Technical Note No 46

Introduction to building envelope energy transfer

This Technical Note is one of four on the effect of building envelope performance on energy use in buildings. The series comprises:

TN 46 Introduction to building envelope energy transfer
TN 47 Overall building envelope U-values
TN 48 Energy loss through windows
TN 49 U-values of curtain walls

Introduction

This Technical Note introduces the reader to the basic principles of heat transfer that are required to understand the contribution that building envelopes can make to the construction of energy efficient buildings.

Information is given on heat transfer mechanisms, material properties and general calculation principles.

A guide to relevant UK legislation and standards is also given.

Energy transfer

Energy is gained or lost from a building by:

- Radiation or convection from the outer surface of the building

And

- Air leakage (mass transfer) into or out of the building.

Energy transfer through a building envelope may cause heat gain or heat loss, either of which may lead to increased energy use in a building depending on the external climate. The requirement for heating or cooling may be constant in tropical or polar regions but will otherwise vary seasonally as it does in the UK.

	Internal heating required	Internal cooling required
Heat gain	Good	Bad
Heat loss	Bad	Good

Table 1 Effect of heat transfer

Energy efficient facades have to:

- Be insulated to keep the external surface as nearly the same as the external temperature *(Reduces convection and radiation losses/gains from the outer surface)*
- Be sealed to prevent gross air leakage *(reduces mass transfer losses/gains)*
- Shield internal surfaces *(Reduces radiation losses/gains from/to internal surfaces)*
- Allow in sufficient daylight *(Reduces energy used for artificial lighting)*

Units

Energy

Energy is the same as work and the unit of energy is the Joule (J). The unit of force is the Newton (N) and 1 Joule is 1 Nm. Energy may also be measured in kilowatt-hours (kWh), which is the common charging unit for energy. 1 kWh = 3.6×10^6 J.