



## Tatara Bridge Design as a Spectacular Landscape Element

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## Summary

Tatara Bridge, world-class class cable-stayed bridge, was to be constructed in an area of rich natural scenery. Thus, aesthetic design of the towers, cable alignment, pier and girder shape, color had to be carried out within sever structural constraints, including aerodynamic stability and economics. In this way, elegant structure which harmonized with natural scenery was realized.

**Keywords:** Aesthetic design, Harmony, Light and shadow, Symbolic elements, Towers, Cable alignment, Pier, Color, Aerodynamic stability.

## 1. Introduction

The Tatara Bridge is a world-class cable-stayed bridge with a main span of 890 meters, a total length of 1,480 meters, which was completed and opened to the public in 1999 (Fig.1). It forms part of the Nishi-Seto Expressway, the westernmost route of the Honshu-Shikoku Expressway.

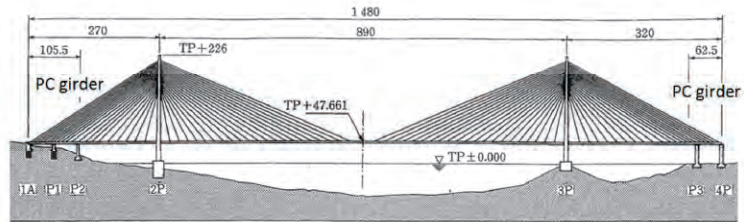


Fig. 1: General view of the Tatara Bridge

Although cable-stayed bridges have been built in a variety of structural types, when the span is as long as that of the Tatara Bridge, the structure is basically dictated by considerations of aerodynamic stability and structure. Within these limitations, studies were carried out on tower shape which plays an important role in aesthetic design, cable layout, shape of the bridge piers and color with the aim of developing a spectacular landscape element.

## 2. Design Themes of the Aesthetic Study

Since the Tatara Bridge was to be constructed in an area of rich natural scenery characterized by scattered islets as representative of the Seto-Inland Sea, particular attention was paid to harmony with the site surrounding. Taking into consideration this environment and also the expected socioeconomic effects of the bridge on the region, landscape design themes were developed for the design. It was considered that the themes of “light and shadow,” “futuristic,” “leap,” and “sense of existence” shown below were most suitable world-class cable-stayed bridge.

## 3. Towers

Since the bridge has two cable planes, the possible skeleton designs for the towers are the A-type, inverted Y-type, rigid frame type, and twin column type. So wind stability and securing structural

rigidity of towers, whose height are over 200m, were very important problem that detail study was carried out, and four design schemes, A-type and inverted Y-type (Basic configuration, With slit, Upward fanning) were selected (Fig.2). With wind tunnel tests, A-type tower showed superior aerodynamic performance, but large amplitude out-of-plane vibrations (galloping) arose in inverted Y-type (Basic configuration) model.

So, inverted Y-type (Basic configuration) was rejected. On the other hand, it was considered that inverted Y-type (With slit) was an aesthetical excellent design because, with the slit, the column top was wider, but the shadow cast by the slit made it appear slimmer, and the design is unconventional as a tower column, so it has a certain originality.

Maintaining continuity of the girder at the tower, knuckle point was displaced at the fairing tip of the girder. As a result, gradient of lower part of tower's columns were eased and total proportion of towers are improved.

## 4. Girder and Cable configuration

The main girder consists of shallow steel boxes whose depth is 2.7m. In the view of landscape design, slender girders seemed to merge into the island scenery.

The cable configuration adopted for the Tatara Bridge is a multi-cable fan design with 21 cables on each span. The cables were laid out to form a plane with smooth, varying gradation when seen as a whole. And, the lowest cable was attached to the girder as near to the tower as possible.

## 5. Color

Superstructure color was studied and a light gray (Munsell No. N7.5) was selected for the towers and girders since it matches with the concept of "light and shade", surrounding scenery of a string of small islands with evergreen vegetation and the color of the prestressed concrete girders.

## 6. Conclusions

Although many structural elements of this design were determined by structural requirements, including aerodynamics, it was still possible through careful consideration to come up with a balanced, meaningful design without increasing costs. Tatara Bridge which has a symbolic high towers and slender girder harmonized with natural scenery. And, more elegant structure was realized for careful aesthetic design by using scale-model and computer aided photo-montages. The final view is shown in Fig.3.

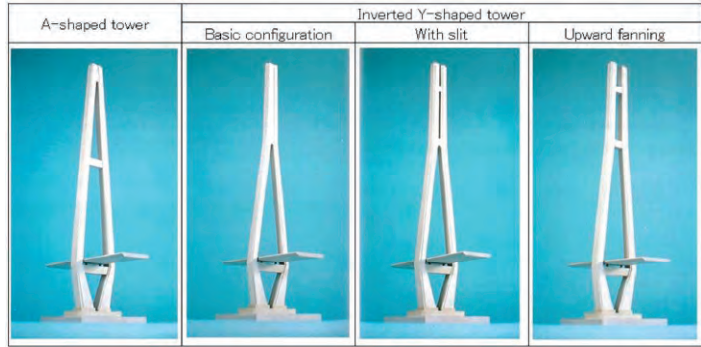


Fig. 2: Comparative study of tower shape



Fig. 3: Tatara Bridge

- [1] FUZIWARA T., "Aesthetic Design for The Tatara Bridge", JPCI Journal of Prestressed Concrete, Vol.42, No.2, Mar. 2000, pp.81-85 .