



## Numerical Thermal Modelling Calculations – A Summary

### Heat escapes from buildings by:

- a. migrating through the main building heat loss elements (walls, ground floors, roofs, windows and doors);
- b. warm air exiting through both the designed ventilation and through un-planned holes and gaps in the building envelope, and;
- c. migrating through highly conductive junctions between the main heat loss elements.

Traditionally at these junctions structural considerations and buildability have taken priority, resulting in concentrations of dense construction materials which often completely interrupts the insulation system. It is this third item that *Numerical Thermal Modeling* addresses.

The most common method of evaluating thermal bridge losses in the SAP calculation is to use a prescribed coefficient called the  $\gamma$ -value, which basically increases the total heat loss area by a fixed percentage and then designates that area as the thermal bridge having a U-value of 1.0 W/m<sup>2</sup>. KSAP 2005 has two set  $\gamma$ -values:

$\gamma = 0.15$  is SAP default for all forms of construction in the absence of any information about the junction details, and;

$\gamma = 0.08$  can be used where details can be shown to be consistent with published junction details known as accredited construction details (ACDs) for masonry, timber frame and steel frame buildings.

Alternatively and less commonly used, the SAP calculation can consider each thermal bridge individually, where a detail specific coefficient is multiplied by the length of the junction to produce the linear thermal loss. These coefficients are known as  $\Psi$ -values, and they are specific to construction details and construction method.

In 2010, SAP 2009 will no longer permit the use of  $\gamma = 0.08$  for accredited details. Instead a set of  $\Psi$ -values published in Appendix K of the SAP Specification will have to be applied to all junctions, and the results summed to calculate the total thermal bridge heat loss for the building.  $\gamma$  – values by their universal nature are crude and generally conservative values to use to estimate thermal bridge losses.  $\Psi$ -values offer a more considered and accurate method to evaluate these losses. Using system specific  $\Psi$ -values that have been calculated using finite element heat flow methodology are going to be more accurate still, and they will reward good design practice.

### Numerical Thermal Modeling Calculations are performed in accordance with:

**EN ISO 10211-2007** (*British Standards*)

**IP 1/06 & BR497** (*BRE Press*) and with reference to the following publications:

**EN ISO 6946** (*British Standards*)

**BR443** (*BRE Press*)

### Effective use of Numerical Thermal Modeling

There are two steps to the effective use of Numerical Thermal Modeling:

1. Accurately model the system junctions to produce lower  $\Psi$ -values than the published generic values.
2. Use the results of the numerical modeling process to develop more thermally efficient junction details.