

Conceptual design of new super-span cable-stayed bridge

Jia HU

PhD student
Hunan University
Changsha, Hunan, China
hujia200512@163.com

Jia Hu, born 1984, received his civil engineering degree from the Univ. of Central South in Changsha, Hunan, China.

Xudong SHAO

Professor
Hunan University
Changsha, Hunan, China
shaoxid@hnu.edu.cn

Xudong Shao, born 1961, received his Ph.D. in civil engineering and professor position from the Univ. of Hunan. His main area of research is new bridge structure.

Hua ZHAO

Lecturer
Hunan University
Changsha, Hunan, China
zhmit@hotmail.com

Hua Zhao, born 1975, received his Ph.D. in civil engineering from the Univ. of Alabama at Birmingham, USA.

Summary

This paper presents a conception of super-span cable-stayed bridge, namely, a cable-stayed bridge with partial ground-anchorage and cross stays, which is applicable for cable-stayed bridges with main span length around 1400 m. Its main characteristic is that the long stays cross with each other and are anchored in the ground anchor, resulting in little horizontal pressure force in the main girder. Compared with self-anchored cable-stayed bridge, this system has following significant advantages at structure aspect : (1) Horizontal pressure forces in the main girder caused by cables are greatly reduced; (2) As the cross stays can provide dual vertical supports and balance the horizontal forces with each other perfectly, the horizontal angle of long stays can be reduced and the height of tower will decrease to only about 1/5.6 of main span length. Moreover, advantages at economic aspect are as follows : (a) Steel consumption of the main girder and pylon will obviously reduce; (b) The configuration of anchor is about 30% of that of suspension bridge with similar main span. Study shows that cable-stayed bridge with partial ground-anchorage and cross stays is a competitive scheme for super span around 1400 m.

Keywords: super-span; partial ground-anchorage; cross stays; cable-stayed bridge; conceptual design.

1. Introduction

With the development of design and construction technology, the span of cable-stayed bridge is constantly increasing, the construction of Sutong bridge and Stonecutters bridge announced that the cable-stayed bridge's main span stepped into 1000 m. Compared with suspension bridge, cable-stayed bridge has obvious advantages in economy, wind stability, adaptability of foundation and construction of security [1]. Therefore, increasing the cable-stayed bridge's span so that it can compete with Suspension Bridge becomes a research hotspot. Masatsugu Nagai analyzed feasibility of a 1,400 m span steel cable-stayed bridge [2], Xigang zhang and Airon g chen researched cable-stayed bridge programs with a main span from 1308 m to 2100 m [3].

The development of cable-stayed bridge's span brings the following key issues: First, the horizontal component of cable force will exert a pressure to the main girder. With the increasing