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3. Special Bridges

The Tanigawa Bridge

As stated in chapter 11, the Joetsu Shinkansen passes through mountainous regions of heavy snowfall and snowslide. The Tozagawa Bridge and the Tanigawa Bridge were planned to be constructed over valleys between tunnels (see fig. 1 and Photo 1) and designed under a special consideration of hazard due to snow.

The structure consists of one large box in which a double track is laid, as shown in Fig. 2 (The Tanigawa Bridge), so that trains may be operated completely free from snowfall and snowslide.

The structure was designed as a deep beam because its span-depth ratio is as large as 3.4. In order to investigate its behaviour, a one-fortieth model made of acryloyl resin was statically and dynamically tested.

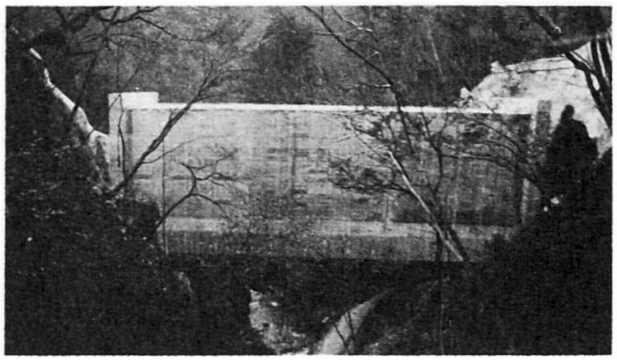

Photo 1 Tanigawa Bridge

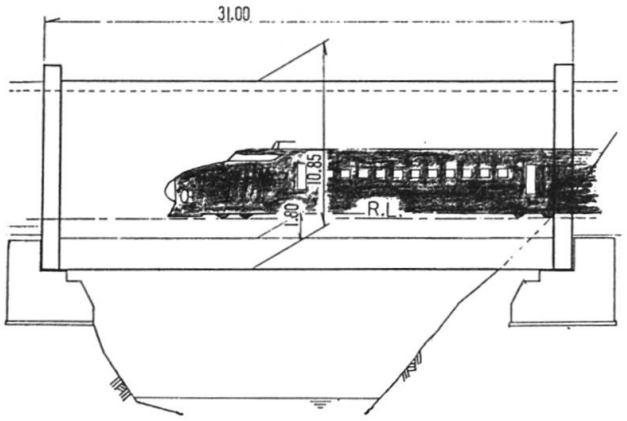

Fig. 1 Side view

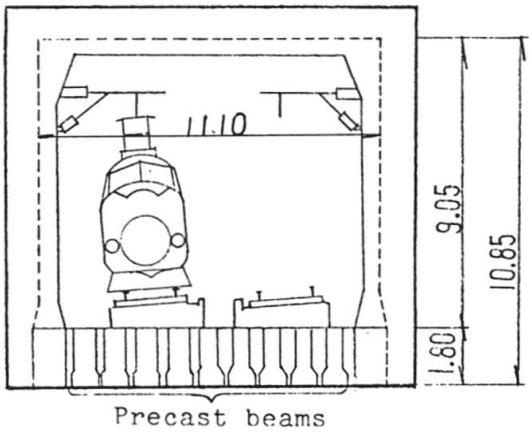

Fig. 2 Cross section

The Kanagase Bridge

As this bridge is to be constructed on extremely weak ground in a marshy area, there are possibilities of a large horizontal displacement of piers during and after earthquakes. A special consideration, therefore, has to be paid to the design of the bridge.

The shoes on the intermediate piers standing at intervals of 20 m support only the vertical load and are movable both in the transverse and longitudinal directions. Instead, the superstructure, a continuous prestressed concrete girder bridge, is provided with a great number of prestressing bars in both its outer girders (see Fig. 3), forming a 220 m long simple beam in a horizontal plane as a whole (see Fig. 4), which is supported by the abutments located at the ends and constructed on firm bedrock. The bridge is, accordingly, free from the horizontal displacement of the intermediate piers, so that the alignment of the rails may be well kept.

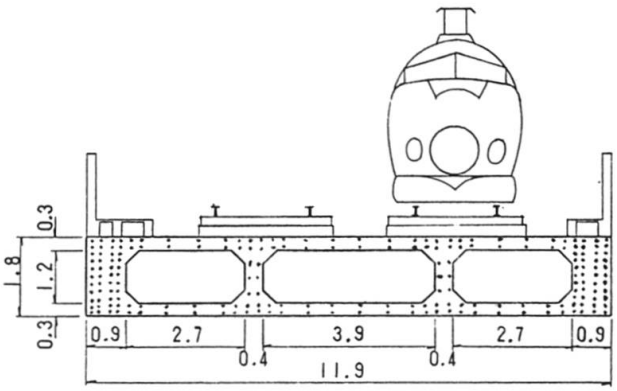

Fig. 3 Cross section

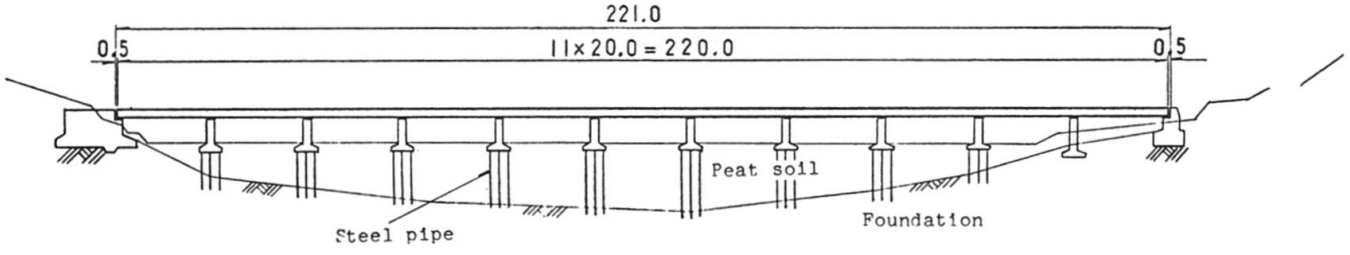

Fig. 4 Side view

The Aoyama Bridge

The Aoyama Bridge is a wall-type rigid frame structure for the Tohoku Shinkansen, crossing the existing Tohoku Main Line with an intersectional angle of 10 ^{o} in the north of Morioka Station (see Fig. 5 and Photo 2).

Firstly, the concrete walls were built on both sides of the conventional rail line. Then, the concrete for the upper slab to support the tracks for the Shinkansen was cast, using a form table which was supported by the side walls and movable on rails as shown in Fig. 6. Thus, on completion of the slab of 10 m in length in the longitudinal direction, the travelling form was moved to the next block. The same constructional procedure was repeated until the whole structure of 110 m in total length was completed.

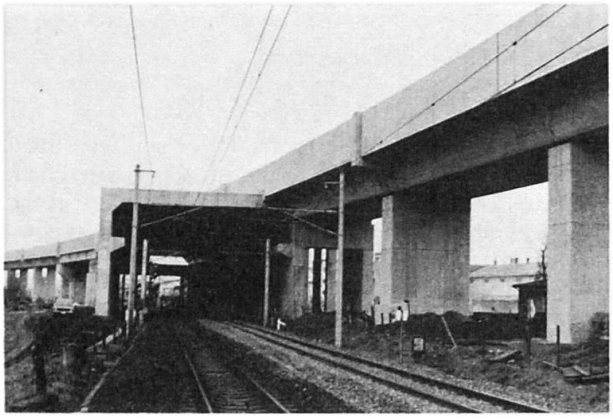

Photo 2 Aoyama Bridge

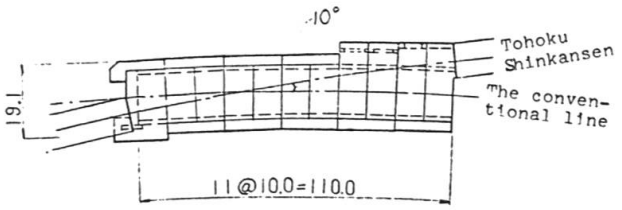

Fig. 5 Plan

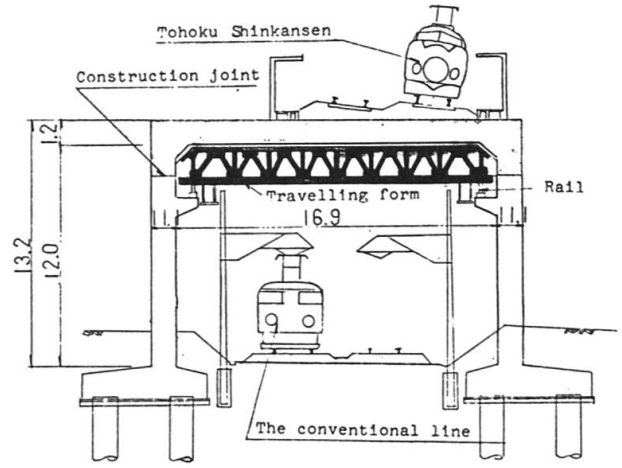

Fig. 6 Cross section

The Tonegawa Bridge

Continuous steel truss bridges with open floor were used extensively in the Tokaido Shinkansen, but such bridges were not commonly in use thereafter, because of the great noise generated during train passage through them. A new type of steel truss bridge was, however, developed for the newer Shinkansens.

The Tonegawa Bridge is one of the bridges of this type. The features of the bridge are as follows (see Fig. 7 and Photo 4).

It has concrete floor slabs which compositely act with the steel floor beams and stringers and which support the slab-type tracks. The steel floor beams and stringers are covered by concrete to damp their vibration, and also inverse-L-shaped walls are provided on both sides of the bridge to abate the noise. The end spans have additional under-covers for further reduction of noise, because there are residential areas in their vicinity.

Photo 3 Tonegawa Bridge

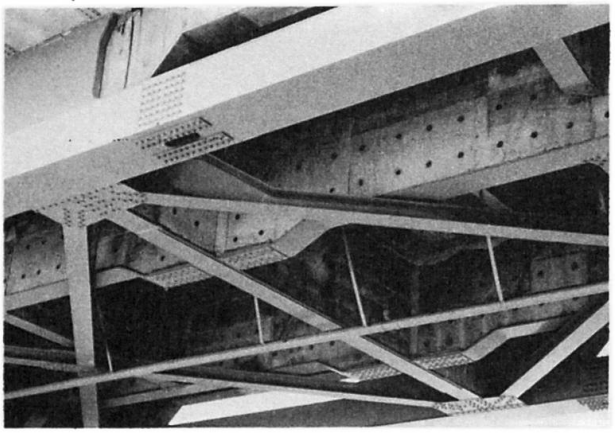

Photo 4 Steel floor system encased in concrete

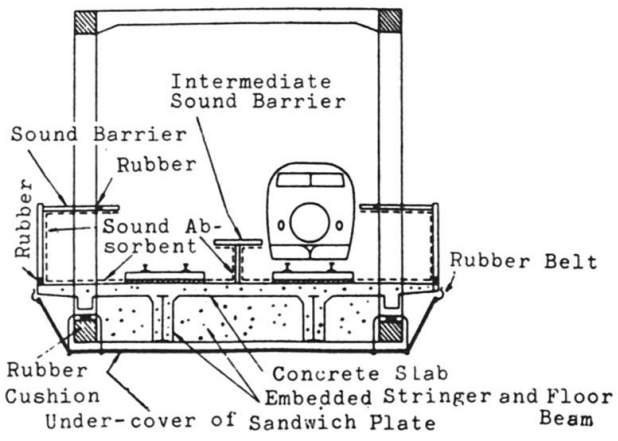

Fig. 7 Cross section