A PRAGMATIC APPROACH TO INCORPORATE THE EFFECT OF THERMAL BRIDGING WITHIN THE EPBD-REGULATION

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Thermal bridging accounts for ± 5% of conduction heat losses.

Photograph: Guardian (UK) Anglian

SENIVV – study (1995-1997)
Introduction

Different approaches to incorporate thermal bridges into EPBD-regulations, depending on member states.

- Numerical simulations
  \( \Psi \)- and \( \chi \)-values
  \((W/mK)\) or \((W/K)\)

- The simplified approaches
  \(\Delta U\) added to \(U\)-value of component
  Use of tabulated values
  Use of thermal bridge atlas
Introduction

... but often still time consuming and not always an incentive to perform better

A PRAGMATIC APPROACH TO INCORPORATE THE EFFECT OF THERMAL BRIDGING WITHIN THE EPBD-REGULATION

- Overall methodology
  - three options to take thermal bridging into account
- The simplified approach
- Conclusions
Overall methodology

Three options to take thermal bridges into account

**OPTION A**
Detailed method

**Variable increase of total thermal transmittance**

**OPTION B**
Method of the EPB-accepted nodes

**EPB-accepted nodes**

**Small fixed increase of total thermal transmittance**

**not -EPB-accepted nodes**

**Variable increase of total thermal transmittance**

**OPTION C**
Fixed increase

**Large, fixed increase of total thermal transmittance**
Overall methodology

Impact of thermal bridges on the overall heat losses

default value of fixed increase of overall transmittance taken as 3 W/K
Overall methodology

Three options to take thermal bridges into account

OPTION A
Detailed method

- Variable increase of total thermal transmittance
  - Small fixed increase of total thermal transmittance
  - Variable increase of total thermal transmittance

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not-EPB-accepted nodes
Variable increase of total thermal transmittance

Large, fixed increase of total thermal transmittance
The simplified approach

EPB – accepted node

Fulfils one of the BASIC RULES

- BASIC RULE 1 minimal contact length
- BASIC RULE 2 insertion of insulating element
- BASIC RULE 3 path of minimal thermal resistance

and/or

Fulfils $\Psi_e \leq \Psi_{e,\text{lim}}$
The simplified approach

- **EPB – accepted node**
  - Fulfils one of the **BASIC RULES**
    - **BASIC RULE 1** minimal contact length
    - **BASIC RULE 2** insertion of insulating element
    - **BASIC RULE 3** path of minimal thermal resistance
  - **Fulfils** $\Psi_e \leq \Psi_{e,\text{lim}}$

The simplified approach

Limit values of the linear transmittance coefficient

<table>
<thead>
<tr>
<th>Type of thermal bridge</th>
<th>Limit value</th>
</tr>
</thead>
<tbody>
<tr>
<td>External corners</td>
<td></td>
</tr>
<tr>
<td>- wall/wall connection</td>
<td>-0.10 W/m.K</td>
</tr>
<tr>
<td>- other external corners</td>
<td>0.00 W/m.K</td>
</tr>
<tr>
<td>Internal corners</td>
<td>0.15 W/m.K</td>
</tr>
<tr>
<td>Wall/window and wall/door junction</td>
<td>0.10 W/m.K</td>
</tr>
<tr>
<td>Foundations</td>
<td>0.05 W/m.K</td>
</tr>
<tr>
<td>Balconies</td>
<td>0.10 W/m.K</td>
</tr>
<tr>
<td>Others</td>
<td>0.00 W/m.K</td>
</tr>
</tbody>
</table>
The simplified approach

EPB – accepted node

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and/or

Fulfils $\Psi_e \leq \Psi_{e,\text{lim}}$
Global aim

- Simple rules (straight forward, easy to use)
- No calculations needed
- Based on common sense
- Flexible (broader applicable than e.g. thermal bridge atlas)

Starting point: guarantee THERMAL BREAK along building skin

Can easily be checked during design and construction phase

⇒ increase awareness!
The simplified approach

Basic rule 1: minimal contact length

connecting insulation layers need a sufficient contact length

\[ d_{\text{contact}} \geq \frac{1}{2} \times \min(d_1, d_2) \]
The simplified approach

Basic rule 2: insertion of insulating element

Insulating elements have to fulfil three requirements
The simplified approach

Requirements to apply basic rule 2:

1. The intermediate material is an insulating material
   
   \[
   \lambda \text{ -value requirement: } \lambda \leq 0.2 \text{W/mK}
   \]

2. Criterion of thermal resistance relative to components
   
   \[
   R\text{-value requirement: } R \geq \min \left( \frac{R_1}{2}, \frac{R_2}{2}, 2 \right)
   \]

3. Sufficient contact length cfr. basic rule 1
   
   \[
   \text{Contact length : } d_{\text{contact,}i} \geq \frac{1}{2} \times \min(d_{\text{ins. part}}, d_x)
   \]
Example

Check basic rule 2

Intermediate element has to

1. have a low thermal conductivity
   \[ \lambda = 0.08 \leq 0.2 \text{ W/mK} \text{ OK!} \]

2. have a sufficient thermal resistance
   \[ R_{\text{facade}} = \frac{0.12}{0.04} = 3 \text{ m}^2\text{K/W} \]
   \[ R_{\text{floor}} = \frac{0.05}{0.03} = 1.67 \text{ m}^2\text{K/W} \]
   \[ \Rightarrow R \text{ must be } \geq \frac{1.67}{2} = 0.84 \text{ m}^2\text{K/W} \]
   \[ \Rightarrow R = \frac{0.08}{0.08} = 1 \text{ m}^2\text{K/W} \text{ OK!} \]

3. make contact with other insulation layers
   Cfr. Basic rule 1 \text{ OK!}
The simplified approach

Basic rule 3: path of minimal thermal resistance

If continuity is not possible, heat flow path needs to be sufficiently long

Required minimum heat flow path length: $l_{\text{heat flow path}} \geq 1$ meter
The simplified approach
Conclusions

• Thermal bridging accounts for significant share of total heat losses.
• An approach with three options has been developed to take thermal bridges into account in Belgian EPBD-regulation.

Three options to take thermal bridges into account

**OPTION A**
Detailed method

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Method of the EPB-accepted nodes

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Fixed increase

Large, fixed increase of total thermal transmittance
Conclusions

• The basic rules guarantee a continuous insulation layer within the building envelope
• The rules are defined in such a way that requirements are relative to the insulation level of the building
• The proposed simplified approach is mainly based on common sense:
  – rules are easy to use
  – much broader applicable than e.g. thermal bridge atlas
  – can be easily checked by designers, contractors, inspectors
  – increase awareness of good thermal detailing

Thank you for your attention