# Evaluation of Secondary Stress at Main Cable in Suspension Bridge

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## Summary

The evaluation method of the secondary stress of the main cable in suspension bridge is suggested briefly. The secondary stress of the main cable in Yi Sun-sin Bridge is estimated by the suggested method considering the actual residual tension of the wrapping wires measured in construction site. The secondary stress considering both the construction stage and service stage exceeds 10% of the tensile strength of wires in the main cable.

**Keywords:** Suspension Bridge, Main Cable, Angular Change, Parallel Wire Cable, Secondary Stress

## 1. Introduction

When designing a suspension bridge, the cross-sectional area of main cable is basically determined by the primary stress due to the cable tension. But, the secondary stresses due to the angular change of parallel wire cable are not negligible.

The shape of cable varies and induces a lot of angular changes while suspending the stiffening girder during the construction stage. Between wires of this unwrapped cable, there is no frictional resistance. During the service stage, the shape of cable which is wrapped by wrapping wires is also changed under the loads of traffic, wind and temperature. The frictional resistance between wires produced by wrapping pressure should be considered when evaluating the bending stress of this wrapped cable.

In this paper, the actual secondary stresses at main cable of Yi Sun-sin Bridge with a main span of 1545m are investigated. The secondary stresses during the construction stage are estimated assuming that wires are freely slipped mutually. The field measured value of residual tension of wrapping wires is considered to estimate the secondary stresses during the service stage assuming that the wires are slipped if the shear stresses between wires exceed the frictional resistance produced by wrapping pressure on cable.

## 2. Secondary Stresses due to the Angular Change of the Main Cables

Three basic curves, 'No-slip cable', 'Friction-slip cable' and 'Free-slip cable', which are divided by the slip and friction between wires, are used for evaluating the secondary stresses of the main cable[2].

- No-slip cable: The deflection curve of tensioned cable subjected to bending moment is exponential function assuming that there is no slip between wires in the cable[3].
- Friction-slip cable: The inner pressure produced by the cable wrapping makes a small frictional resistance between the wires. If the bending moment is small as much as the shear force between wires doesn't exceed the frictional resistance, the cable behaves as like as No-slip cable. On the other hand, if the shear force between the wires exceeds the frictional resistance, the slip between the wires is started. In this paper, the deformed shape of slipped

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