Postprint of Experimental Study on Hydration Heat Temperature Field of PC Box Girder

Authors: Xiaofei Wang

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Abstract

To investigate the distribution characteristics and development patterns of the hydration heat temperature field in large-tonnage PC box girders during whole-span prefabrication, field monitoring and analysis of the hydration heat temperature field were conducted during the casting process of a 50 m PC box girder. The research results indicate that the hydration heat temperature in the box girder during whole-span prefabrication follows a development process characterized by "rapid temperature rise—sustained high temperature—slow cooling"; the temperature distribution at each cross-section exhibits left-right symmetry, with the maximum temperature occurring in the core region in the middle of the web at Section S1, reaching 74°C, while the maximum temperatures at Sections S1 and S2 both exceeded 70°C with a prolonged high-temperature duration; the temperature difference at each cross-section demonstrates a development process of "rapid increase—slow decrease", with the maximum temperature difference occurring between the web–top slab junction and the top slab surface, and the temperature difference distribution on the left and right sides being essentially consistent; the maximum temperature differences at Sections S1 and S2 both exceeded 25°C, which is prone to causing concrete cracking, necessitating the implementation of corresponding temperature control measures during the box girder construction process. The research findings can serve as a reference for the whole-span prefabrication of large-tonnage PC box girders.

Full Text

Preamble

Experimental Study on Hydration Heat Temperature Field in PC Box Girders

Wang Xiaofei1
(China Railway 16th Bureau Group 3rd Engineering Co., Ltd., Huzhou 313000, China)

Abstract

To investigate the distribution characteristics and development patterns of hydration heat temperature fields in large-tonnage PC box girders during full-span prefabrication, field monitoring and analysis were conducted during the casting of a 50 m PC box girder. The results indicate that the hydration heat temperature follows a development pattern of "rapid heating—high temperature duration—slow cooling." Temperature distribution across sections is left-right symmetrical, with the maximum temperature of 74°C occurring at the core of the web in Section S1. Both Sections S1 and S2 exhibited peak temperatures exceeding 70°C with prolonged high-temperature duration. Temperature differences across sections follow a "rapid increase—slow decrease" pattern, with maximum temperature differences occurring between the web-top plate junction and the top plate surface. The temperature difference distribution is essentially consistent on both sides, with maximum differences exceeding 25°C in both Sections S1 and S2, which can readily cause concrete cracking. Corresponding temperature control measures should be implemented during box girder construction. The research findings can provide reference for the full-span prefabrication of large-tonnage PC box girders.

Keywords: Bridge engineering; Concrete box girder; Hydration heat; Temperature field; Field monitoring

Note: Figure translations are in progress. See original paper for figures.