Parametric Study on Hutong Highway and Railway Bridge

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Abstract

Development of long-span railway cable-stayed bridges in China was systematically concluded including breakthrough of main span and technical innovations. Parametric analysis on Hutong Bridge, a rail-cum-road cable-stayed bridge with main span of 1092m, includes effects of side to mid-span ratio, girder height to mid-span ratio, girder width to mid-span ratio, and effective pylon height to mid-span ratio. Results show that structural rigidity decreases gradually as side to mid-span ratio increases. Increasing girder height improves the structural rigidity limitedly. Girder width influences natural frequency and flutter stability. Increasing effective pylon height could improve the whole vertical rigidity, and reduce the longitudinal rigidity of the pylon.

Keywords: Railway cable-stayed bridge; innovations; parametric study; Hutong Bridge; side to mid-span ratio; girder height to mid-span ratio; girder width to mid-span ratio; effective pylon height to mid-span ratio.

1 Introduction

Railway cable-stayed bridge has developed for more than three decades in China since Hongshui River Railway Bridge, a prestressed concrete cable-stayed bridge, was constructed in 1981 with main span of 96m. Starting with Wuhu Changjiang River Bridge, an extradosed rail-cum-road (RCR) cable-stayed bridge with main span of 312m built in 2000, China has entered a new era of long-span railway bridges. After nine years, a milestone cable-stayed bridge-Wuhan Tianxingzhou Bridge was built which supported four-track traffic and a six-lane highway over the Changjiang River with a span arrangement of (98+196+504+196+98) m [1].Number of recent completed and ongoing long-span railway cable-stayed bridges in China has exceeded twenty. Hutong Bridge, a kilometre-scale RCR cable-stayed bridge with truss girder, has started construction in March 1st, 2014 with 115m steel-concrete caisson, 325m double pylon and 1092m main span [2]. Application of new material, new technology and new equipment strongly supports the continuous breakthrough of span length. In this paper, technical innovations were summarized in the construction of railway cable-stayed bridges in China. And distribution of overall design parameter of cable-stayed bridges was also discussed. Parametric study on Hutong Bridge was finally carried out, including side to mid-span ratio, girder height to mid-span ratio, girder width to mid-span ratio, and effective pylon height to mid-span ratio, etc.

2 Development and innovations of railway cable-stayed bridges

Railway cable-stayed bridges developed steadily with the help of innovations, including the calculation theory, new structural system and new material, etc. Thanks to the infrastructure projects in railway especially the high-speed railway (HSR),

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