



New Developments and Challenges in PC Bridge Design in China

Dong XU

Professor, Ph.D.

Tongji University
Shanghai, China

xu_dong@tongji.edu.cn

Dong XU, born 1966, received his PhD in bridge engineering from Tongji University. He is professor of Dept. of Bridge Eng. at Tongji University.



Junli ZHAO

Professorate Senior Engineer
CCCC Highway Consultants
CO., Ltd.
Beijing, China

zhaojunli@hpd.com.cn

Junli ZHAO, born 1965, received his bridge engineering degree from Tongji University. He is vice chief engineer of CCCC Highway Consultants CO., Ltd..



Abstract:

After a brief introduction of major bridge construction in the 21st century in China, this paper focuses mainly on the new developments and challenges in PC bridge design in China. Some development in hybrid system and composite deck to increase the span capacity and efficiency for service load, including concrete deck with corrugated steel webs, hybrid girder system and extradosed system are discussed. Cracks and excessive deflection are two major defects of PC bridges in China. The most frequently occurred cracks in box girder are summarized and analyzed, and the innovative concepts of Complete Checking Stresses and three-layer stresses are proposed, which can completely express the spatial behavior of box girder, and describe how the cracks happen in box girder bridges. Spatial Grid Model (SGM) is the most suitable and direct analytical model to produce the three-layer stresses completely. Finally, the link between excessive deflection and shear reinforcement design is also analyzed and a new design proposal for shear reinforcement is briefly introduced.

Keywords: PC bridge, corrugated steel webs, cracks and deflection, complete checking stresses, Spatial Grid Model (SGM), shear reinforcement design

1. Introduction

1.1 Bridge Construction in China in the New Century^[1]

Since the 21st century, China has entered into a new round of construction boom. Among thousands of bridges constructed in the latest decade, some major representative bridges are introduced as below:

➤ Lupu Bridge, 2003, Shanghai

It is a half-through steel arch bridge with a main span of 550m (Fig.1). The soaring box-arch bridge has an aesthetic and contemporary appearance. Lupu Bridge received the 2008 IABSE Outstanding Structure Award, which is the first China bridge to win this prize. It was also served as a technical “logo” of the Expo 2010 in Shanghai.



Fig.1 Lupu Bridge



Fig.2 Donghai Bridge