Design and Construction of Chongqing Lijia Jialing River Bridge

Ya-ping Lai， Xiao-hu Chen， Fu-cheng Yan

T.Y. Lin International Engineering Consulting（China） Co., Ltd., Chongqing 401121, China

Contact: laiyaping@tylin.com.cn

Abstract

To achieve a cost-effective, rational, and efficient structural system, two traditional structural systems—a continuous rigid frame (CRF) girder bridge and a deck arch bridge—are combined to form a new bridge type—arch-stiffened girder (ASG) bridge. This bridge type fulfil the innovative and unique requirements for the Chongqing Lijia Jialing river bridge. The ASG bridge combines the simplicity of a girder bridge with the elegance of an arch bridge. In terms of structural behaviours, the ASG bridge utilizes the arch to assist the main girder and forms a self-balancing system, significantly reducing the mid-span and side-span girder lengths, and thus optimizing structural performance through increased vertical stiffness and effective control of long-term deflection. This article discusses the major components of the Chongqing Lijia Jialing river bridge's design, construction, load capacity testing, and effects upon completion.

Keywords: hybrid structural system; arch-stiffened girder(ASG) bridge; girder-arch combined structure; structural design; construction method.

1 Introduction

Both continuous rigid frame (CRF) and deck arch bridges are suited for use in mountainous environments. CRF bridges has monolithic pier and girder connection which eliminates the need for large tonnage bearings at the main piers. The main girder structure is continuous, which has a more reasonable force distribution, offers smooth riding condition, simple construction, low operation and maintenance cost, and is more economical [1]. But longer span CRF bridges often have less predictable deflection and cracks [2-4] in the girder, this bridge type is best suited for spans not more than 200m [5]. Additionally, the long-span deck arch bridge is economical and attractive in hilly terrain, where it has been frequently utilized [6]. However, due to the considerable force at both end supports, it can only be applied in proper geological conditions. Hence, this bridge type also has limitations.

A hybrid structural system formed by the combination of two or more conventional structural systems may exhibit more complicated mechanical behaviours but provide superior structural performance. The combined bridge system could retain the respective advantages of both bridge systems. As a result, it is novel to study and design a new type of long-span ASG bridge with high spanning capacity, excellent mechanical performance, and a low economic cost index that is based on conventional bridge construction materials, current bridge design codes, and the hybrid structural system design concept [7].

The Chongqing Lijia Jialing River Bridge was selected following a comprehensive study of bridge types, considering the bridge's construction method, long-

https://doi.org/10.2749/nanjing.2022.0410
Distributed by structurae