CHARACTERISTIC OF FLEXURAL CRACKS IN REINFORCED CONCRETE BEAM UNDER LOW CYCLE DYNAMIC LOAD

BY:

MD RASUL MOHAMAD NOR
SITIHAW A HAMZAH

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ABSTRACT

Reinforced concrete has been widely used in Malaysian construction industry. Both residential and industrial buildings have been constructed using reinforced concrete and at present, many more high-rise structures are constructing with it. Dynamic load on reinforced concrete structure has been widely studied especially on bridges. However, with the recent seismic activity surrounding Malaysia's continent, it has been an interest to determine the dynamic response of reinforced concrete structure in building. This investigation focused on reinforced concrete beam of grade 30 with water cement ratio 0.3, tested under dynamic load influence. A total of 9 beams of size 125mm x 150mm x 1400mm were cast and tested. Deflections and crack patterns during serviceability and ultimate limits were investigated. The investigation shows that the beam deflected between 0.608 mm to 2.527 mm when subjected to 1 million and 3 million cycles during serviceability and ultimate limits. Flexural crack initiated at mid span both under static and dynamic load influence.

CHAPTER 1: INTRODUCTION

1.1 Introduction

Cracking must be controlled and deflections must not be excessive for a concrete structure to be serviceable. The concrete structure must also not vibrate excessively to reduce the occurrence of cracking. Concrete shrinkage plays a major role in each of these aspects of the service load behaviour of concrete structures.

The design for serviceability is the most difficult and least well-understood aspect of the design of concrete structures. Service load behaviour depends primarily on the properties of the concrete and these are often not known reliably at the design stage. Moreover, concrete behaves in a non-linear and inelastic manner at service loads. The non-linear behaviour that complicates serviceability calculations is due to cracking, tension stiffening, creep, and shrinkage. Of these, shrinkage is the most problematic. Restraint to shrinkage causes time-dependent cracking and gradually reduces the beneficial effects of tension stiffening. It results in a gradual widening of existing cracks and, in flexural members, a significant increase in deflections with time.

The control of cracking in a reinforced or prestressed concrete structure is usually achieved by limiting the stress increment in the bonded reinforcement to some appropriately low value and ensuring that the stress increments after cracking and maximum spacing requirements for the bonded reinforcement. However, few existing code procedures, if any, account adequately for the gradual increase in existing crack widths with time, due primarily to shrinkage, or the time-dependent development of new cracks resulting from tensile stresses caused by restraint to shrinkage.