DEAP Thermal Bridging Factor Application

Contents

1.   Introduction

There are three default values available for 'Thermal Bridging Factor' (y) in DEAP manual Appendix K under www.seai.ie/deap.

A default value of **y = 0.15 W/m^{2}K** applies for all dwellings except the following:

- **y = 0.08 W/m^{2}K:** for new dwellings, whose details conform with ''Limiting Thermal Bridging and Air Infiltration --- Acceptable Construction Details'' Prepared by the Department of Housing, Local Government and Heritage, www.gov.ie/housing, as referenced in Building Regulations 2008, 2011, 2019, 2021, and 2022 TGD L. This requires that the relevant drawings be signed off by the developer/builder, site engineer or architect.

- **y = 0.11 W/m^{2}K:** Only applies to new dwellings where Building Regulations 2005 TGD L applies. This value may be used when sign-off by the developer/builder, site engineer or architect indicates that all details in the dwelling have been constructed in accordance with both:
  i.   Diagrams 3 and 4, and Sections 1.2.4 and 1.2.5 of Building Regulations 2005 TGD L
  ii.   The details set out in the Homebond publication "Right on Site, Issue No. 28" or the 5th or later editions of the Homebond Manual.

This application enables BER Assessors to calculate a non-default Thermal Bridging Factor for use in the Dwelling Energy Assessment Procedure (DEAP). This 'Thermal Bridging Factor Application' references the default linear transmittance values (ψ [W/ (mK)], or Psi values) in Appendix D of TGD L 2022. The application may be used to determine a non- default thermal bridging factor (y) for use in DEAP.

The methods outlined in TGD L 2022 for limiting thermal bridges are to:
(1) adopt Acceptable Construction Details for typical constructions as shown in sections 1 to 6 in the document "Limiting Thermal Bridging and Air Infiltration – Acceptable Construction Details" for all key junctions.
(2) adopt Acceptable Construction Details sections 1 to 6 combined with details from Appendix 2 of the document "Limiting Thermal Bridging and Air Infiltration – Acceptable Construction Details" or other certified details (as defined in (iii) below) for all key junctions.
(3) use certified details which have been assessed in accordance, and comply, with Appendix D, e.g., certified by a third-party certification body such as Agrément or equivalent or certified by a member of an approved thermal modelers scheme (to be developed) or equivalent for all key junctions;
(4) use alternative details which limit the risk of mould growth and surface condensation to an acceptable

The transmission heat loss coefficient H$_{TB}$ associated with non-repeating thermal bridges is based on the formula described in Section D3 of TGD L 2022:

$$H_{TB} = \sum (L \ x \ \Psi)$$

- L is the length of the junction/thermal bridge over which Ψ applies.

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The linear transmittance (Ψ) describes the heat loss associated with a thermal bridge. This is the rate of heat flow per degree, per unit length of the bridge that is not accounted for in the u-values of the plane building elements containing the thermal bridge. The Y- factor for DEAP is then derived as follows:

$$y = \frac{H_{TB}}{\sum A_{exp}}$$

- Y is the thermal bridging factor (y) as calculated by this application.
- "A_{exp}" is the sum of exposed (heat loss) areas of the dwelling in m^2.

The calculation procedure to establish the linear thermal transmittance (ψ) is outlined in BRE IP 1/06. Details should be assessed in accordance with the methods described in I.S. EN ISO 10211. These calculations of two dimensional or three dimensional heat flow require the use of numerical modelling software validated against I.S. EN ISO 10211.

Values of ψ can be determined from the results of numerical modeling to the required standards or can be taken from Tables D1 to D6 of TGD L 2011 for Acceptable Construction Details if the details are followed during design and construction.

This calculation is based on the methods outlined in Appendix D of TGD Part L 2022 and can be applied to new dwellings meeting the criteria set out in TGD L 2022 Section 1.3.3.2. **The user must include all thermal bridges at junctions in the building. The y factor can be calculated using this application for use in DEAP.**

A guide to Acceptable Construction Details (ACDs) is intended to help the construction industry achieve the performance standards in the Technical Guidance Document (TGD) to Part L of the Building Regulations - Conservation of Fuel and Energy - Dwellings.

Technical Guidance Document L, Limiting Thermal Bridging and Air Infiltration, Acceptable Construction Details 2021 Edition, has been prepared by the Department of Housing, Local Government, and heritage.

A sample calculation and Wireframe of typical 3-bed semidetached house showing typical thermal bridges normally present using the actual lengths of the internal junctions the y factor for use in DEAP.
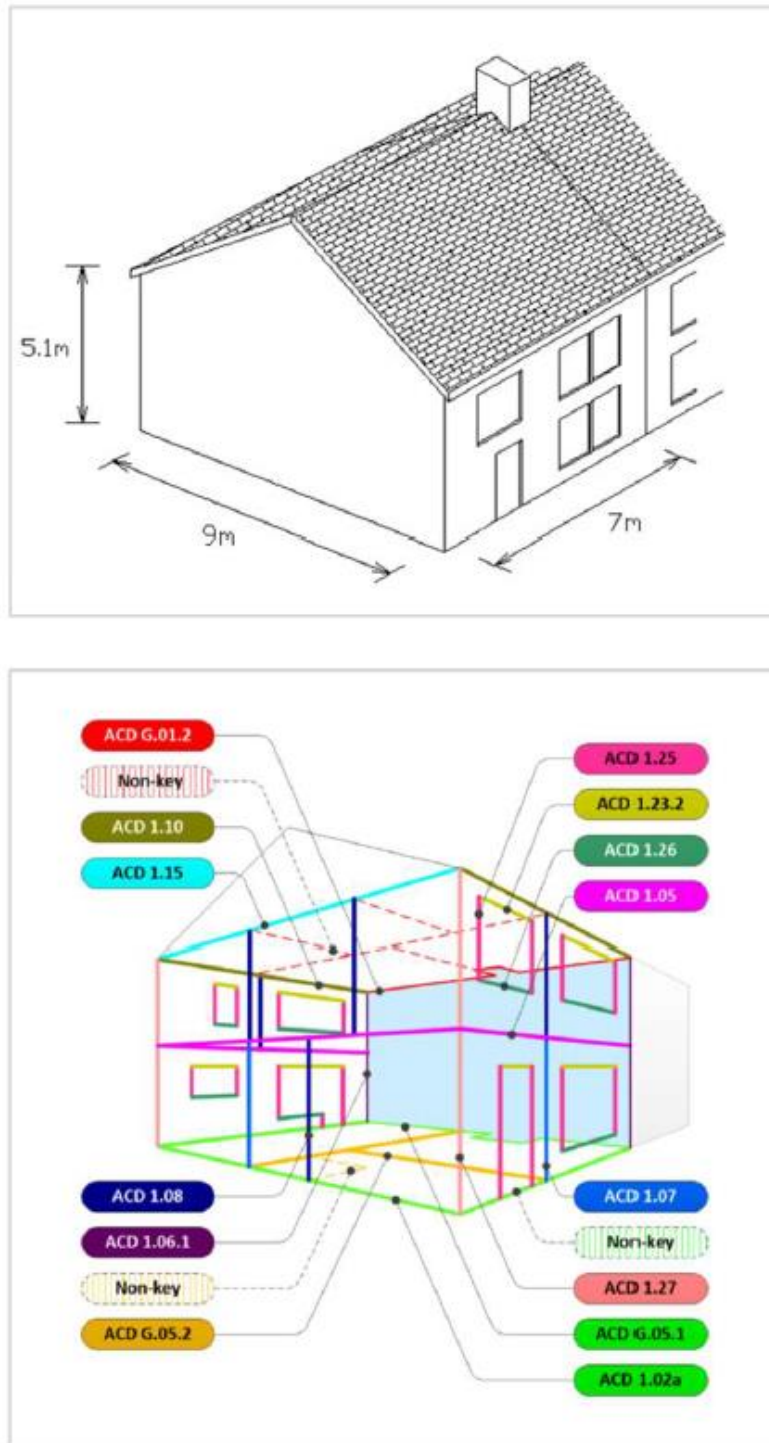
Figure 1

2.   Using the Y value calculation tool

The 'Thermal Bridging Factor (y)' is based on the junctions not taken into account in the calculation of the U-Values of plane building elements. These include junctions around openings such as windows and doors and junctions at the intersection of two planar elements such as the corners of walls, junctions between floors and walls and junctions between walls and ceilings.

The lengths of all of the junctions are first measured in metres and the total exposed and semi- exposed (heat loss) envelope area of the building determined. The exposed envelope area is available from the DEAP Envelope area calculations. Measurements are based on internal surfaces.

This data is used by the Microsoft Excel application, 'Thermal Bridging Application.xlsm'. This application is designed to run in Microsoft Excel 2007 and later versions. **Ensure that macros are enabled in Microsoft Excel when using this application.**

Data is entered in the 'Calculations' Tab of this application. This is accessed by selecting the tab directly or by pressing the 'Thermal Bridging' button on the 'Title' tab.

2.1 'Calculations' tab layout.

The 'Calculations' tab is divided into two sections. The header area in Figure 2 contains information relating to the whole dwelling. The detailed table in Figure 3 displays data relating to each individual junction within the dwelling.

The header area (Figure 2) is divided into three sections as follows:
1) The section to the left identifies the dwelling including the MPRN, BER number, address, and a comments section.
2) The middle section contains a data entry box for the total exposed and semi-exposed envelope area of the dwelling, a results box for showing the final calculated 'Thermal Bridging Factor (y)' and a button for adding new junctions to the details area.
3) The right most section contains a key indicating what the different colours in this application refer to. Only the yellow "user input" boxes are editable by the user.
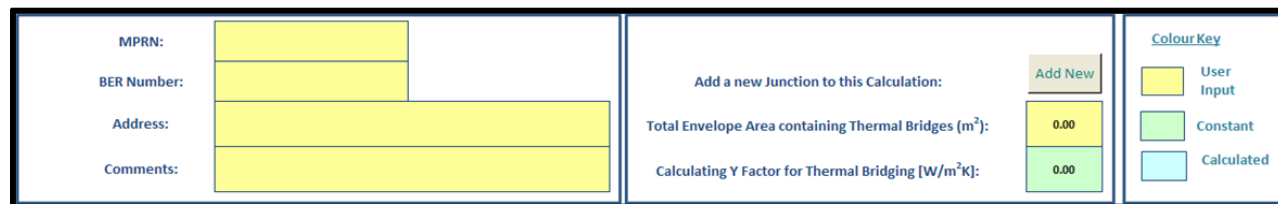

Figure 2

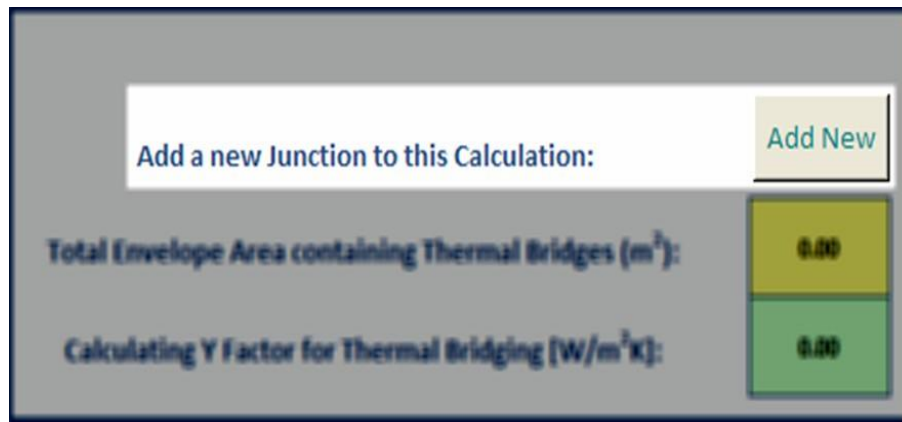| Delete	Edit	Item Number	Table	Junction Detail	Description	Target U-Value(W/m^{2}K)	Psi Value (W/mK)	Length (m)	Calculated Value Psi*L (W/K)

Figure 3

2.2 Adding a new junction.

Figure 4

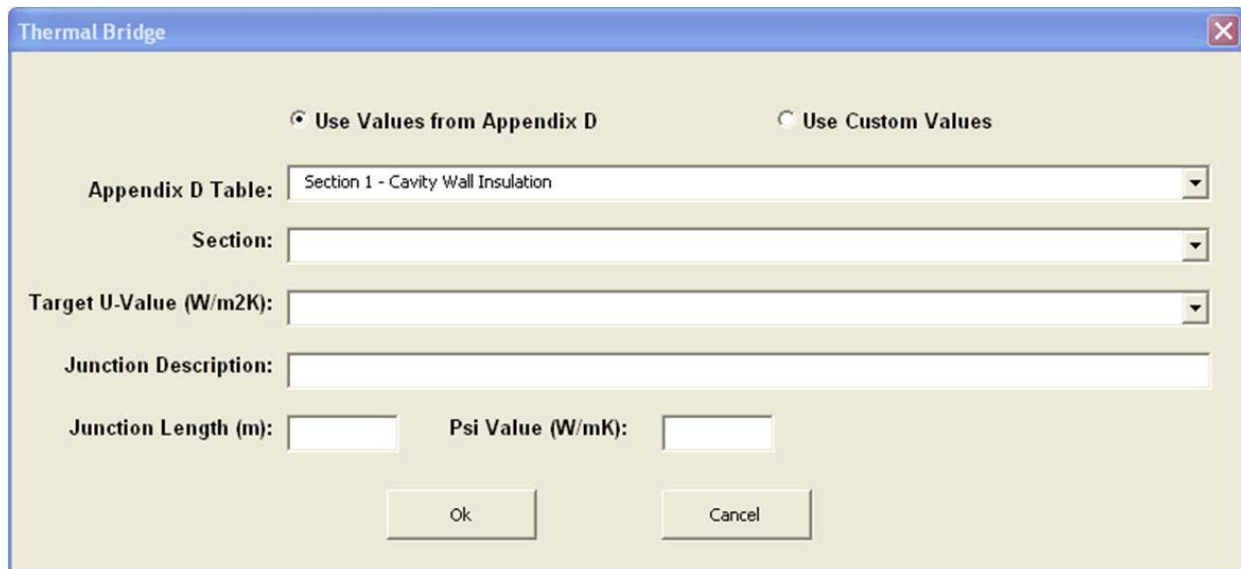*Figure 5*

To add a new junction to the list, click the 'Add New' button highlighted in <u>Figure 4</u>. This presents the user with the following window:

The window in <u>Figure 5</u> allows the user to enter the thermal bridge details for a junction in one of two ways, either by selecting from the Appendix D tables or entering a custom calculated Psi Value. The associated junction length is entered in metres. The junction is identified by the user using the "junction description" entry. All measurements refer to internal surfaces of the building elements.

To enter data from the Appendix D tables, the option at the top of the window *'Use Values from Appendix D'* should be selected. The first drop down list on this window, Appendix D Table, has six options, one for each of the tables in Appendix D as follows:

Section 1 - Cavity Wall Insulation
Section 2 - External Insulation
Section 3 - Internal Insulation
Section 4 - Timber Frame Construction
Section 5 - Steel Frame Construction
Section 6 - Hollow Block Construction

Figure 6

The appropriate option is chosen based on construction type. Once selected, the options in each of the other two dropdown lists are automatically populated to reflect the chosen table. For example, if 'Section 1 – Cavity Wall Insulation' is selected then the rows of TGD L 2022 Table D1 are automatically displayed in the dropdown list entitled 'Section'. The 'Target U-Values' from Table D1 are also automatically listed to the third dropdown list. **The user must refer to the footnotes associated with the relevant tables D1 – D6 in TGD L 2022.**

To enter a custom Psi Value for a junction, select the *'Use Custom Values'* option at the top of the window. This disables the three dropdown lists relating to Appendix D described above and requires entries for the junction description, junction length and the certified Psi value. When entering a custom Psi value, full details on the method used to determine this value must be retained including thermal models of the relevant junction to the required standards.

Once all selections have been made and the junction length added, pressing the 'Ok' button closes the window in Figure 5 and adds this junction to the list of junctions as demonstrated in Figure 7.

Delete	Edit	Item Number	Table	Junction Detail	Description	Target U-Value(W/m²K)	Psi Value (W/mK)	Length (m)	Calculated Value Psi*L (W/K)
		1	Section 4 - Timber Frame Construction	4.12.2: Eaves – Insulation between and under rafters – Unventilated/Ventilated rafter void – Pitched Ceiling Dormer	Junction betweeb Upper Floor Ceiling and NE Wall	0.15 U-value. Insulation between studs and internal Insulation (roof U = 0.14) (floor U = 0.15)	0.0130	6.450	0.084

Figure 7

This process is repeated for all junctions in the building. As each junction is added the 'Calculated Factor for Thermal Bridging (y)' in Figure 2 is automatically recalculated.

The workbook should be saved with a unique name for future reference. This is a Read-Only file so a new file name must be provided by the user at the time of initial saving.

2.3   Editing and deleting junctions.

As can be seen in Figure 7 the cells in the added row have three different colours:
4)   Green – are constants and cannot be edited on screen.
5)   Blue – are automatically calculated values which cannot be edited.
6)   Yellow – are fields where data entry or alteration allowed.

In Figure 7 there are three yellow fields i.e., allowing data entry.

1)   Delete – Allows the user to select this row for deletion.
2)   Edit – Allows the user to select this row to be edited.
3)   Length (m) – allows the user to change the junction length without re-entering all of the details.

To delete a row from the grid, the user must click the delete cell on that row. This results in a delete symbol appearing as shown in Figure 8. Clicking this cell again results in the delete symbol being removed. Once at least one row has been selected for deletion, clicking the Delete button located at cell A9 deletes this row from the grid. The user can select multiple rows for simultaneous deletion.
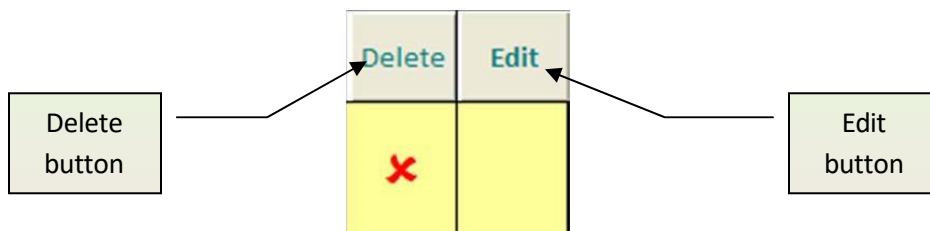

Figure 8

To edit a row in the grid, the user must click the edit cell on that row. This results in an edit symbol appearing as per Figure 9. Clicking this cell again results in the edit symbol being removed. Only one row can be edited at a time. Once a row has been selected, clicking the Edit button located at cell B9 opens the Edit window as described in Figure 10 with the data from this row displayed. This window is similar to the data entry window described in Figure 5. Any item can be changed by making a new selection from the drop-down list or by entering data in the data entry box. Finally pressing OK saves the changes and pressing Cancel reverts to the "calculation" screen, cancelling the changes made to the line.
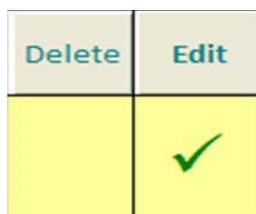

Figure 9

Figure 10

2.4 Reminders.

The calculator provides three reminders as can be seen in Figure 11.

1. The total length of ground floor door thresholds to be included in the floor-to-wall thermal junction length if it has not been separately defined as a key junction.

2. Thermal Bridging is lower than average, average, and higher than average of 0.05 W/m²K. **This is for information only.**

3. Halving of psi-values for party wall junctions**. Half the length of the junction should be entered as a workaround where this is necessary.**

Figure 11