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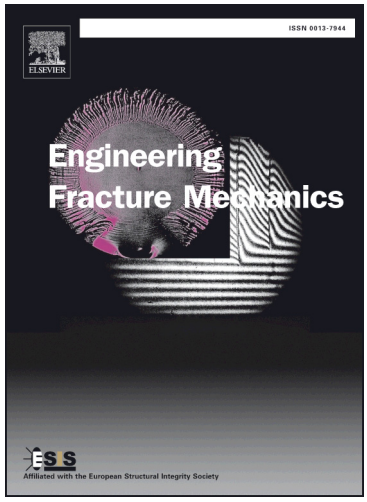

Methods for Calculating Fracture Energy of Very High Strength Concrete

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PII: S0013-7944(14)00320-8
DOI: http://dx.doi.org/10.1016/j.engfracmech.2014.09.017
Reference: EFM 4389

To appear in: *Engineering Fracture Mechanics*

Received Date: 17 January 2014
Revised Date: 8 August 2014
Accepted Date: 29 September 2014

Please cite this article as: Teng, S., Yu, L., Darren, L.T.Y., Methods for Calculating Fracture Energy of Very High Strength Concrete, *Engineering Fracture Mechanics* (2014), doi: http://dx.doi.org/10.1016/j.engfracmech.2014.09.017

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Methods for Calculating Fracture Energy of Very High Strength Concrete

Susanto Teng[1] and Liu Yu[2] and Lim Tze Yang Darren[3]

Abstract

In this paper, existing methods for calculating the fracture energy of very high strength concrete (compressive strength of about 105 MPa) are reviewed and a new method is proposed. Twenty nine three-point bending beam specimens made of very high strength concrete incorporating Ultra Fine Ground Granulated Blast-furnace Slag (UFGGBS) were tested. The depths of the beam specimens range from 75 mm to 300 mm. The fracture energy calculated by Hillerborg's work-of-fracture method, Bazant's size effect method, and Karihaloo-Nallathambi's effective crack method, as well as two empirical formulas of Bazant and Becq-Giraudon and of CEB-FIP Model Code 1990 were investigated and compared on the basis of the tested specimens. It was found that the results from the different methods were very different from one another. In addition, the authors introduce a nonlinear regression method based on the effective elastic crack model to calculate the fracture energy. It is shown that the proposed method shows good tolerance on the scattered test data, and thus leads to a more consistent fracture energy value.

Keywords: fracture energy, very high strength concrete, ground granulated blast furnace slag, work-of-fracture method, effective elastic cracks, size effect method, nonlinear regression

1. INTRODUCTION

In comparison to Ordinary Portland Cement (OPC), the production of some cement replacement materials, such as Ground Granulated Blast-furnace Slag (GGBS), requires less

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