Design of Takimi Footbridge locating the world heritage Shiraito Falls

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Summary

This article reports the design of Takimi footbridge constructed near the Shiraito Falls in 2013. Shiraito falls is one of its component World heritage "Mt. Fuji: Object of Worship, Wellspring of Art." This footbridge was required to meet the several constraints – fit to the cultural situation, fewer alternation of land and minimization of material – so that the authors approached the conceptual design and satisfy all requirements.

Keywords: PC arch bridge, conceptual design, Mt. Fuji, Shiraito falls, compact bridge.

1. Introduction

"Mt. Fuji: Object of Worship, Wellspring of Art." was inscribed on the U.N agency's prestigious World Heritage list in 2013. Mt. Fuji including Sengen Shrine at its foot, five major lakes, the Miho-no-Matubara pine grove and Shiraito Falls. Underground water of Mt. Fuji forms this waterfalls which is famous as a sightseeing area from long time ago in Japan.

Takimi Footbridge constructed on this site in 2013 as shown in Fig. 1. The design of this footbridge was required to meet several constraints and had to be elegant structure as a component of the World Heritage site.

Fig. 1: Takimi Footbridge and Shiraito Falls

2. Design of Takimi Bridge

2.1 Design Concept

To achieve an optimum design taking into account the design constrains, “Compact bridge design” is adopted as design concept. This concept plays a vital role in satisfying the constraints and also aesthetic considerations.

2.2 Bridge Planning

2.2.1 Study on Structural System

Three types of structural system are studied on bridge planning. Agency for cultural affairs prescribed us to compare with traditional bridge system – suspension bridge and girder bridge. Suspension bridge’s anchorage requires huge alternation of land. On the other hand, PC girder bridge’s height is 2.0m and it seems to be massive. Rahmen bridge’s volume is relatively compact and the alternation of the land is minimum in this three types of structural system, so the agency recommended this structural system.

2.2.2 Development of Structural System and Form

Raw Rahmen bridge proportion is so artificial that it doesn’t suit with the landscape of Shiraito Falls. Pi Rahmen is a first development of this structure that enables to decrease the height of girder from 1.5m to 0.9m. However, this structure’s proportion is rather suitable to the expressway than this site. Therefore, the points of diagonal members and girders are shifted to the center span and the axis of diagonal members is rounded to smooth the flow of forces. This structure is kind of Arch bridge, but also remains the character of Rahmen bridge, we calls this structural system “Balanced Flat Arch: BFA”.

In general, the development of bridge form is separated from development of structural system. We design the both two elements considering the design concept at the same time.

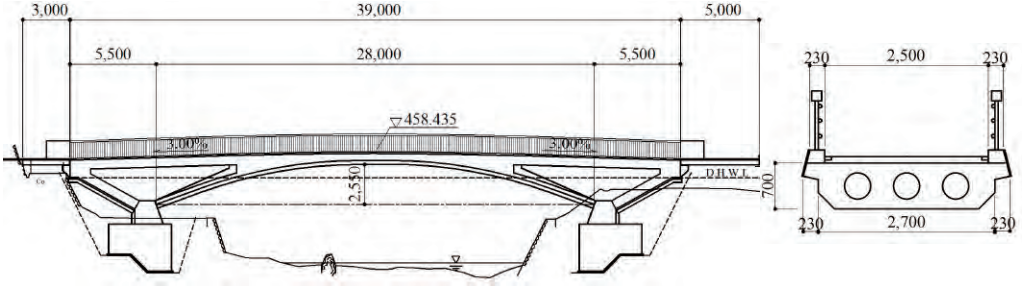

Fig. 2: Elevation and Section of the Takimi Footbridge

3. Conclusions

We carried out the conceptual design and the following achievements:

- Total minimization of bridge volume including foundations
- High redundancy for vibration, flood, and earthquake
- The aesthetic of bridge attract the sight tourist and people comes to Shiraito Falls to see this footbridge.
- Consideration about aging