Engineered Energy and Environmental Control Systems

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ASSESSMENT OF THE THERMAL PROPERTIES OF TIMBERCRETE WITH A HOT DISK THERMAL ANALYSER

Product Description and Scope of Report

Timbercrete is a cellulose-concrete composite building material. The manufacturers of Timbercrete claim that the thermal conductivity of Timbercrete is significantly lower than ordinary concrete. This report assesses the thermal properties of Timbercrete by means of the Transient Plane Source method of thermal testing, using a Hot Disk Thermal Constants Analyser (Hot Disk) supplied by Hot Disk AB, Sweden.

Experimental Method

Six Timbercrete samples, with nominal size 100x100x45 mm, were supplied by Timbercrete Ltd for testing by the University of Canterbury, Christchurch, New Zealand. The samples were cast more than three months prior to testing and were cured indoors at room temperature. They were conditioned at 21^{o}C for five days prior to testing and were then tested at 21^{o}C.

The Hot Disk 'basic method' was used to test the Timbercrete samples. A 16.5 mm diameter sensor (Number 4922) was sandwiched between the large faces of two Timbercrete samples of the same nominal density. Measurements were taken with a power of 0.3 Watts applied to the sensor for 160 seconds, resulting in an estimated probing depth of 15-20 mm in each sample. After a delay of six hours the opposite ends of the matching pair of samples were tested in the same way.

Thermal Properties

The results of the experimental measurements are shown in Table 1. It can be seen that thermal conductivity of Timbercrete increases from 0.234-0.414 W/mK as its density varies from 900-1100 kg/m^3. And it can be seen that there is a non-linear relationship between the thermal conductivity of Timbercrete and its density.

Timbercrete's thermal conductivity is less than that of ordinary concrete (approx. 1.3 W/mK) and solid clay bricks (approx. 1.2 W/mK).

Wall R-value

As Timbercrete is a homegenous material the total thermal resistance of a solid Timbercrete wall can be found from:

$R = L/k + R_{si} + R_{so}$ m^2K/W

where L (m) is the wall thickness, k (W/mK) is the thermal conductivity and R_{si} and R_{so} (m^2K/W) are the internal and external surface resistances respectively.

ing Interim New Zealand Standard NZS 4214(Int):2002 *Methods of determining the total thermal resistance of parts of buildings* the standard total thermal resistance of a 0.2 m thick, fine sawdust Timbercrete wall, for example, is:

R = 0.2/0.234 + 0.09 + 0.03 = 0.975 m^2K/W. (NZ)

R = 0.2/0.234 + 0.12 + 0.04 = 1.015 m^2K/W. (Aus)

Table 1 Thermal test results for Timbercrete samples

Product Type	Test Number	Thermal Conductivity (W/mK)	Thermal Diffusivity (mm^2/s)	Volumetric Heat Capacity (MJ/m^3K)
Fine sawdust Timbercrete (nominally 900 kg/m^3)	1	0.2295	0.3470	0.6612
	2	0.2384	0.3585	0.6651
	Mean @ 21°C	**0.234±0.005**	**0.353**	**0.663**

Disclaimer

Reported values for the thermal properties of Timbercrete apply to the test samples supplied by Timbercrete Ltd. Ensys Ltd does not warranty the thermal performance of Timbercrete products supplied by Timbercrete Ltd.

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