Study on the Self-Balancing System of 2300m Main Span Suspension Bridge and Relative Mechanical Characteristics

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Abstract

Zhangjinggao Yangtze River Bridge has a main span of 2300 m, and a tower height of 350 m. A huge bending moment at the tower bottom under operation loads would happen if the traditional fixed restraint system between the saddle and the tower top were adopted. In the actual design, a movable saddle was used as a self-balancing device at the tower top, releasing part of the shear force, thus reducing the bottom bending moment. Due to friction, the movable saddle on the flexible tower complexes the structural calculation model and force transmission mechanism. This study established a computational model of the longitudinal movable saddle to analyze the static response and the mechanical properties including the consideration of the influence of friction. The study shows that the self-balancing system significantly reduced the maximum bending moment at the tower bottom under a vehicle load and/or a temperature load. Whereas this system increased the bending moment of the tower under a longitudinal wind load. Large friction coefficients undermined the effect of the self-balancing system.

Keywords: suspension bridge; self-balancing system; flexible tower; saddle; structural response.

1 Introduction

The tower height of Zhangjinggao Yangtze River Bridge reaches 350 m, which needs greater stiffness to ensure structural stability. However, the increase of the tower stiffness will lead to an enlargement of the bending moment at the tower bottom, which creates a great challenge for the tower's design. The use of practical support and restraint devices at the tower top, which partially releases the unbalanced cable tensile force, is

https://doi.org/10.2749/nanjing.2022.0301