Conventions for calculating the Ψ-value of a separating (or partition) wall that penetrates the insulation of the ground floor

In order to determine the Ψ-value for such walls it is necessary to construct two models – firstly, the floor with the separating wall (Figure 1), giving a heat loss Q_1 , and secondly, the floor without the separating wall (Figure 2), giving Q_2.

To model the heat loss into the ground adequately it is necessary to include the large ground volumes shown, and because the separating wall causes heat loss both perpendicular and parallel to its length, it is necessary to construct the three dimensional models shown in Figures 1 and 2. Note both models are identical – i.e. have the same overall dimensions (areas and volumes) of both models, except that the second model has the wall and its foundation removed and replaced by a continuation of the floor construction. Normally the second model is simply an amendment of the first.

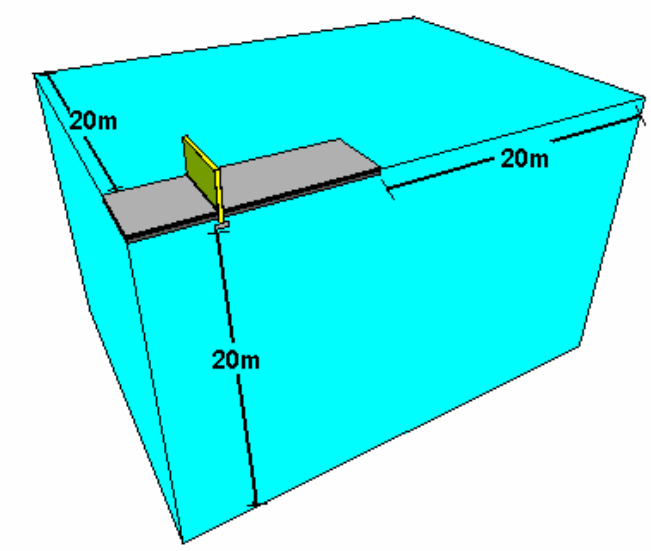

Figure 1 – Complete model of ground floor and separating wall (showing ground dimensions)

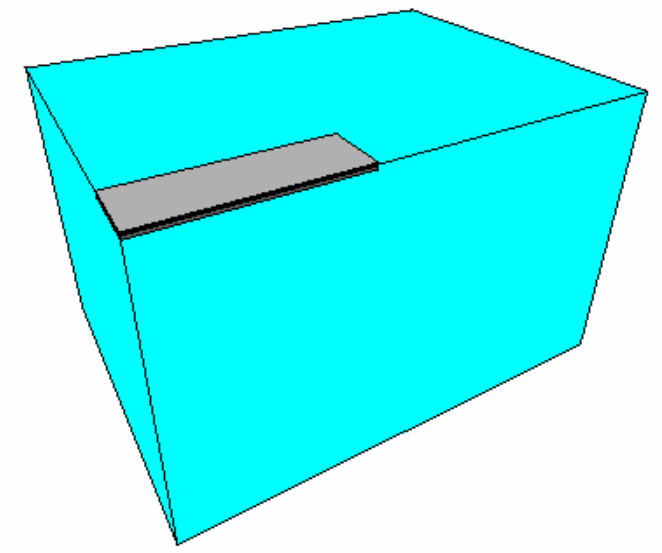

Figure 2 – Same model as in Figure 1, but with the separating wall (and its foundation) removed and replaced by the floor construction

The Ψ-value determined from the difference in heat flow from these two models takes account of only the constructional thermal bridging effect of this junction and not any geometrical effect (see below). This constructional Ψ-value, Ψ_C, is determined from :-

$$\Psi_c = \frac{(Q_1 - Q_2)}{w \times \Delta T} \text{ W/m·K} \qquad (1)$$

Where Q_1 is the calculated heat loss including the separating wall, in W

Q_2 is the calculated heat loss not including the separating wall, in W

w is the width of floor (in the model) parallel to the separating wall, in m

ΔT is the temperature difference between inside and outside, in °C

To avoid the Ψ-value of the separating wall junction with the ground floor depending on the nature of the external walls, in the models both the gable and side walls are replaced with 300 mm wide adiabatic boundaries as shown in Figure 3.

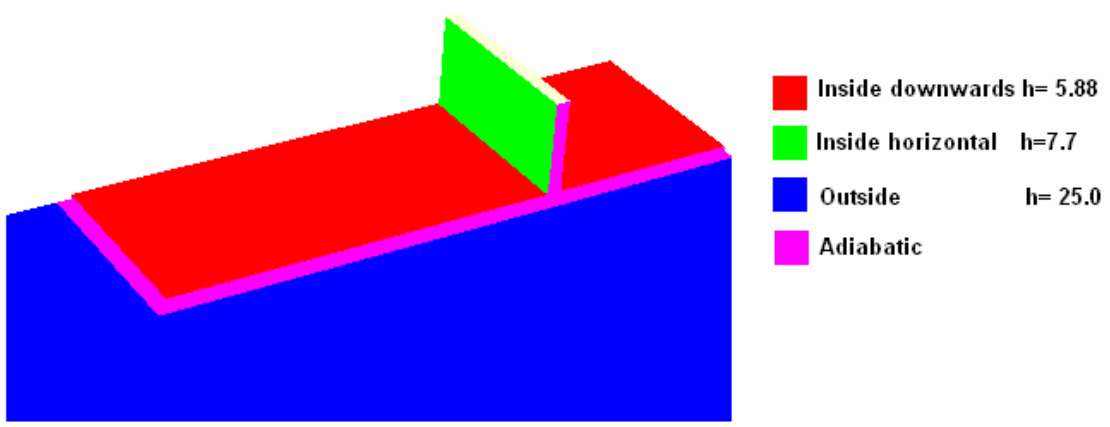

Figure 3 – Boundary Conditions

Separating walls can separate between different built forms – mid-terrace, end terrace and semi-detached. However, the Ψ-value depends only slightly on built form with a variation of about + 0.01 W/m·K between the mid-terrace and the semi-detached cases. By convention, the build form to use when modelling the ground floor/separating wall junction is that of the end-terrace. The calculated Ψ-value of the separating wall junction with the ground floor is then applied in all built forms.

The cross-section of the end-terrace built form is shown in Figure 1. The characteristic dimension, b, of the floor is taken to be 8m. The width of the floor in the model parallel to the separating wall from the floor edge to the opposite adiabatic is then half the characteristic dimension of the floor, i.e. 4 m. The height (above the inside floor level) to the adiabatic at the top of the separating wall is taken to be 1.2 m.

As indicated earlier, the Ψ-value determined from these two models (with and without the separating wall) is made up of only the constructional thermal bridging effect of the junction of the separating wall with the floor. Where the separating wall is between properties, since the U-value of the floor is applied up to the finished internal area of the floor, i.e. only up to the separating wall, there is an additional heat flow to be applied to the junction where this is equal to the U-value of the floor in the model multiplied by the thickness of the separating wall. In the case of a separating wall within the same property (e.g. a partition wall) there is

no additional heat flow since the U-value of the floor applies to an area that includes the width of the separating wall.

Thus in the case of a separating wall *between* properties, Ψ is determined from –

$$\Psi = \Psi_c + (t_{wall} \times U_f) \text{ W/m·K} \quad (2)$$

where

Ψ_c is the value calculated from equation (1)

t_{wall} is the thickness of the separating wall and

U_f is the U-value of the floor from the model

and half of the calculated Ψ-value is assigned to each property.

In the case of a separating wall *within* a property, Ψ is equal to Ψ_c from equation (1) and the full calculated Ψ-value is assigned to the property.

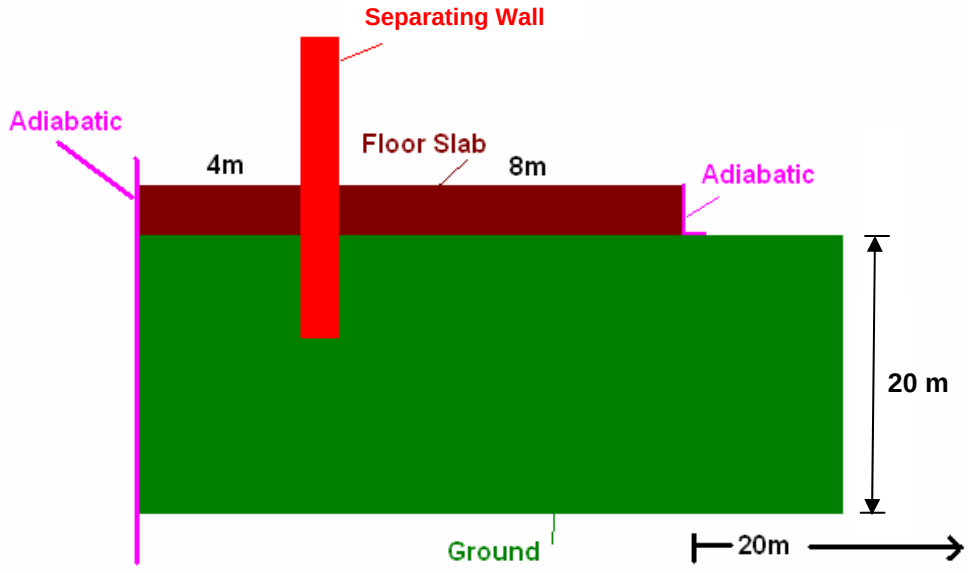

Figure 1 - End Terraced built form

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