1. Overview

The Awa Shirasagi (White Egret) Ohashi Bridge is a steel road bridge that crosses the Yoshino River. This 1,291-meter-long bridge was constructed by Tokushima Prefecture to alleviate the chronic traffic congestion in the city of Tokushima and plays a central role as part of the Tokushima Eastern Loop Line.

The Yoshino River is the largest river in Shikoku region and flows from west to east. It is considered to be one of the three major rivers in Shikoku that frequently overflow their banks, and has been given the nickname Shikoku Saburo. The estuary area that includes the location where the bridge was constructed is a participant in the East Asian - Australasian Shorebird Site Network. The extensive tidal flats are the habitat for diverse wildlife that include the fiddler crab, and the area is an extremely important environment that serves as a stopping point and group wintering spot for migratory birds.

For this reason, in the bridge planning it was decided to avoid placing bridge piers in the tidal flat section (approximately 200 m) in order to minimize the burden placed on the precious tidal flat and habitat environment. In addition, the height of the main towers was reduced out of consideration for bird flight, and cables were placed in only a single plane, creating the world’s first “Cable Egret” truss system bridge. Many other techniques were employed for environmental considerations, and at the same time efforts were made to reduce costs.

■Bridge Specifications

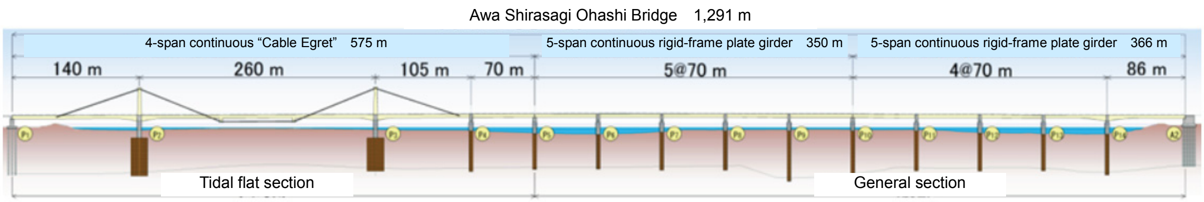
Bridge length: L=1,291 m Total width: W = 26.3-32.3 m

Bridge type

Tidal flat section: 4-span continuous “Cable Egret” plate girder bridge L=575.0 m

General section: 5-span continuous rigid-frame plate girder bridges (series of 2) L=716.0 m

Substructure	Wall type reinforced concrete bridge piers, wall type steel-reinforced concrete bridge piers, rigid-frame reinforced concrete bridge abutments
Foundation structure	Steel pipe sheet pile caisson foundation, inner-excavated steel composite concrete pile foundation



2. Features of the bridge

(1) Substructure

A steel pipe sheet pile well foundation was used as the foundation structure in the river. Of these foundations, the bridge piers with the exception of P2 and P3 in the tower base section were constructed using a method that would have low impact on the river environment, one that involved no riverbed excavation and did not require measures to deal with turbid water or waste soil disposal, and that was also flexible in the bridge axial direction and was therefore appropriate for a continuous rigid-frame structure built on soft ground. High strength joints, which have a larger diameter than ordinary joints and are filled with high strength mortar, were used for the joints between the partition wall sections. This was the first time that these joints had been used in Japan. They increase the shear capacity of the joint tenfold, creating a more rigid foundation and enabling the shape of the foundation to be made more compact. Barges were used for construction, and the burden on the river environment was reduced through the placement of temporary piers and other temporary structures.

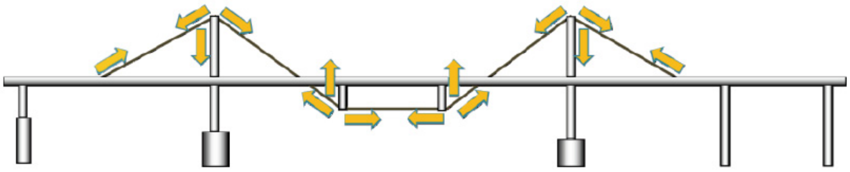
(2) Superstructure

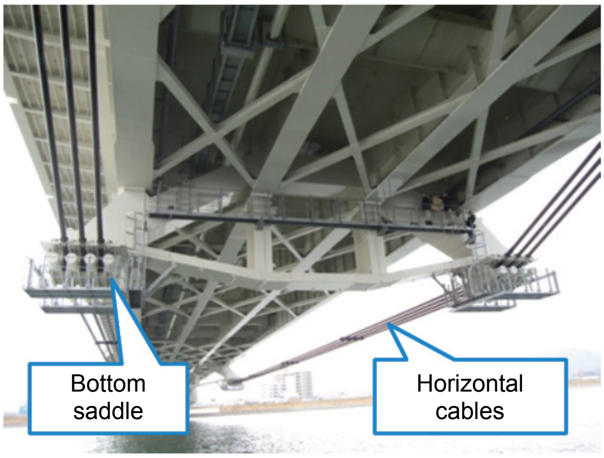
A composite rigid-frame structure that rigidly connects a small number of plate girders and the reinforced concrete piers was used for the superstructure. This increased earthquake-resisting performance and also reduced the cost of maintenance and so on.

For the tidal flat section, the world's first "Cable Egret" truss system, combining the properties of a cable-stayed bridge and a cable truss system, was adopted. Saddles and horizontal cables were placed beneath the girders in the center span, and the cable truss structure lifted the girders while at the same time lowering the anchorage points of the stay cables in order to give the cables a larger angle. This made it possible to reduce the height of the main towers and achieve a long center span length of 260 m with a small number of cables. In addition, three parallel cables were used for the stay cables and four parallel cables were used for the horizontal cables, and all of the cables were contained in a single plane out of consideration for bird flight.

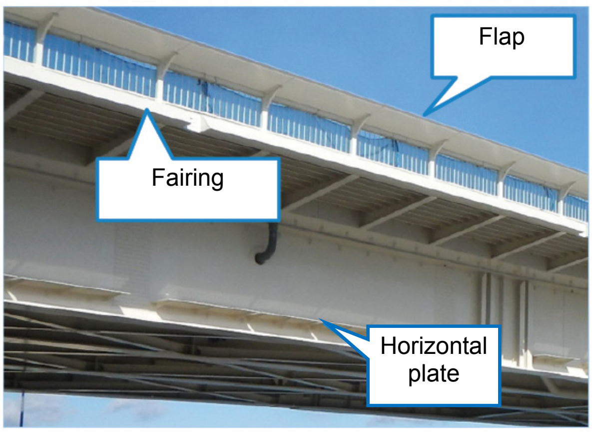
The location where the bridge was constructed is one that is routinely subjected to typhoons. For this reason, wind tunnel tests were conducted using a two-dimensional section model in order to develop measures to make the girders wind-resistant, and flaps, fairings and horizontal plates were provided. Based on wind tunnel tests using a model of the entire bridge, large lower lateral members were used, and the scope of installation was enlarged to ensure greater stability. Safety was also confirmed during the erection process. Following the completion of the erection process, a large shaking machine was used to conduct vibration tests on the actual bridge in order to confirm the appropriateness of the natural frequency and the attenuation rate.

As the potential for wake galloping in the cables was a concern, wind tunnel tests using an actual scale model were conducted, and the stay cables were provided with high-damping rubber dampers, while the horizontal cables were provided with helical wires and connecting fittings as a damping means.





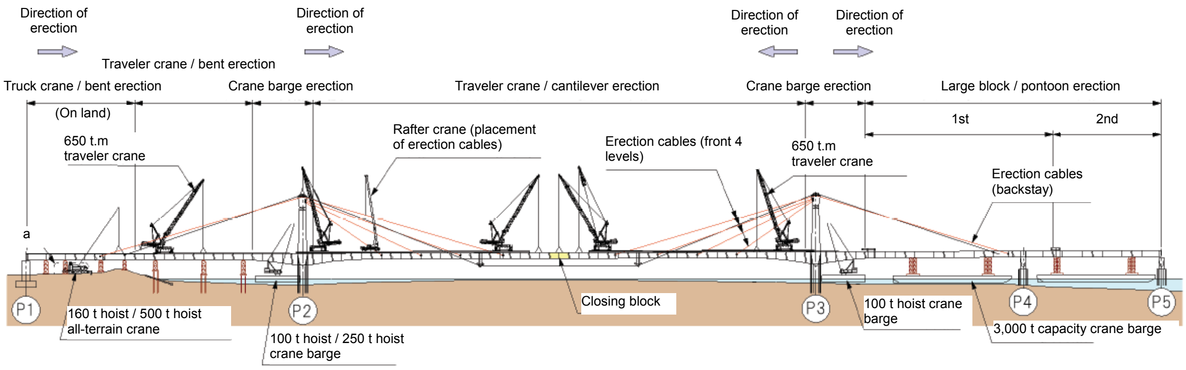
Field observations were conducted for a period of one year following completion in order to verify the appropriateness of these wind-resisting measures. No significant vibrations were observed.



For construction of the superstructure, most sections were constructed in a single operation through the use of barges. At locations where the water depth was shallow and barges were unable to enter, launching erection and cantilever erection were employed to minimize the impact on the river environment.

To erect the “Cable Egret” truss system, a combination of crane and bent erection and barge erection was used for the side spans. Once the main towers had been erected, the center span was constructed by means of diagonal suspension and cantilever erection using temporary cables and traveler cranes. After the closing block for the main girders had been put in place, the actual cables were put in place and the temporary cables were removed. Then the steel shell for the sandwich floor slab that would serve as the composite floor slab was laid and fill concrete was poured, and the steel floor slab for the pedestrian section was constructed.

Out of consideration for the creatures inhabiting the tidal flats, the lighting system has LEDs placed inside the bridge railing to ensure little light leakage.



3. Conclusion

The Awa Shirasagi Ohashi Bridge was planned in a way that resolved the serious issues of alleviating traffic congestion in a regional city and reducing the environmental burden associated with bridge construction. Construction began in 2005, and the bridge was completed and opened to traffic in April 2012. Congestion on roads in the area has been alleviated due to the opening of the bridge, and it is well-regarded by the residents of the prefecture as a new landmark of the Yoshino River.