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2. Large-scale Bridges

The following are examples of large-scale bridges for the Tohoku and Joetsu Shinkansens.

The 2nd Abukumagawa Bridge

This bridge, constructed 5 km south of Koriyama Station, is a prestressed concrete bridge for the Tohoku Shinkansen.

As shown in Fig. 1, Fig. 3 and Photo 1, it is a 5-span continuous bridge of one-cell-box type supporting a double track. Each span is 105 m long which is among the longest in railway prestressed concrete bridges. Its total length is 526.5 m and it was erected by Dywidag Method (cantilever method).

The seismic effect of the super-structure on the substructure is so large that special devices, so-called "Stoppers", are installed at the tops of the piers and abutments in order to distribute the seismic force evenly to each of them (see Fig. 2).

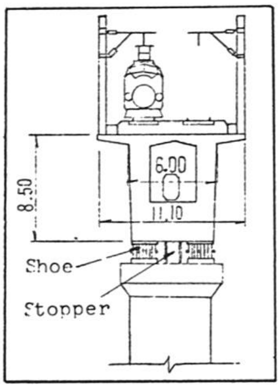

Fig. 1 Cross section

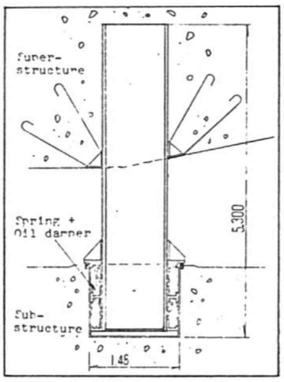

Fig. 2 Stopper

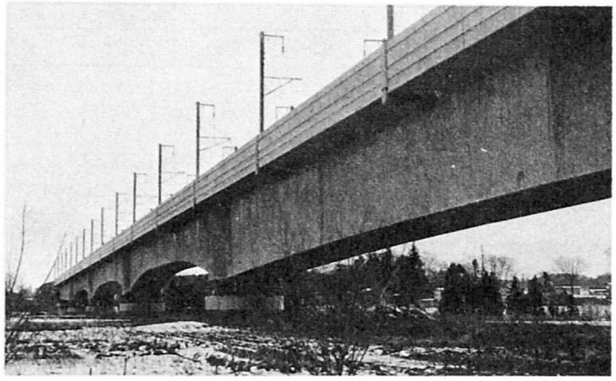

Photo 1 2nd Abukumagawa Bridge

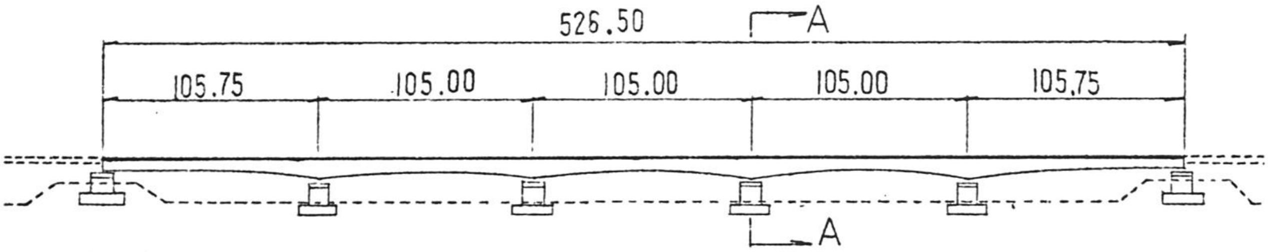

Fig. 3 Side view

The 2nd Okazato Viaduct

It is a prestressed concrete through-bridge for the Tohoku Shinkansen near Oyama Station. Its span is 61.4 m, which is the longest span of the prestressed concrete through-type railway bridges. As shown in Fig. 4 and 5, it is a simply supported structure with two main girders for a double track.

Concrete of ultimate design strength of 450 kg/cm2 was applied for reduction of its dead weight. The dimensions of the piers were so severely restricted that concrete structures reinforced by steel-frames were adopted for them.

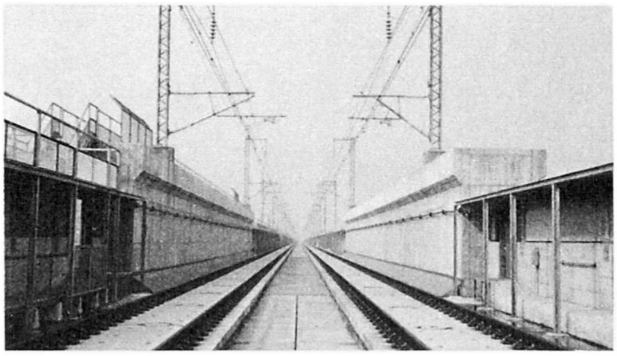

Photo 2 2nd Okazato Bridge

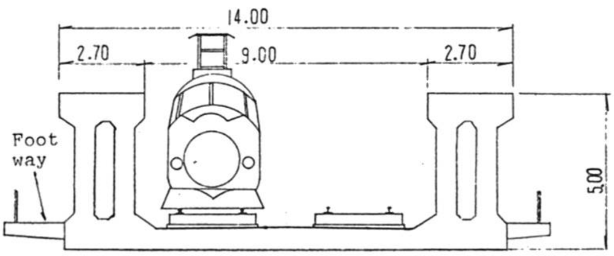

Fig. 4 Cross section

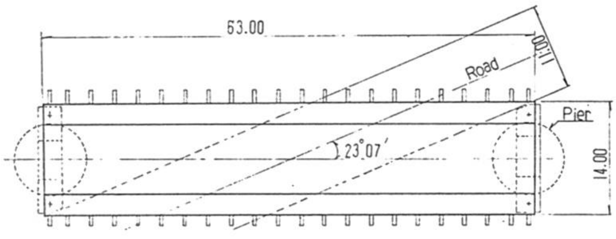

Fig. 5 Plan

The Yamazaki Bridge

Steel-concrete composite girder bridges are used these days as low-noise railway bridges in preference to steel bridges. They are economical structures, too, in such cases where bridges are to be erected over existing railways or highways with heavy traffic and to be constructed on weak ground.

The Yamazaki Bridge, for the Tohoku Shinkansen, 76.0 meters long, is the longest composite girder bridge in J.N.R. A large span length and high piers were required, because it crosses another bridge for an express highway at an acute skew angle of 27 degrees.

The section of the bridge consists of one-box-cell for a double track use as shown in Fig. 6, and the steel to be used is SM 58 (its tensile strength is 58 kg/mm2). The steel plates are treated for damping of vibration as explained in chapter 12.

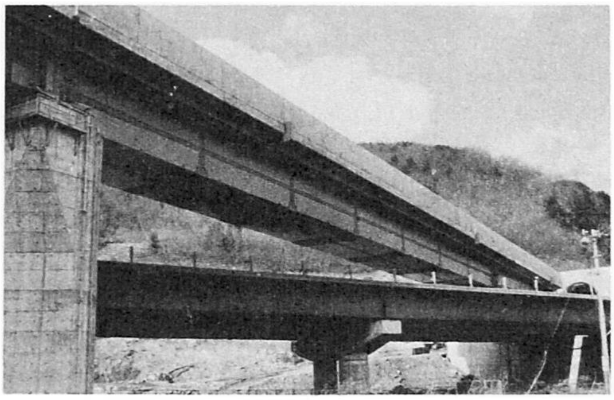

Photo 3 Yamazaki Bridge

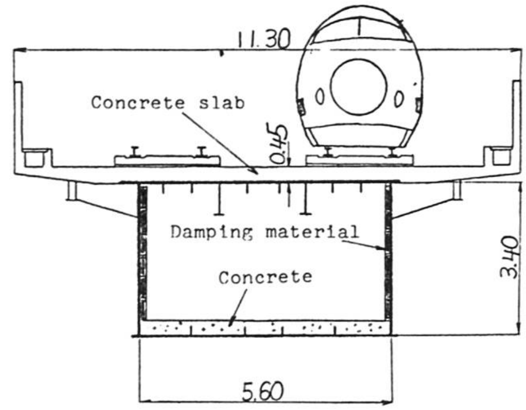

Fig. 6 Cross section

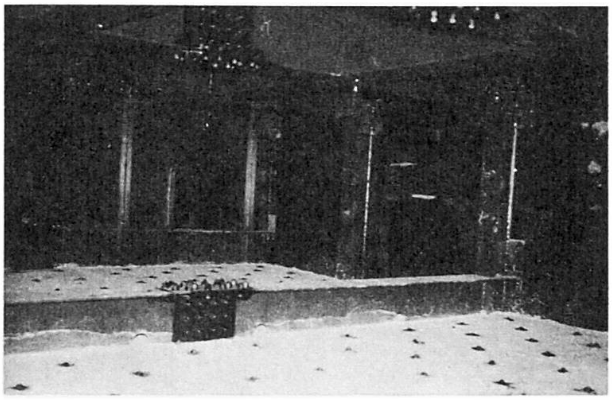

Photo 4 Inside of the box girder

The Akayagawa Bridge

The Akayagawa Bridge, consisting of 5 spans, was constructed for the Joetsu Shinkansen. As shown in Fig. 7, the total length is 298 m and the center span of 126 m is crossed by an arch structure which was erected by cantilevering from both sides. In this unique erection method a huge back stay composed of a prestressed concrete member which was stressed to as much as 4800 tons was installed diagonally between the top of the end pier of the arch and the bottom of the adjacent pier of the girder span. Then as the erection work progressed, high-strength steel bars were provided diagonally between the vertical members, forming a truss structure as shown in Photo 5. The control of tensioning these steel bars was very important and complicated. Finally the back stay and the steel bars were removed.

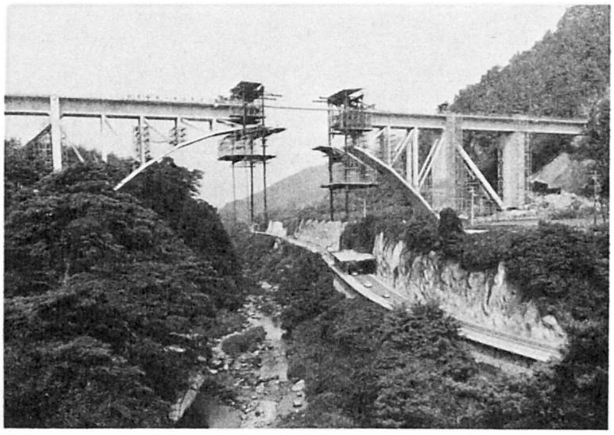

Photo 5 Akayagawa Bridge under construction

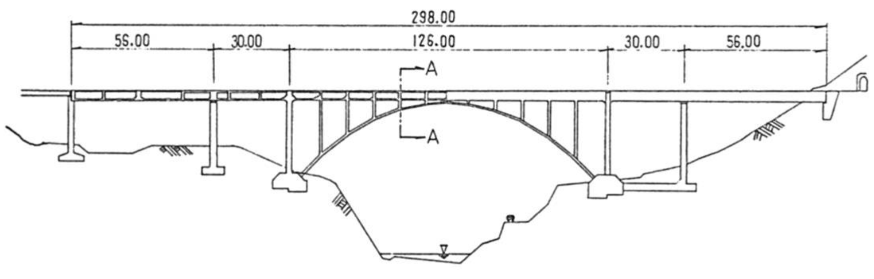

Fig. 7 Side view

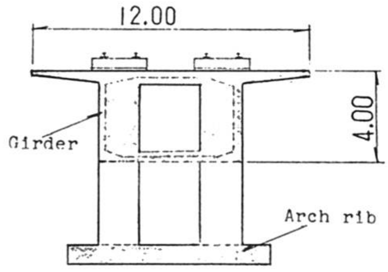

Fig. 8 Cross section (A-A)