Reference Details:

Koinumarukawa**Owner** Japan Highway Public Corporation, Japan +++ **Basic Design** NEWJEC Inc., Japan +++ **Detail Design and Contractor** Sumitomo Construction Co. Ltd., Kawada Industries Inc., both Japan Shimoda**Owner** Chubu Branch, Japan Highway Public Corporation (JH), Japan +++ **Preliminary Design** Toyo Giken Consultant Co. Ltd., Japan +++ **Final Design and Construction** Kajima Corporation, Japan

DSI Services (Koinumarukawa and Shimoda) Supply of Strand Tendons type MC 19 Ø 0.6"and 27 Ø 0.6" with epoxy-coated strands.

Koinumarukawa and Shimoda Bridge in Japan

Innovative free cantilever construction method using hollow box girders with webs made of corrugated steel

The Koinumarukawa and Shimoda Bridges are recent examples of bridges in Japan, where the webs of the hollow box girders are no longer made of concrete, but of corrugated steel. Their shape is similar to the shape of sheet pile walls. Because these corrugated steel plates have to transfer the shear loads of the bridge girder to the piers, they are welded to each other, in a distinct phase of the free cantilever construction cycle, along the joints of the girder segments.

By using this method, the linear weight of the girder is reduced, with a threefold advantage over the traditional concept:

- lengths of the bridge segments can be increased,
- bridge segment lengths can be standardized because the weight increase of the segments close to the piers remains moderate,
- number of bridge piers may be reduced as a result of the flexibility obtained by the ability to increase the length of the spans.

This result is a considerable potential for savings in both construction time and cost.

When designing the Koinumarukawa Bridge, the engineers wanted to avoid any interference of construction work with post-tensioning ducts and tendons placed in both the deck and bottom slabs of the girder. Therefore,the decision was made to use only external tendons for the entire structure. For that reason, all cantilever tendons in each girder segment had to be anchored on buttresses in the upper corners of the hollow box.

Since no sufficient experience existed concerning the concentrated load transfer into the composite girder segments, investigations were made both by finite element calculation (FEM)and by full-scale load tests on girder segment elements. The test results obtained when studying the complex load-bearing and deformation behaviour of the structure made it possible to determine the dimensions and the mild steel reinforcement of the girder zones in question.
For both of those innovative and technically interesting structures external DYWIDAG Tendons type MC 19 Ø 15.2 mm with epoxy-coated strands were used. The tendons were cement grouted only in the anchorage areas.

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