UNIVERSITI TEKNOLOGI MARA

THERMAL CONDUCTIVITY OF SELECTED TROPICAL TIMBER USING HOT BOX METHOD

RAIHANA BINTI MOHAMAD HATA

Thesis submitted in fulfillment
of the requirements for the degree of
Master of Science

Faculty of Civil Engineering

April 2019

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.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

Name of Student	:	Raihana binti Mohamad Hata
Student I.D. No.	:	2013618072
Programme	:	Master of Science (Civil Engineering) – EC750
Faculty	:	Civil Engineering
Thesis Title	:	Thermal Conductivity of Selected Tropical Timber Using Hot Box Method
Signature of Student	:	.....
Date	:	April 2019

ABSTRACT

In this study, thermal conductivity of selected tropical timber species was measured using Hot Box method. Each of the selected timber species represent hardwood and softwood as classified in Malaysian Standard MS 544 Part 2. Samples are categorized according to Strength Group (SG) and listed as SG1 to SG7. The higher the strength group, the higher its strength and density. For this research, Chengal, Balau, Kekatong, Kempas, Kembang Semangkok, Keranji, Merpauh, Perupok, Nyatoh, Rubberwood, Terap, Jelutong, Pulai and Sesendok were selected. Application and selection of timber for building are good for insulation as timber has lower thermal conductivity compared to concrete, steel and others building materials. Thus, data on thermal conductivity value for different timber species are useful for building design purposes. Therefore, the objectives of this research is first to determine the heat flux through selected timber species which the data then used to calculate the thermal conductivity and hence the correlation to its physical characteristic. The hot box method was selected since the test gave sufficient amount of data to analyse the thermal conductivity values. The hot box method also gave accurate data compared to other method. The Hot Box method of testing is based on steady state conditions. The testing was conducted up until the heat flux, air temperature and surface temperature value at hot and cold chamber become persistent. The thermal conductivity test was carried out based on BS EN ISO 8990:1996 and MS 1532:2002 standard. Prior to thermal conductivity test, density and specific gravity value were first measured. The moisture content measured using oven dried method. Heat flux value recorded for selected timber species ranged from 90.0 wm^{-2} to 139.3 wm^{-2} which is 35.4% different. The value of heat flux were then used to calculate thermal conductivity value. Based on calculations, the value of thermal conductivity are range from the highest is SG3 Kembang Semangkok 0.051 $Wm^{-1}K^{-1}$ and lowest is SG6 Terap 0.033 $Wm^{-1}K^{-1}$ which the difference in 35.3%. Terap is the best timber species for building insulation purposes. The values of thermal conductivity were then compared with moisture content, density, specific gravity and temperature to see their relationship between these parameters. The relationship between density, specific gravity, moisture content, temperature to thermal conductivity shows a poor linear relationship R^2 of 0.09 and 0.14. As conclusion, timber with lowest moisture content, density and specific gravity is preferable for building insulation purposes.

TABLE OF CONTENTS