Creep Analysis of Encased CFST Arch Bridges, A Case Study of Wanxian Yangtze River Bridge

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Summary

Encased CFST (Concrete Filled Steel Tubular) arch structure is an innovative arch structure, in which heavy arch lifting; especially in long span arch bridge is avoided implementing special technique in its construction, as in construction of Wushan Yangtze River Bridge of span 420 m. With the attempt to compute time dependent stresses and deformation due to creep, an experimental creep study is organized on plain concrete, CFST and encased CFST column, and the test result on column member is verified using numerical method. The verified numerical technique is employed to compute creep effect on arch bridges. The results indicate that the crown deflection due to creep is not excessive; the amount will be function of type of concrete, the span of bridge, the dead load of structure and load at transfer. The amount will be less for encased CFST arch bridge compare to RC bridge. A case study made in this paper suggests that Wanxian Yangtze River Bridge’s crown will deflect 16 cm in 3 years.

Keywords: Encased CFST; arch bridge; experiments; crown deflection; creep.

1. Introduction

With the development of concrete technology and in-depth understanding of internal stress state of structures upon load, structural engineers have been able to transform their dream into reality. For many reasons, for example economy, aesthetics, and sometime for bridges over rivers whose high flood level may changes suddenly or raises, sometime it may be essential to choose long span arch bridges. One of the main problems to build long span arch bridges is “Construction difficulty due to heavy self weight”. An innovative construction technique has been deployed in some of arch bridges [1]. One of the advantages of such construction techniques is convenient way to construct long span arch bridges. First arch ring is formed using hollow steel tubes; then, it is filled with concrete. The CFST arch ring is then used as a formwork to form complete cross section of arch rib. CFST steel tubes being embedded in concrete in such arch ribs, arch bridges of these types are named as encased CFST arch bridges (Named by co-author of this paper).

Ample researchers has been done about strength characteristics of composite arch bridge, that is how we could built super long span arch bridge with greater confidence, and there are a lot of such construction in pending[2]. Despite greater achievements in construction and internal force analysis of such bridges, time dependent response of such bridges hasn’t been studied well, which may likely cause serviceability problems and sometime even the stability problem of arch rib. No experimental works regarding the encased CFST arch bridges has been done till date [3].Design and

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