

Resistance of prestressed bridge girders to diagonal tension cracking

Marco A. Roosen

Delft University of Technology, Delft, the Netherlands

Rijkswaterstaat, Ministry of Infrastructure and Water Management, Utrecht, the Netherlands

Max A.N. Hendriks

Delft University of Technology, Delft, the Netherlands

Norwegian University of Science and Technology, Norway

Yuguang Yang, Cor van der Veen

Delft University of Technology, Delft, the Netherlands

Dick G. Schaafsma

Rijkswaterstaat, Ministry of Infrastructure and Water Management, Utrecht, the Netherlands

Contact: M.A.Roosen@tudelft.nl

Abstract

Diagonal tension cracking is the governing failure mode for bridge girders with a thin web that are highly prestressed and contain little shear reinforcement. When assessing existing bridge girders using the Eurocode 2 [1], it often turns out that it is not possible to demonstrate sufficient resistance to diagonal tension cracking. This paper evaluates the method to determine the maximum principal tensile stresses as used in the Eurocode 2 [1] and investigates how flexural cracks affect the principle tensile stresses in the regions without flexural cracks. This paper also investigates how the tensile strength of the web is affected by the presence of compressive stresses and by the size of the area subjected to high tensile stresses. Based on the results of these investigations, an improved model is proposed to determine the resistance to diagonal tension cracking.

Keywords: shear tension failure, diagonal tension cracking, tensile strength of concrete, prestressed girders, bi-axial behaviour, size effect.

1 Introduction

In the Netherlands, existing bridges are being assessed to investigate whether they are capable to resist the current traffic loads, which have

increased since the bridges were designed. A part of these bridges consists of prestressed concrete girders with a thin web. If these girders are highly prestressed and contain little shear reinforcement they will instantly fail at diagonal tension cracking. Preliminary assessments show that it is demanding