PERFORMANCE AND FATIGUE BEHAVIOUR OF PRESTRESSED CONCRETE RAILWAY SLEEPERS CONTAINING FIBRES

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LAPORAN AKHIR PENYELIDIKAN "PERFORMANCE AND FATIGUE BEHAVIOUR OF PRESTRESSED CONCRETE RAILWAY SLEEPERS CONTAINING FIBRES"

Merujuk kepada perkara di atas bersama-sama ini disertakan 3 (tiga) naskah Laporan Akhir Penyelidikan bertajuk "Performance and fatigue behaviour of prestressed concrete railway sleepers containing fibres".

Sekian, terima kasih.

Yang benar,

PROF. MADYA DR. HJH. KHAFILAH BT. DIN
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ABSTRACT

The design of railway sleepers must account for irregularities of the train or the rails that generate dynamic loads. The sleepers could develop cracks during a train passage although not influential enough to disturb immediately the global track system. However, these cracks can pose a threat to the overall stiffness properties as they can propagate further under repeated loads induced by the train. Consequently they can cause fatigue, which is a structural failure at service condition. This will later constitute a major maintenance item if the problem is not properly addressed. It is intended that the application of high-strength concrete (HSC) with the inclusion of fibres in railway sleepers could reduce, delay or in certain conditions arrest the rate of crack growth.

The design of sleeper was proven to comply in partial of the referenced Standards requirements. The fabrication works undertaken also proved that all procedures were followed satisfactorily and that the laboratory of the Faculty of Civil Engineering was able to handle the production. Structural tests carried out where loads were applied at rail seat showed that behaviour of HSFC sleepers had high flexural strength capacities due to the presence of fibres. These fibres were able to delay crack growth and under constant amplitude loads of 3 million cycles, there were no cracks observed. The fatigue test result is useful as datum information if actual railway loading need to be simulated in future works.

1.0 INTRODUCTION

1.1 General

The design of railway sleepers must account for irregularities of the train or the rails that generate dynamic loads. The sleepers could develop cracks during a train passage although not influential enough to disturb immediately the global track system (Gustavson, 2000). However, cracks are still a threat to the overall stiffness properties as they can propagate further under repeated loads induced by the train. These cracks can cause fatigue, which is a structural failure at service condition of the sleeper and consequently this can constitute a major maintenance item if the problem is not properly addressed.

Existing prestressed concrete sleepers utilised normal concrete strength of grade 40 and more that can fall in the category of 'high strength' but do not include special admixtures. This study focussed on a proposal cf a new design concrete mix that is tough to prevent fracture of sleepers.

1.2 Objectives of Study

The main objectives of the research work encompass;

a) To apply high strength fibre-reinforced concrete (HSFC); which is derived from preliminary works, as railway sleeper material,

b) To design and fabricate prestressed concrete railway sleepers with HSFC material and that it complies design standards,

c) To test the sleeper under static load at rail seat and established datum information for fatigue test,

d) To examine behaviour of the sleeper subjected to static and fatigue loading at rail seat.

1.3 Significance of Study

Significance of HSFC is not new but limited in the applications and even most design codes have not stipulate thorough regulations. It is noted to exhibit lower cumulative length of cracks and with inclusion of fibres the rate of crack growth could be reduced if not eliminated (Kjellssen *et al*,