Planning and Design of Mishima Suspension bridge the Japan's Longest Pedestrian Suspension Bridge－

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Summary

A project for construction of the Japan's longest pedestrian bridge is underway with private funds, in Mishima city, Shizuoka prefecture. At the moment, the basic configuration, basic planning, aesthetic study and wind tunnel test of the suspension bridge has been completed. The basic bridge configuration, the structural configuration and the aesthetic study of the above-mentioned pedestrian suspension bridge with 400m long center span are reported in this study.

Keywords: Pedestrian suspension bridge, basic planning, aesthetic study, wind observation, wind tunnel test.

1. Introduction

Mishima suspension bridge located at the western foot of Mt. Hakone is a pedestrian suspension bridge which is now under construction with private funds in Mishima city, Shizuoka prefecture. This will be the longest pedestrian suspension bridge in Japan, of which the center span is 400m.

The structural configuration of Mishima suspension bridge is a single span non-stiffened suspension bridge with a road 1.6m width and the wind shield. The height from the valley is around 70m. In this study, the basic bridge configuration, the structural configuration, the aesthetic study and the verification results of wind stability of the Mishima suspension bridge are reported.

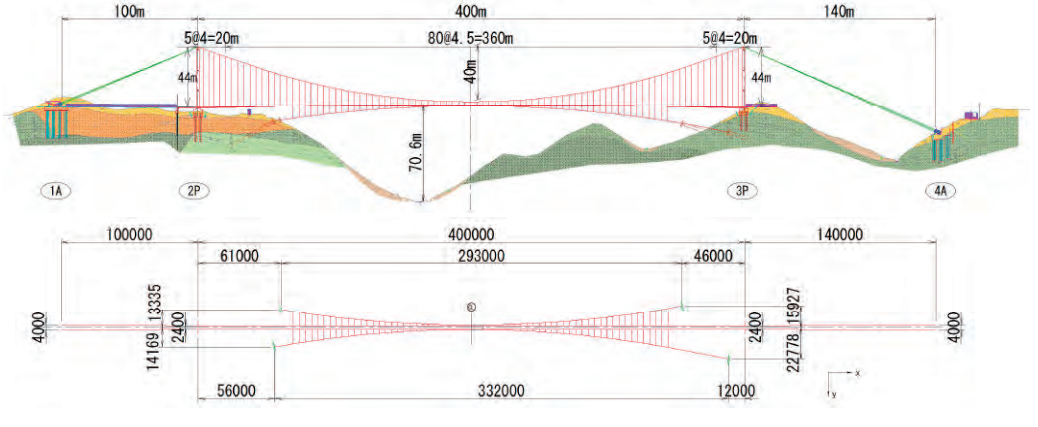

Fig. 1: Overview of Mishima suspension bridge

2. Bridge Plan and View Investigation

1) Open grating deck is set on the center of the road and RC pre-cast decks are set on the sides of the road for making people be thrilled. However, the wind stability was verified from the existing similar structures.

2) A mesh handrail with open view, a soft curved main tower with steel pipe and a soft-imaged substructure with a circular shape are adopted for matching the view of Mt. Fuji, which can be seen from the bridge.

3) Wind measurement was performed on site for the wind stability design. The correlation between the measured results and the information from the meteorological office around the site was confirmed. Furthermore, wind characteristics were investigated by a numerical fluid analysis with considering the actual complicated geographical features in the mountain area. The design wind speed was determined by considering the measurement results and the analytical investigation.

4) The countermeasure for wind stability was applied for preventing harmful vibration from a partial model wind tunnel experiment.

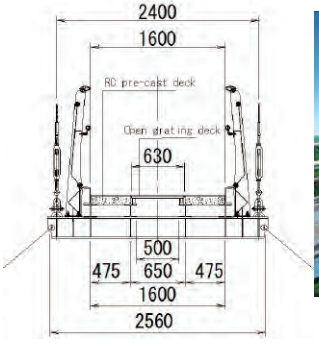

Fig. 2: Cross section of girder

Fig. 3: Side view of hanged structure

Fig. 4: Design of floor part

3. Conclusions

The view of Mishima suspension bridge was investigated by CG and the small model. Especially, the wind stability was verified from several viewpoints. The obtained main results are as follows.

1) High visible bridge planning was performed with giving slender and soft image to whole the bridge shape.

2) The open grating of a width of 630mm, the RC precast deck with the slit of a width of 20mm and the fairing were effective for ensuring the wind stability.

3) The tendency was confirmed that the wind stability was increased with widening the slit of RC precast deck. However, the sections with intermittent slits of a width of 20mm was adopted by considering the serviceability and easiness for walking (if the slit width was 40mm, the toe got caught in the slit). Although relatively large deflection vibration occurred in the section when the attack angle of wind was 10 degrees, the torsion vibration due to the wind acted to decrease the attack angle. Furthermore, there might be no damage of bridge due to the divergence vibration by adopting some countermeasures. As a result, the wind resistance stability was ensured in the finally designed section.

After the several investigations and designs reported in this paper, the site preparation was started from April, 2012. And then, the bridge construction was started from March, 2013. The substructures and the main tower have been constructed and the cat walk has just been hanged at September, 2014. The construction will be finished around the end of 2015.