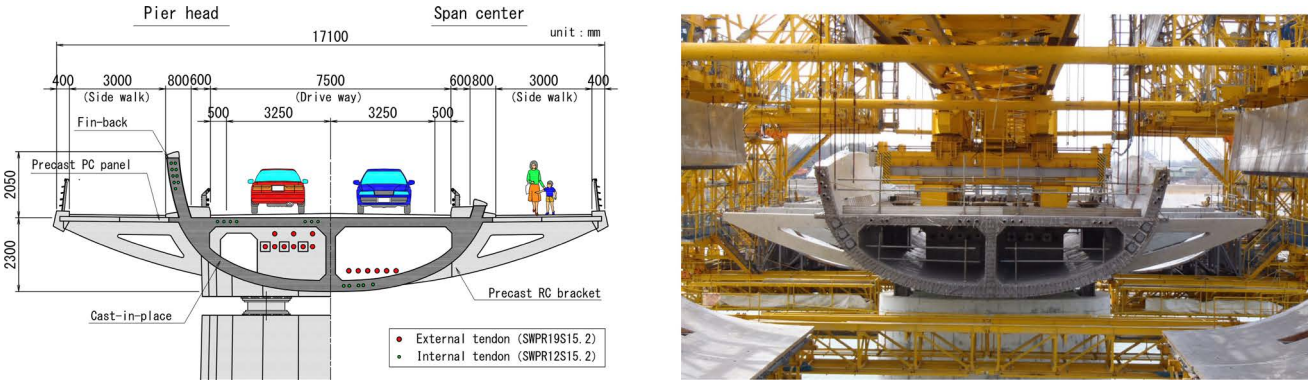

Fig.3 Cross section of main girder

former Kakamigahara city and Kawashima town on November 1st, 2004, Kakamigahara city devised the project to build Nakakoami Line including Kakamigahara bridge (approximately 2.6-km long, Jogo-cho to Kawashimakoami-machi in Kakamigahara city) to relieve traffic congestion and expand the exchange between people in both regions.

To evaluate the bridge design, the planning committee which includes the third party experts was set up. Based on themes suggested by the committee, "the simple and modest appearance that's harmonious with the great landscape around Kiso River, and friendly bridge people can walk enjoying great green and water", the 10-span continuous fin-back bridge was adopted.

So Kakamigahara bridge was completed for 10-span continuous fin-back bridge over Kiso river with 594m length. General view is shown in **Fig.2**, main girder cross section in **Fig.3**.

2. The feature of this bridge

(1) Unique main girder section with fin-back

This bridge is designed to have gentle curves and harmonious with surrounding mountainous view. The section is double cell girder with fin-back using a lot of curved surface and the driveway is made of cast-in-place concrete and sidewalk is made of precast RC brackets and PC panels.

(2) Method of short construction period

To shorten the construction period, the cantilever erection method using the launching girder operable even during flood season was selected.

This method uses the formwork system hanging from the launching girder. The equipments and workers are supplied through bridges already constructed and the launching girder, so the temporary jetty isn't needed.

(3) Bridge accessory

This bridge has unique design having benches and newel made of natural stone, cap stone and curb stone made of gray granite. And also, illumination under the girder and fin-back by LED light is setup.

3. Cantilever erection method using the launching girder

(1) Problem of construction

Cantilever erection method using the launching girder was selected from the design stage. In design , erection girder of box type was selected, but in construction, erection girder of truss type (P&Z cantilever erection system)was selected.

Because the construction starts from one-side of the river, to reduce the time for constructing a unit was a key in the system.

And also, erection girder was supported by support

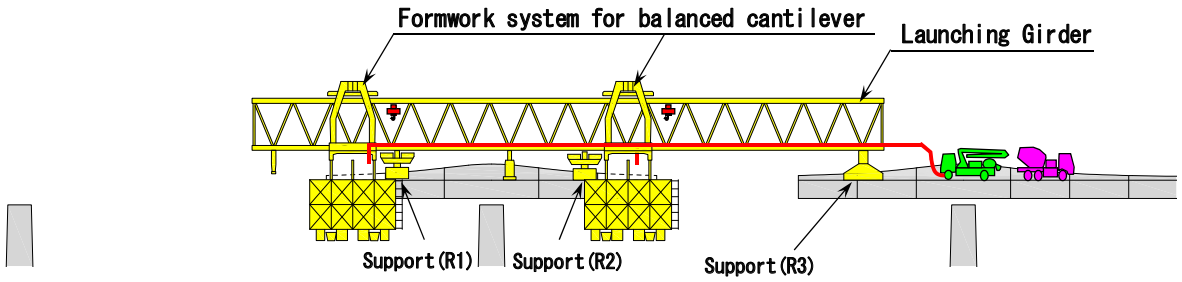

Fig.4 P&Z cantilever erection system (small system)

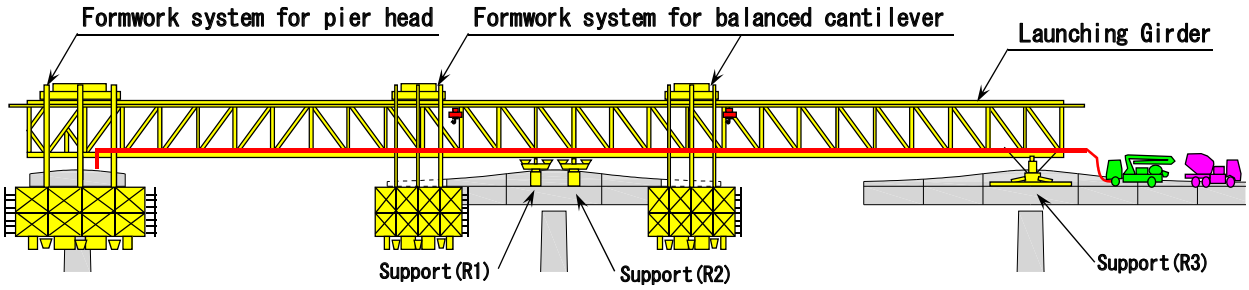

Fig.5 P&Z cantilever erection system (large system)

set on bridge surface. So, total 1000t weight system worked to the bridge keeping girder height low as support reaction force. For these reason, the system of support method and construction process which avoids stress intensity was developed.

(2) Measure to solve problems

1) Measure to shorten the construction period

This bridge is a 10-span continuous fin-back bridge having 60m maximum span length. In a conventional P&Z system generally used small system (**Fig.4**, erection girder length about 80m) and constructed part of cantilever and pier head one after the other. But this method could satisfy the prescribed construction period, so the larger system(**Fig.5**, erection span length 133m) was selected and construction of part of cantilever and pier head was done at the same time. So add to the general cantilever formwork system, the system especially for pier head was developed and used.

2) Measure towards system weight

Support reaction force of the P&Z system should add the weight of concrete block to the weight of the system itself. When the whole system moved to next span, the reaction force worked to the main girder besides pier head. On this occasion the measure not to make a crack in main girder with slender thickness was required.

And also, the section of main girder has half elliptical shape double cell girder with fin-back. A general box girder section has clear load resistance system such as slab work for bending moment and web work for shearing force. On the other hand, in the section of this bridge, the force in each member was complicated and it was expected that 3D deformation including torsion moment would occur. To cope with

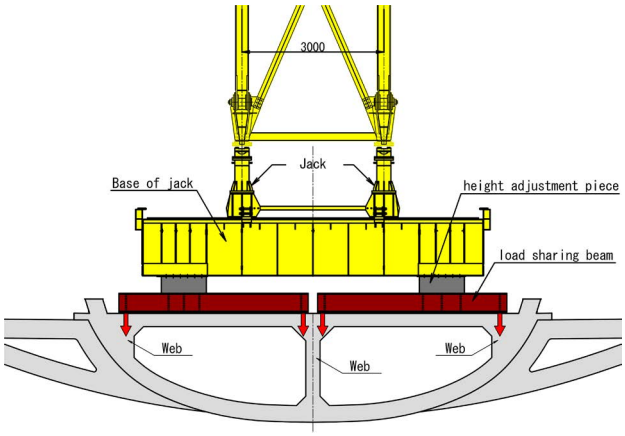

Fig.6 Cross section of support

these conditions, 3D FEM analysis was conducted considering construction stage. The result made clear the mechanism of deformation and stress by various working loads, so the countermeasures such as the change of construction process , the change of location of loading, and the supplement of reinforcing steel bar were applied.

When the erection girder moved to the next span, it was expected that the excessive stress would occur around working position. So a beam sharing load to transmit load directly to the web was set (**Fig.6**).

4. Construction

After 1 – 3 BL work and pier head work finished, P&Z erection system was transported to the next span.

At the transportation, the loading working main girder changed a lot as the change of support condition of the erection girder.

So the operation was advanced very carefully as

Fig.7 Cantilever erection method using launching girder

comparing design and the measured. As a result, the harmful crack didn't appear in main girder. **Fig.7** shows the situation of cantilever erection.

5. Conclusion

The Kakamigahara Bridge (**Fig.8**) was opened for traffic in March 24th, 2013. The bridge adapts itself to original scenery of Kiso river and provides the space of the rest to the citizen. It becomes a new symbol of Kakamigahara city.

Finally, thank you for sincere support and leadership from Kakamigahara city and all concerned.

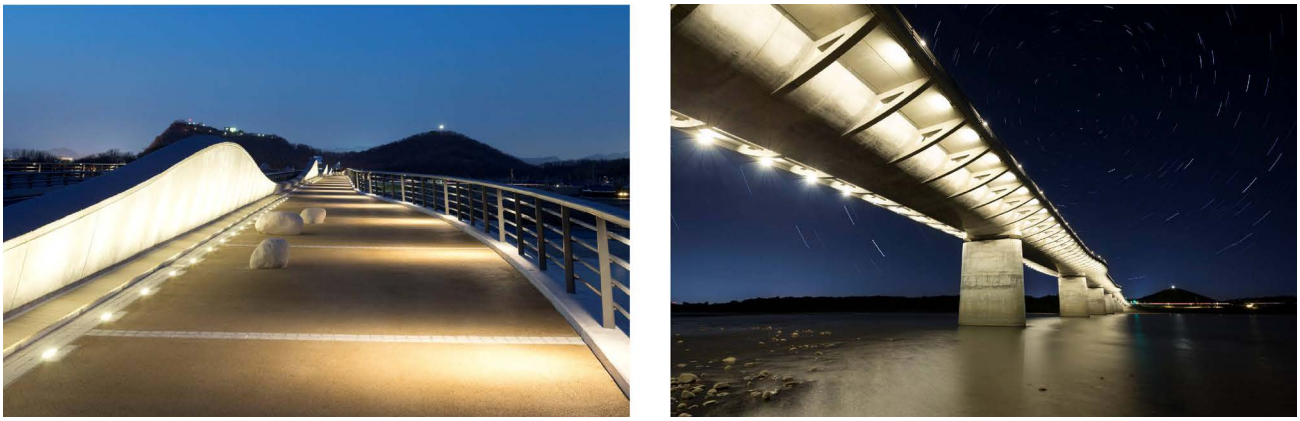

Fig.8 Bridge illumination

概　要

各務原大橋は，各務原市上戸町と川島小網町を結ぶ那加小網線のうち，一級河川木曽川を渡る橋長594m のPC10径間連続フィンバック橋である。本橋の主桁断面は，曲線を多用したフィンバックを有する特徴的な 2 室箱桁断面となっている。

本橋は，早期の開通を実現するため，出水期も施工可能な移動架設桁を用いた張出し架設工法が採用されるなど，短工期施工を意識した設計がなされていた。

本稿では，各務原大橋上部工工事における架設工法に対する事前検討や施工の概要について報告する。