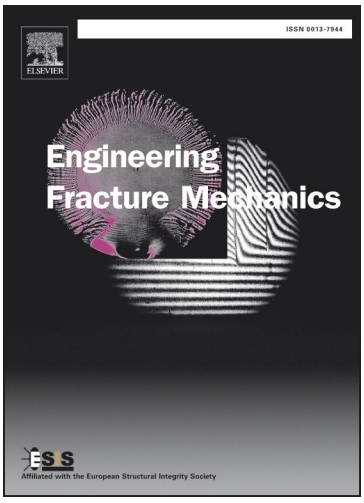

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PII: S0013-7944(18)30346-1
DOI: https://doi.org/10.1016/j.engfracmech.2018.09.017
Reference: EFM 6152

To appear in: *Engineering Fracture Mechanics*

Received Date: 8 April 2018
Revised Date: 12 August 2018
Accepted Date: 10 September 2018

Please cite this article as: Qing, L., Shi, X., Mu, R., Cheng, Y., Determining Tensile Strength of Concrete Based on Experimental Loads in Fracture Test, *Engineering Fracture Mechanics* (2018), doi: https://doi.org/10.1016/j.engfracmech.2018.09.017

Determining Tensile Strength of Concrete Based on Experimental Loads in Fracture Test

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Abstract A theoretical method for determining the tensile strength f_t of concrete was proposed based on the experimental loads in fracture tests. Using the fracture extreme method, only the initial cracking load P_{ini} and the peak load P_{max} were required to be measured. The experimental data from three-point bending notched beams and wedge splitting specimens were used to calculate f_t with different initial crack length versus specimen depth ratios α_0 and specimen dimensions. The results show that the f_t obtained by the proposed method agree with the test values, and the method is insensitive to α_0 and specimen dimensions.

Keywords Concrete; Tensile strength; Initial cracking load; Peak load; Fracture extreme method

1. Introduction

Concrete is a multiphase composite composed of aggregates and mortar. Some microcracks are generated between aggregates and mortar, sand and cement paste, or unhydrated cement particles during the forming stage of concrete. The formation of cracks cause weak performance of concrete in tension and may result in structural safety issues. In addition, temperature, age, and curing condition can also affect the tensile property of concrete. The tensile strength f_t of concrete is a basic mechanical parameter and an important inherent material coefficient in structural designing. It is also an important parameter to describe the softening relation which has been widely used in simulation of crack propagation in concrete.

The uniaxial tensile test is generally considered as the most direct method for determining tensile strength f_t [1], which is carried out not under any theoretical hypothesis and is more reliable than other methods [2]. However, many tests conducted in the past failed because of unexpected crushing which occurred as a result of local stress concentration and eccentricity [3–4]. The accuracy of the tests might be affected by the loading facilities, the shapes and sizes of specimens, etc.

Splitting tests [5], flexural tests [6] and fracture tests are also typically used to determine the f_t of concrete as indirect approaches. However, the values measured by different test methods might be different using various formulas and predetermined assumptions [7] and test facilities, such as the heel block implemented for the

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