



Creep Effect and Time-Varying Reliability Analysis of Prestressed Continuous Rigid Frame Bridge

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Abstract

This paper studies the long-term shrinkage and creep performance of C60 low shrinkage and low creep high performance concrete used in the main bridge of continuous rigid frame box girder bridge. The finite element model of the bridge is established by finite element simulation software. Firstly, the shrinkage and creep effect of the main bridge over a long time is calculated and analyzed by using the shrinkage and creep model of C60 low shrinkage and low creep concrete and different specification models of ordinary C60 concrete. The effects of shrinkage and creep on the internal force, stress, deflection and prestress loss of the main beam of the bridge under different loading ages are studied. Finally, combined with the prior information of concrete materials and data sample information, bayes method is used to predict the service reliability of the bridge. The research results can provide guidance for the long-term shrinkage performance and creep reliability of the bridge.

Keywords: C60 low shrinkage and low creep high performance concrete; Shrinkage creep effect; Bayesian updating method; Failure probability; Bridge reliability

1 Introduction

Concrete shrinkage and creep is a unique time-varying characteristic of the material itself. Concrete creep is a phenomenon that the creep increases with the increase of load holding age under the action of long-term load [1-3]. Concrete shrinkage and creep will increase the prestress loss, long-term deformation and internal force redistribution of concrete bridges after long-term operation [4]. Therefore, many studies began to carry out relevant research represented by C60 high-performance concrete and put relevant research into real bridge application [5-10]. With the construction and use of a large number of prestressed continuous rigid frame bridges, the phenomena of bridge deflection, prestress loss and

cracking caused by concrete shrinkage and creep are common [11-13]. Therefore, the research on the ultra long-term shrinkage and creep effect and long-term reliability of C60 low shrinkage and low creep prestressed continuous rigid frame bridge has certain theoretical value and economic significance.

In recent years, a large number of scholars have studied the shrinkage and creep effect of concrete used in long-span bridges. Liu et al. [14] analyzed the shrinkage and creep effect of Hong Kong Zhuhai Macao Bridge over a long period of 30 years by carrying out the shrinkage and creep test of high crack resistant dense homogeneous concrete used in Hong Kong Zhuhai Macao Bridge; Pan et al. [15] proposed a modified shrinkage and creep prediction model through the shrinkage and creep