

# Performance analysis on Twin-I girder bridges using hollow tubular top flanges

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## 1 Abstract

Twin-I girder bridge systems have advantages including simplified construction process and less material cost. However, due to the weak torsion stiffness of I section, the systems using I-girders requires many cross frames and individual I girder cannot erect without interior cross frame installation. The use of I sections with a hollow tube as the top flange increase the torsion stiffness, which can improve the stability and strength of bridge systems. In the paper, twin-girder bridges systems using traditional I-girder and hollow tubular flanges are studied to provide the differences among them. The analysis results show that the stability of girder with hollow tubular flange is much larger than traditional I girder, which has less requirements for girder erection and needs of interior diaphragms of girder system. Parameters are studied including flange width-to-thickness ratio, web depth-to-thickness ratio and reasonable girder depth. Some recommendation for the design of steel I-girders using hollow tubular flanges are given.

**Keywords:** hollow tubular flange; stability; diaphragms; width-to-thickness ratio; girder depth

## 2 Introduction

Compared with traditional composite bridges consisting of three or more steel I girders, twin-I girder bridges save the steel material and simplify the construction process. In recent years, twin-I girder bridges have a wide application in engineering due to its light-weight and full utilization of the material properties of steel and concrete. Although this I section can increase bending efficiency in the same cross-sectional area, it has the disadvantages due to low torsional stiffness and poor lateral stability. Thus twin-I

girder bridges require many interior diaphragms to maintain the stability during the construction, and the connection details between girders and diaphragms are complicated.

A tubular flange girder is an innovative structure, which uses I-shaped steel girders with rectangular as top flange. This concept of tubular flange was first introduced into bridge engineering field by Wassef et al in 1997, Wimer and Sause performed a design study of tubular flange with a round concrete-filled tube for a four girder prototype bridge in 2004. Compared to conventional I-shaped plate girder, the increased torsional stiffness