

Dynamic thermal properties calculator



The Concrete Centre has launched a free tool for calculating the thermal properties of construction elements, which has been developed by Arup.

Part L of the Building Regulations, which deals with the conservation of energy, is currently being revised along with the compliance tool for housing known as SAP (Standard Assessment Procedure). The changes to SAP include a more-rigorous treatment of thermal mass in housing and the role it can play in passive design. When used appropriately, thermal mass can improve energy efficiency during the heating season by providing a means of capturing and slowly releasing free heat gains from the sun and internal sources. This cuts the load on the heating sys-

tem and reduces CO₂ emissions, particularly in well insulated, air-tight homes.

The revisions take better account of this passive heating effect and, to help designers take advantage, the Concrete Centre commissioned Arup to develop a free Excel-based tool for calculating the thermal mass in floors and walls, which can now be downloaded at www.concretecentre.com.

The methodology is based on BS EN ISO 13786, and is fully aligned with SAP, allowing thermal mass values (also known as Kappa values) to be easily calculated and

used in SAP software. If required, admittance values are also produced, providing an alternative means of assessing thermal mass.

Another feature of the tool is its ability to calculate decrement. This is a property of thermal mass which describes the way in which the density, heat capacity and thermal conductivity (of a wall for example) can slow the passage of heat from one side to the other (decrement delay), and also attenuate gains as they pass through (decrement factor). Designing for a long decrement delay of around nine hours or more, and a low decrement factor can help reduce overheating problems in summer.

The motivation for producing this tool is the growing need among architects and engineers for more information about the thermal characteristics of construction elements, other than just their U-value. This information helps to inform passive design choices and optimise the energy efficiency of the building form and fabric. Going forward, we are likely to see more attention paid to getting this right as the building fabric will have to work harder to help achieve the challenging requirements of Part L and the approaching zero-carbon target for new buildings. A further driver is the need for climate change adaptation, which will also place greater demands on the performance of construction materials.

For further information please contact Tom De Saulles at The Concrete Centre (01276 608714; E-mail: info@concretecentre.com).

Dynamic Thermal Property Calculator (ver 1.0)

Project Details

Project Name: [Input Field]
 Project Number: [Input Field]
 Date of this report: [Input Field]
 Date: [Input Field]
 Created by: [Input Field]

Material Properties

Material: [Input Field]
 Thermal surface resistance: [Input Field] m²SW
 External surface resistance: [Input Field] m²SW
 Location of element: [Input Field]

Element Construction

Layer type - select from the drop down menu (insert gaps)	Layer name	Thickness (mm)	Density (kg/m ³)	Specific heat capacity (kJ/kgK)	Thermal conductivity (W/mK)	Layer weight (kg/m ²)	Layer volume (m ³ /m ²)
Wall Layer	Green concrete	11	1300	840	0.87		
Wall Layer	Aggregate block	100	1400	850	0.11		
Wall Layer	Insulated void	100	30	1450	0.025		
Wall / Ceiling	Plaster	10	1200	840	0.07		
Wall Layer	Self-rendered	20	1700	840	0.07		

Results Summary

Admittance (kg/m²h^{0.5}): 4.32
 Decrement factor (%): 8.12
 Decrement delay (hours): 11.88
 Attenuation (%): 1.18

Instructions

Enter the construction details.
 Choose the layer data from the drop down menu for each layer, with the same order from top to bottom.
 Check the required parameters for each layer, which will automatically have been highlighted in green.
 Values may be copied from the relevant cells.
 For further advice on how to use or to see detailed thermal resistance can be specified.
 Click the CALCULATE button.
 A full list of layers and details will be displayed on the Full Results sheet.

The tool calculates the thermal mass and related properties of construction elements such as walls and floors