

Influence of Curvature Radius on Static and Dynamic Characteristics of Curved Cable- stayed bridge

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Abstract

Curvature radius is one of the key design parameters of curved cable-stayed bridges. In order to obtain the influence law of curvature radius on the static and dynamic characteristics of curved concrete cable-stayed bridge with Π -shaped girder, taking a long span curved cable-stayed bridge as the engineering background, one spatial beam and plate mixed finite element model was established. Based on the theoretical model, the influence of the curvature radius on the structural static characteristics and the dynamic characteristics was analyzed by comparing curved cable-stayed bridges with different curvature radius and straight cable-stayed bridge with the same span. The results show that there is a big influence of curvature radius on the static and dynamic characteristics. The research results can provide some reference for the design of similar bridge structures.

Keywords: Bridge Engineering; Curved cable-stayed bridge; Curvature radius; Parameter Analysis; Static characteristics; Dynamic characteristics.

1 Introduction

The main girder of cable-stayed bridge is generally a straight line. But when the bridge is restricted by the terrain, landform, the road line and beauty requirements, the curved cable-stayed bridge has to be used. The curvature makes the cable-stayed bridge system more complex. On the one hand, the bending and torsion coupling effect caused by the curvature makes the bending moment and deflection of the girder larger than that of straight bridges with the same span. On the other hand, the torsion of the girder caused by the curvature makes the internal and external force uneven. The complex spatial force characteristics of the curved cable-stayed bridge bring great difficulties to the design and construction. Therefore, many scholars have studied this bridge structure, mainly on the key design parameters and calculation method.

Some analysis methods may be found in Raftoyiannis Ioannis G.et.al. [1], Nour Eldeen Hesham[2], Wen, Q.et.al.[3]. The studies about key design parameters which contain curvature radius, bending stiffness, torsional stiffness may be found in Liang Tian et.al. [4],Wan Xiaoming[5], Wang Junli[6]. The design, calculation, construction, installation and main technical features of one curved cable stayed bridge located in the Beijing metro line five could be found in Xiao Haizhu, et al[7].

In the other aspect, with the increase of the span of cable-stayed bridge, the structure becomes more and more gentle, which is more sensitive to the dynamic load and seismic load. The dynamic characteristics of the structure get more and more attention. The structural behavior of the bridge under the action of live load were studied by