LAPURAN PROJEK TAHUN AKHIR

KURSUS DIPLOMA LANJUTAN KEJURUTERAAN AWAM

KAJIAN KEJURUTERAAN, I.T.M. SHAH ALAM

DEFLECTION AND CRACK CONTROL OF " COMPOSITE BEAMS FROM RUBBER, TIMBER AND PALM OIL WASTE

BY

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SYNOPSIS

This experimental project is an investigation of deflection and crack control of Composite T-Beams made of rubber timber and concrete using palm shells, the two most abundant raw materials in Malaysia.

Initially rubber trees big enough to provide the required size of beams were searched. The RRIM, Sungai Buloh recommended to use two clones but only the seedling type was suitable and for this purpose TJ1 seedling was selected. With the courtesy of FRI, Kepong they were cut into beams and given nominal treatment and air-dry seasoned.

Palm shells obtained from Bukit Rajah Palm Oil Mill were seived and lime washed and from it concrete mix 1:1:0.3 with an expected strength of 30N/mm^2 were prepared to make 300mm x 100mm thick flange of the T-beams, whereas rubber timber 112.5mm x 225mm x 3200mm long as web. The shear connectors consist of two rows of 8mm diameter by 100mm long hexagonal steel bolts spaced at 150mm centres. Three such beams and one other section 112.5mm x 337.5mm rubber timber web underwent bending test after 28 days of curing.

During the test the maximum crack width, crack length, crack propogation and mode of failure were observed. Deflections and strains at midspan were also measured at different stages of loading. The results show that cracking criteria set out by CP110 is easily satisfied. But the requirement for deflection criteria could not be easily satisfied owing to lower values of Modulus of Elasticity of the two materials. The strain distribution was found to be closer to a normal composite section of concrete and steel. Overall the performances of the beams tested can be considered as satisfactory and the possibility of utilizing these materials for structural purposes is quite bright.

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CHAPTER ONE

INTRODUCTION

Rubber and palm oil are well known agricultural produce but rubberwood (or Hevea Brasiliensis) and palm shell wastes are comparatively new and not heard of in the construction industry, although rubberwood is being successfully utilised commercially in the light industry (furniture) to a certain extent.

Research carried out by the Rubber Research Institut of Malaysia (RRIM)[1] in collabration with the Standards and Industrial Research Institute of Malaysia (SIRIM)[1] has demonstrated that rubberwood could be used as roof trusses, weatherboards, door and window frames in housing construction. Also, research carried out by Universiti Pertanian Malaysia (UPM)[2] and experimental projects by the Institut Teknologi MARA (ITM)[3] has shown that palm shell waste can be used as an aggregate substitute for the ordinary concrete. Further research should enhance the application of both materials in the construction industry (refer Plate No.1 in Appendix D).

The composite action of timber and concrete has been studied in the past[4] and suitable shear connectors were needed. The composite action of rubberwood and lightweight concrete using palm shell aggregates is investigated in this experimental project in view of the importance of both being in abundance and replaceable raw materials.

1 AVAILABILITY OF RUBBERWOOD

The replanting and felling of rubber trees is done after 25 years since tapping for latex ceases to be