Scaled Model Design and Verification of Shaking Table Test of Taizhou Changjiang Highway Bridge

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Summary

Taizhou Changjiang Highway Bridge, which belongs to three-pylon two-span suspension bridge, realizes the purpose of crossing the broad and open water area with super long span bridge, attracting the attention in the field of the bridge around the world. However, the investigation on the seismic performance of this kind of bridge is insufficient. Shaking table test of Taizhou Changjiang Highway Bridge will be carried out to study in-depth the influences of some important factors on the seismic performance of this bridge, including restraining system and non-uniform excitation. During the process of designing the shaking table test model of Taizhou Changjiang Highway Bridge, it would be difficult to manufacture the test specimens of the girder and pylons if the similarity ratio is strictly followed. To overcome this problem, in this paper, the simplified scaled model is adopted to consider the similarity ratio of flexural stiffness but ignore the similarity ratio of the torsion and axial stiffness. Based on an FEM model, comparison of the internal forces and displacements reveals that the differences between the simplified scaled model and the prototype are acceptable. So, the simplified scaled model can be used to perform the shaking table test.

Keywords: three-pylon two-span suspension bridge; shaking table test; stiffness equivalence; FEM verification.

1. Introduction

While china is conducting the world's largest transportation infrastructure, many large-span bridges have been built or are under construction. Taizhou Changjiang Highway Bridge and Maanshan Changjiang Highway Bridge , which belong to three-pylon two-span suspension bridge, realize the purpose of crossing the broad and open water area with a super long span bridge, attracting the attention in the field of the bridge engineering around the world. Compared to the conventional two-pylon suspension bridge, the seismic performance of three-pylon suspension structure is very different, on which many factors have significant influences , for example, horizontal stiffness ratio of the middle pylon to side pylons, the type of infrastructure, pylons, girder pier support system. Many challenges are encountered and many new requirements are brought out during the construction of multi-pylon continuous-span suspension bridge.

The “Multi-functional Shaking tables Lab” of Tongji University was supported by the 985-project program of ministry of education. The shaking tables testing system is composed of four shaking tables in which the vertical load capacities of A and D are 30 tons and those of B and C are 70 tons, and the lengths of two trenches are 70 and 30 meters respectively. All four tables are moveable within the first 70m trench and work as a large linear shaking table array. Tables can work in same way or with relative motion. The shaking tables testing system, with a total vertical load capacity of

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