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STEEL FIBRES AS FLEXURAL CRACKS INHIBITOR IN REINFORCED FIBROUS CONCRETE BEAMS UNDER STATIC LOADING

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

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ABSTRACT

Flexural cracks are the most common problem in structural members which are subjected to bending moments. The introduction of steel fibres in concrete beam has been proposed as flexural cracks inhibitor. This research of steel fibres as flexural cracks inhibitor in concrete beam under static loading was conducted focusing on simply supported beam to determine the crack propagations in flexure by varying the steel fibre content placement in the beam. The 25 kg/m^3 steel fibre was chosen for this study since the optimum concrete strength (f_{cu}) is achieved with this steel fibre dosage. Seven sets of concrete beams of 150 mm x 250 mm x 1000 mm in size consists of three RC beams with full steel fibrous concrete (SFRC), three RC beams with steel fibre placed within tension zone of the beam, three RC beams with steel fibre placed at the half of tension zone of the beam, two conventional RC beams (without steel fibre) as control sample, one unreinforced concrete beam with full steel fibre, one unreinforced concrete beam with steel fibre at tension zone only and one unreinforced concrete beam with steel fibre at half of tension zone. The variations in these seven sets of beams is intended to find the optimum steel fibrous concrete placements towards inhibiting flexural cracks in the beam. Experiment was conducted through three points bending test. The results showed that addition of steel fibre in conventional reinforced concrete beam increase the crack initiation load, yield load and ultimate load by 60%, 69% and 56% respectively. It also reduced the ratio of ultimate load over yield load by 46% and increased the ratio of ultimate load over theoretical load by 40%. The crack opening is reduced by 11%. The crack failure of all the beams are classified as flexure crack and occurred in the mid third span. The addition of steel fibre in the conventional RC beam showed that it inhibits the flexural cracks.

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To my beloved parents, with your greatest love and prayer, I am able to get this successfulness.

CHAPTER ONE
INTRODUCTION

1.1 BACKGROUND

The most important material in concrete structure is concrete and it is playing a part in all building structures. It is broadly used in the building construction because of its advantages such as the moulded ability to take up various structural forms or shapes required with minimal cost. Reinforced concrete beam is a composite material consisting reinforcement bars embedded in a hardened concrete matrix. It is also a composite material of dry mix that consists of cement, coarse aggregates and fine aggregates (Bhatt *et. al*, 2006). Concrete which carries the compressive forces is assisted by the reinforcement bar which resists tensile forces.

The reinforced concrete beams are arguably the most used in the buildings construction. However, concrete is known as a brittle material and weak in tension. Cracking will take place whenever tension occurs in concrete beam and it becomes a fundamental weakness of concrete. Cracking that occurred when stresses in the concrete exceed the concrete strength is usually a major problem for concrete structure usually in terms of site application, resistance to loading and general lack of durability.

Cracking is one of the common problems in the concrete structure. Structural members which are subjected to bending moment such as slabs and beams will develop flexural cracks. Flexural cracks occur when the stresses in the tension zone exceed the bending strength of the concrete. Primary cracks is form first and secondary cracks will forms when moment is increase. In the practical purposes, it can be assumed that the cracks will extend the crack line from the tension face to the location of zero stress of the beam cross section. Tensile strength of concrete is only about 10% of the compressive strength of concrete and the reinforcement bars is designed to resist these tensile forces which are transferred by bond between the interfaces of concrete and reinforcement bars (Mosley *et. al*, 1999).

Cracks are induced in reinforced concrete elements as a results of flexural tensile stress due to bending under applied loads, diagonal tension stress due to shear applied loads, volume changes due to shrinkage, creep, thermal and chemical effects and