

Effects of water-cement ratio and notches to the flexural strength of concrete

Mohamad Shazwan Ahmad Shah^{1*}, Norhazilan Md. Noor¹, Ahmad Beng Hong Kueh¹ and Mohd. Nasir Tamin²

¹ School of Civil Engineering, Faculty of Engineering, Universiti Teknologi Malaysia, 81310 UTM Johor Bahru, Johor, Malaysia.

² School of Mechanical Engineering, Faculty of Engineering, Universiti Teknologi Malaysia, 81310 UTM Johor Bahru, Johor, Malaysia.

Email: mohamadshazwan.ahmadshah@gmail.com

Abstract. It is often assumed that flexural strength of concrete has less significance impact on overall concrete strength. However, from fracture mechanics point-of-view tensile is an element the mechanics always look into due to cracking does associate with tension. In the research, fracture is translated into physical laboratory experiment by introducing notches. Physical laboratory works on concrete beams with three-point bend test configuration under static load and calculating outputs from laboratory with numerical equations. Three-point bend test method is conducted because from the testing, tensile strength or also recognised as flexural strength of concrete for each water-cement ratio could be attain. Thus, the aim of this article is to reveal and discuss the pattern of flexural strength of concrete on different water-cement ratio. The testing follows conventional fracture three-point bend test on concrete but with revised version by testing notched concrete beams. Normal three-point bend tests were run on concrete beams with different notch sizes; 30 mm, 15mm, and 5 mm respectively. There were three water-cement ratio decided in concrete mix; 0.3, 0.4, and 0.5. Thus, the trend of flexural strength of concrete follows the trend of water-cement ratio. Flexural strength increases when water-cement ratio increases up to water-cement ratio 0.5.

Keywords-flexural strength; water-cement ratio; concrete

1. Introduction

Flexural strength or bending stress are also recognised as Modulus of Rupture[1]. For concrete or brittle material, these parameters represent tensile strength of a concrete. Flexural strength could be obtained using two types of testing in concrete which are three-point bending and four-point bending test [2, 3]. The setting of these test have the similar two supporting rollers below the concrete beam and the distance between the rollers at each ends is measured as “span”. The importance of flexural strength could be clearly noticed by fatigue and fracture. Fatigue and fracture can be interpreted through a material’s endurance.

1.1 Three-Point Bending Test and Four-Point Bending Test

The differences are three-point has only one loading force at the middle of the concrete beam specimen transmitted through a roller, and four-point has two loading forces transmitted through two rollers with certain diameter. Three-point bend test emphasizes on its maximum stress in the middle

