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

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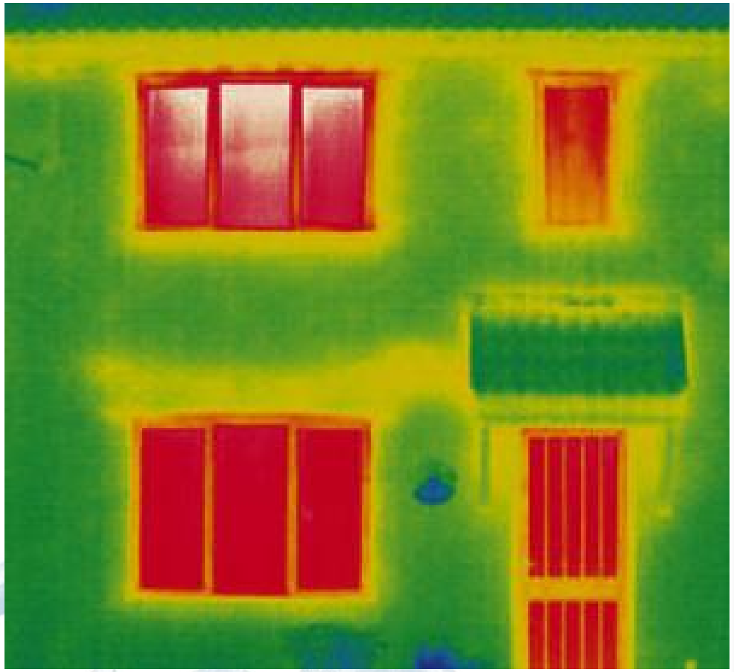
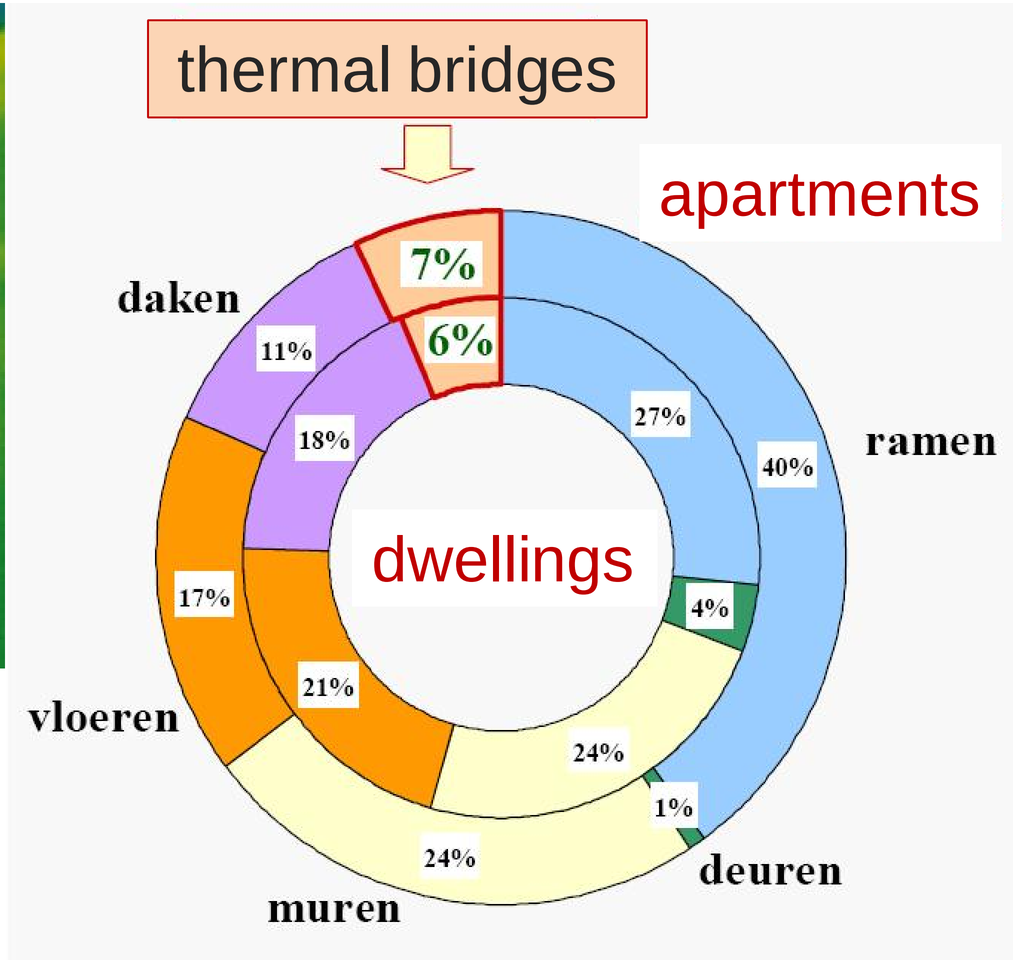
Introduction

Thermal bridging accounts for ± 5% of conduction heat losses



Photograph: Guardian (UK) Anglian



SENVIVV – study (1995-1997)

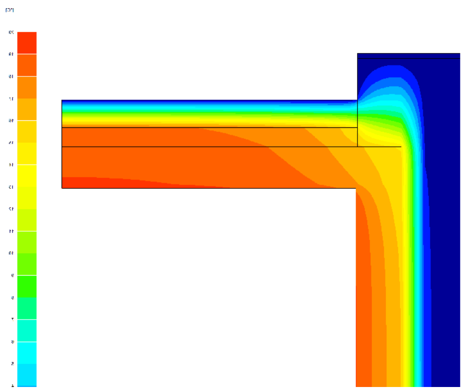
Introduction

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

- Numerical simulations

  Ψ- and χ-values

  (W/mK) or (W/K)



- The simplified approaches

  ΔU 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

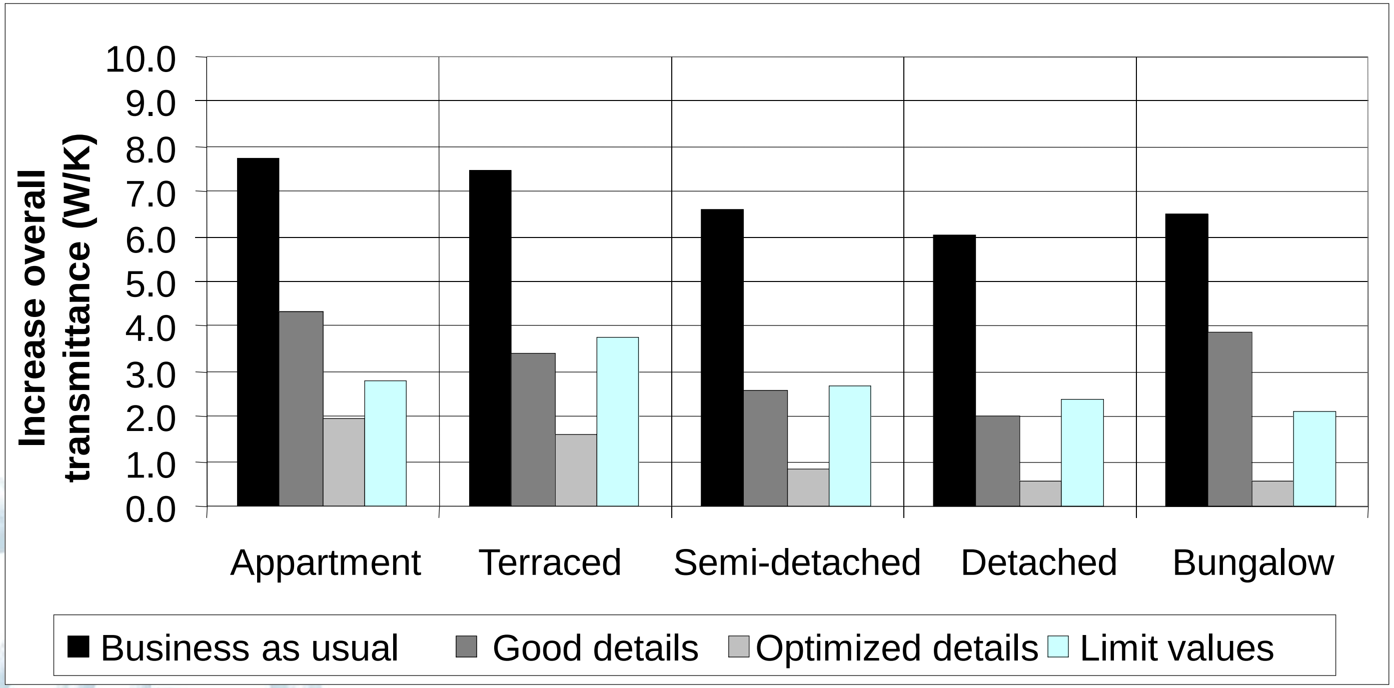
OPTION C

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

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

Three options to take thermal bridges into account

OPTION A

Detailed method

Variable increase of total thermal transmittance

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Method of the EPB-accepted nodes

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not -EPB-accepted nodes

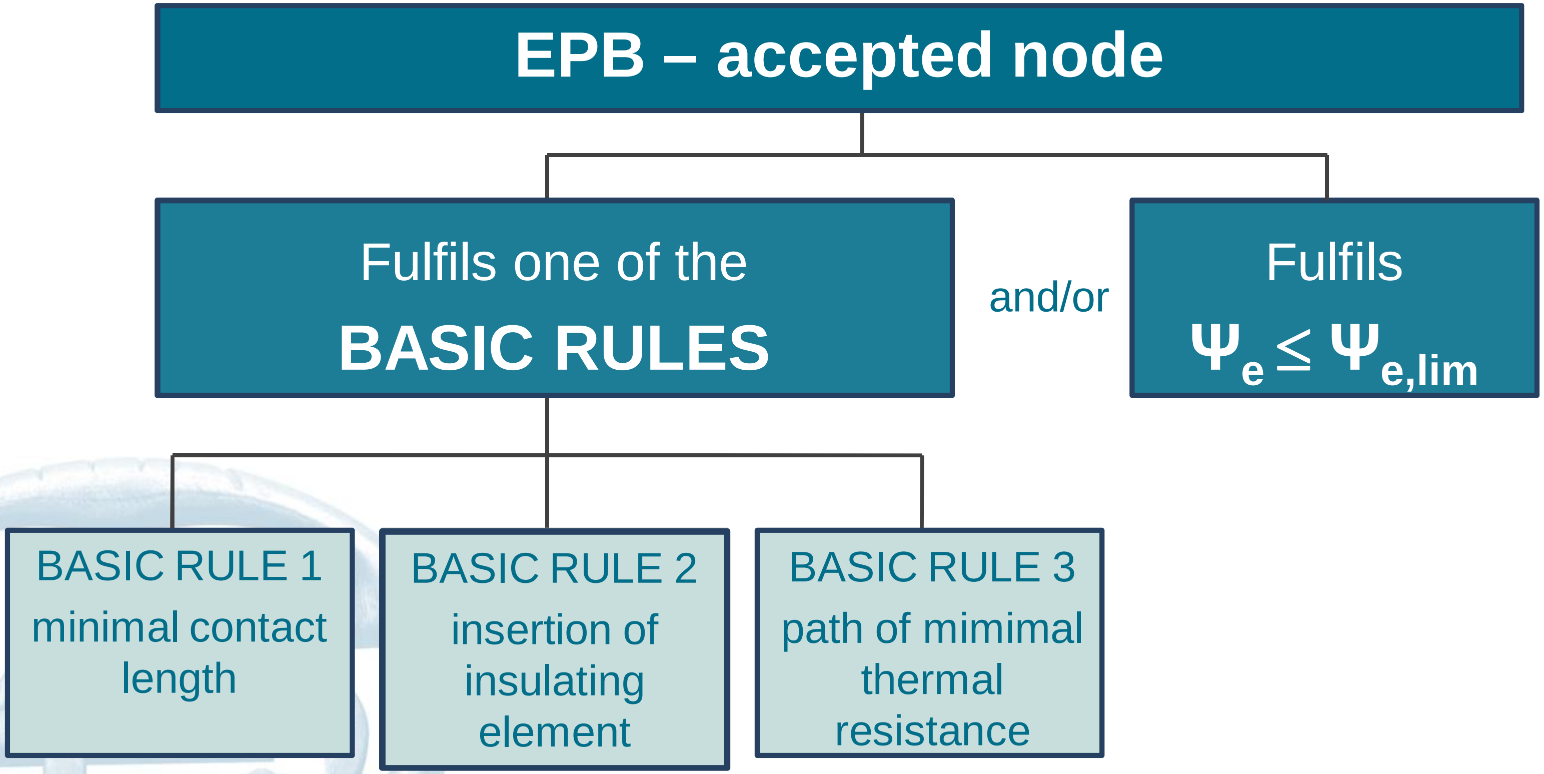
Variable increase of total thermal transmittance

OPTION C

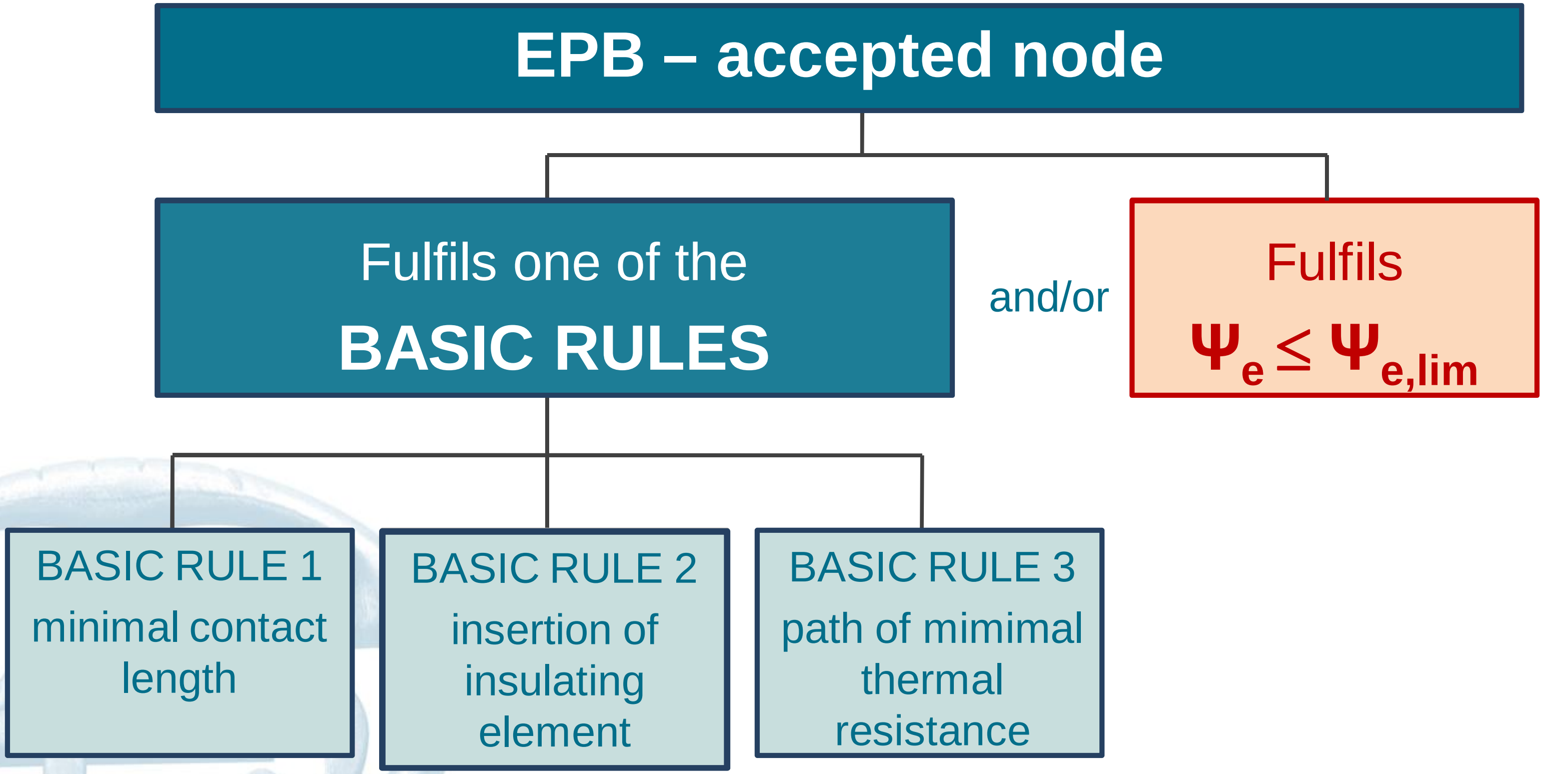
Fixed increase

Large, fixed increase of total thermal transmittance

The simplified approach



The simplified approach



The simplified approach

Limit values of the linear transmittance coefficient

Type of thermal bridge	Limit value
External corners	
- wall/wall connection	-0.10 W/m.K
- other external corners	0.00 W/m.K
Internal corners	0.15 W/m.K
Wall/window and wall/door junction	0.10 W/m.K
Foundations	0.05 W/m.K
Balconies	0.10 W/m.K
Others	0.00 W/m.K

The simplified approach

EPB – accepted node

Fulfils one of the **BASIC RULES**

and/or

Fulfils $\Psi_e \leq \Psi_{e,lim}$

BASIC RULE 1
minimal contact length

BASIC RULE 2
insertion of insulating element

BASIC RULE 3
path of mimimal thermal resistance

The simplified approach

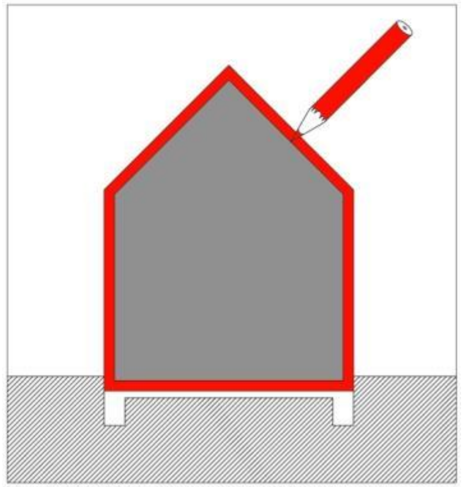
Global aim

- 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

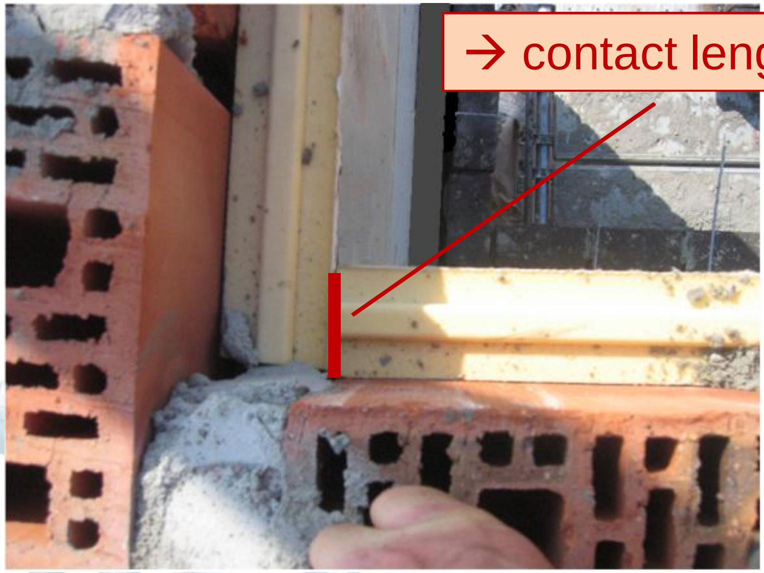
⇒ increase awareness !



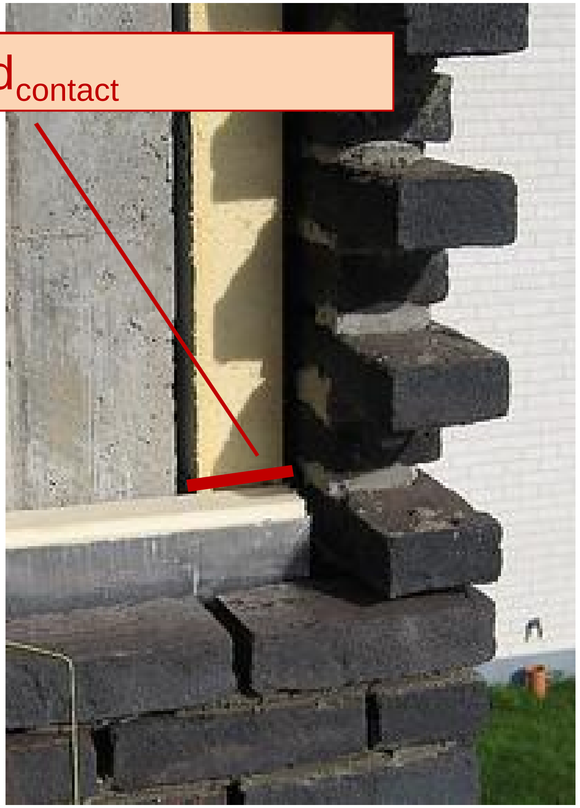
The simplified approach

Basic rule 1: minimal contact length

connecting insulation layers need a sufficient contact length



→ contact length $d_{contact}$

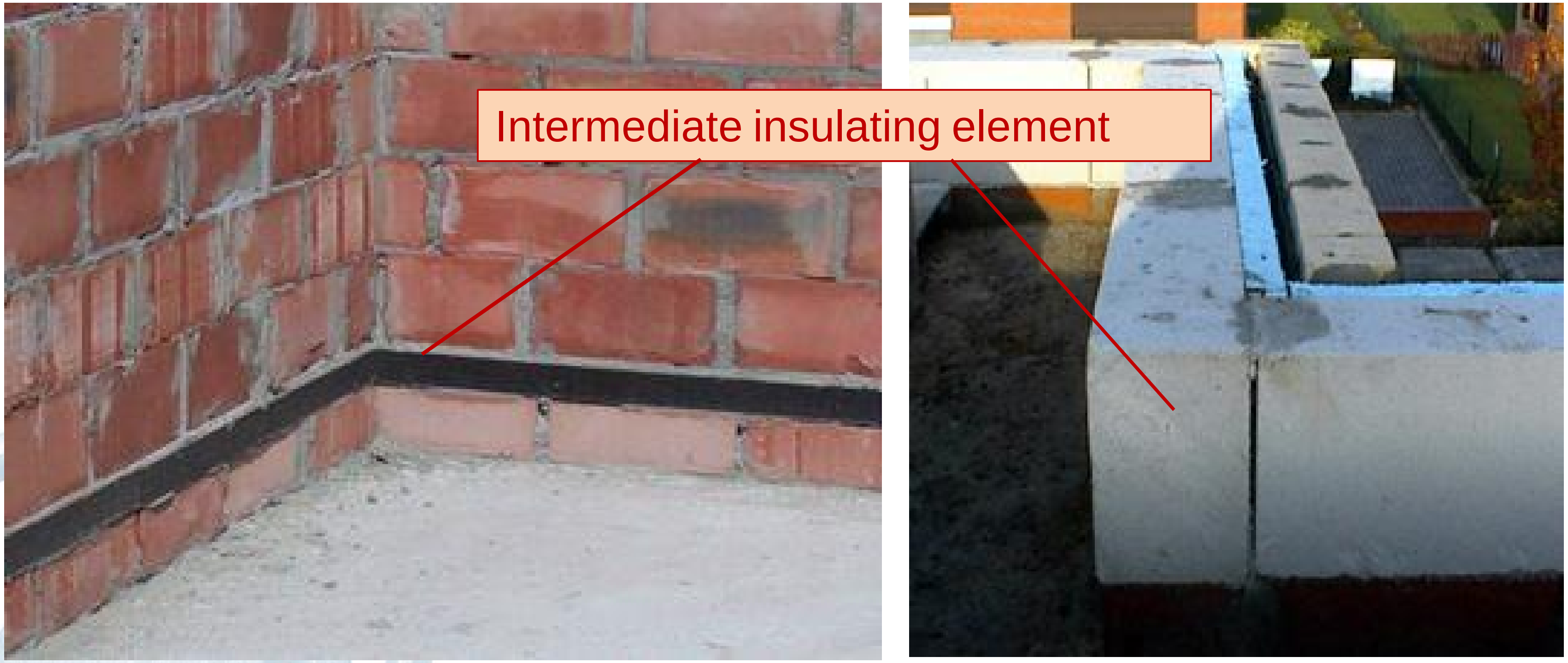


Basic rule 1:

$d_{contact} \geq ½ * \min(d_1, d_2)$

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

λ –value requirement: $\lambda \leq 0.2 W/mK$

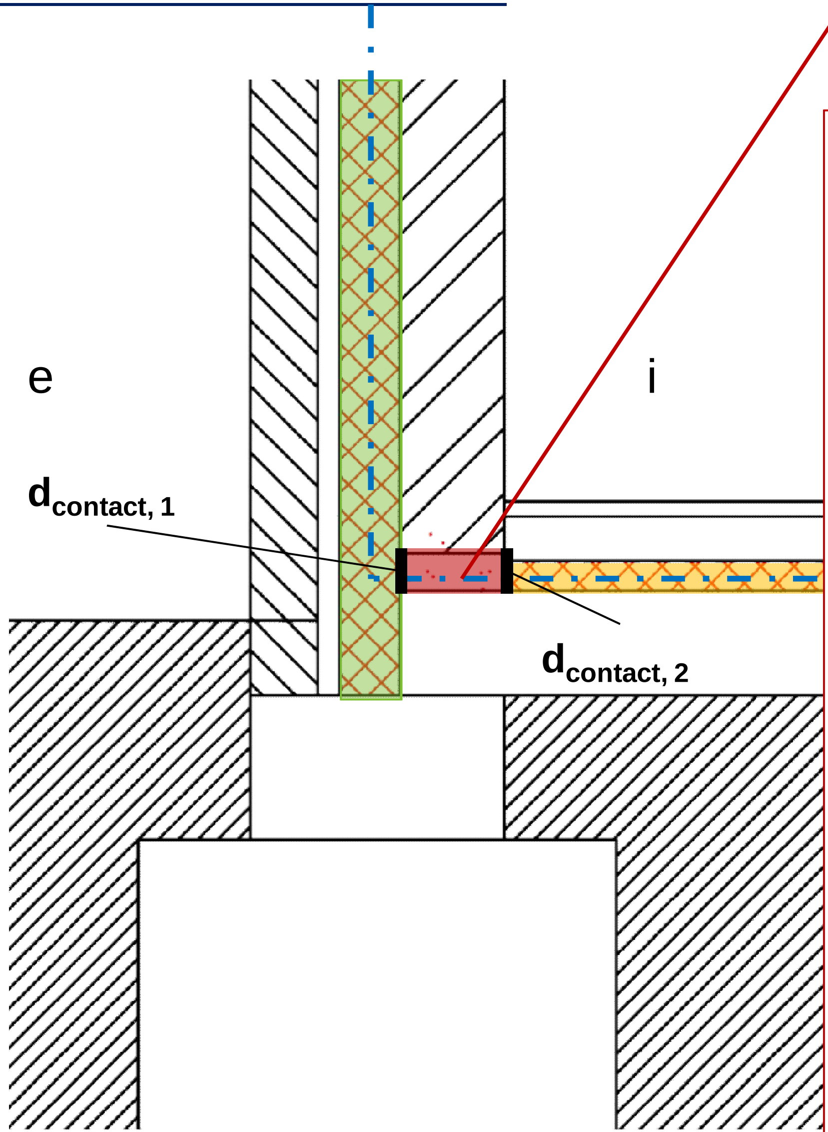
2. Criterion of thermal resistance relative to components

R-value requirement : $R \geq \min(R_1/2, R_2/2, 2)$

3. Sufficient contact length cfr. basic rule 1

Contact length : $d_{contact,i} \geq ½ * \min(d_{ins.\ part}, d_x)$

Example



Check basic rule 2

Intermediate element has to

1. have a low thermal conductivity

   $\lambda = 0.08 \leq 0.2$ W/mK **OK!**

2. have a suffucient thermal resistance

   $R_{facade} = 0.12/0.04 = 3\ m^2K/W$
   $R_{floor} = 0.05/0.03 = 1.67\ m^2K/W$

   → R must be $\geq 1.67/2 = 0.84\ m^2K/W$

   → $R = 0.08/0.08 = 1\ m^2K/W$ **OK!**

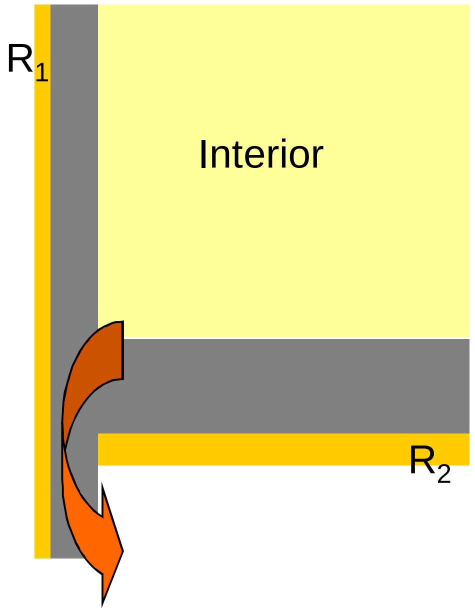
3. make contact with other insulation layers

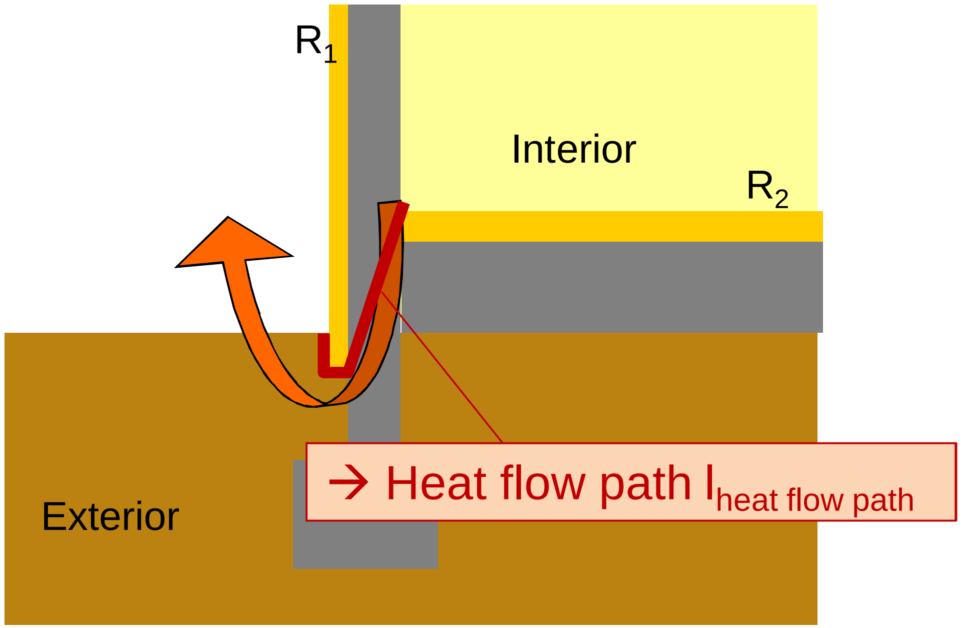
   Cfr. Basic rule 1 **OK!**

The simplified approach

Basic rule 3: path of minimal thermal resistance

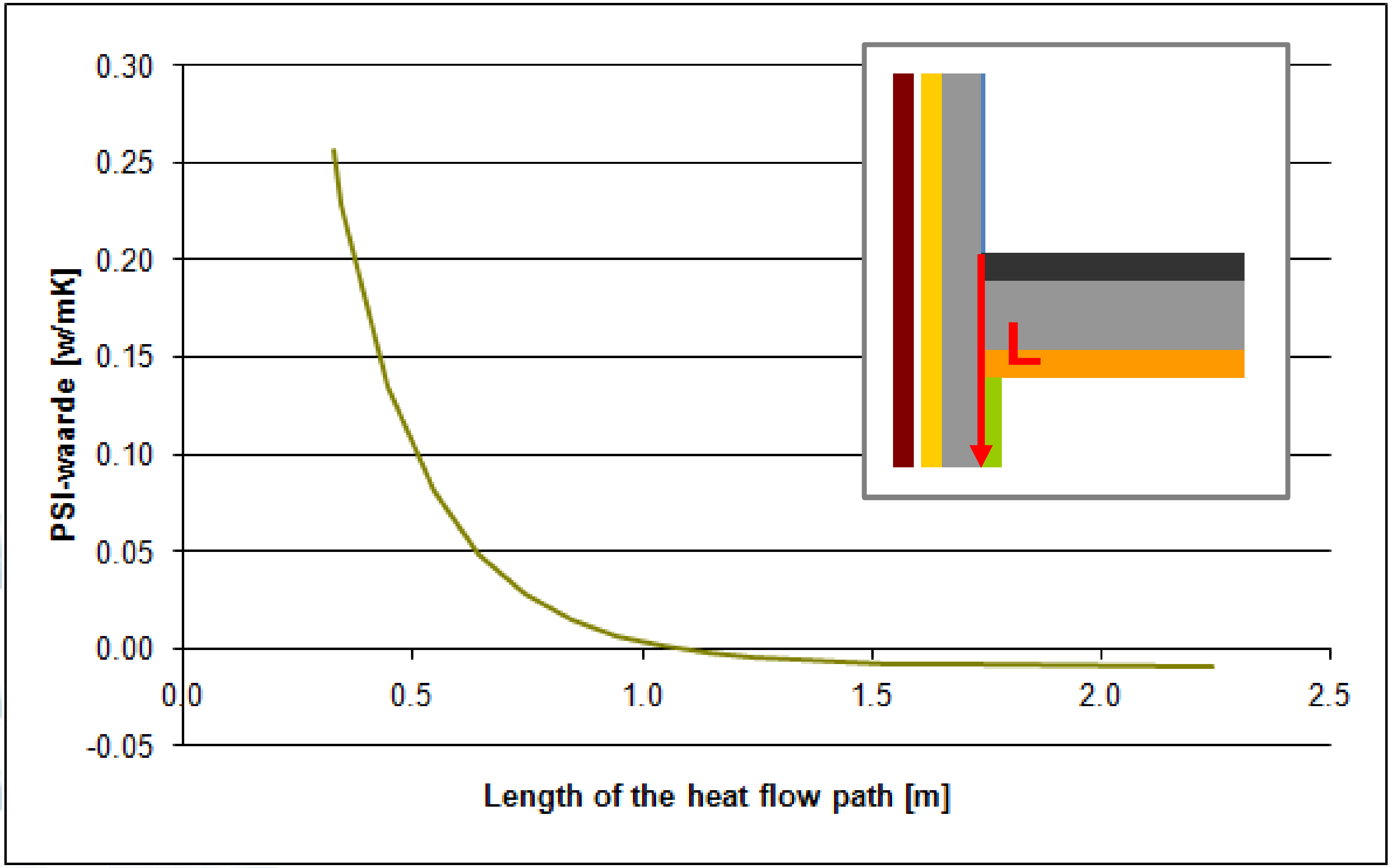
If continuity is not possible, heat flow path needs to be sufficiently long





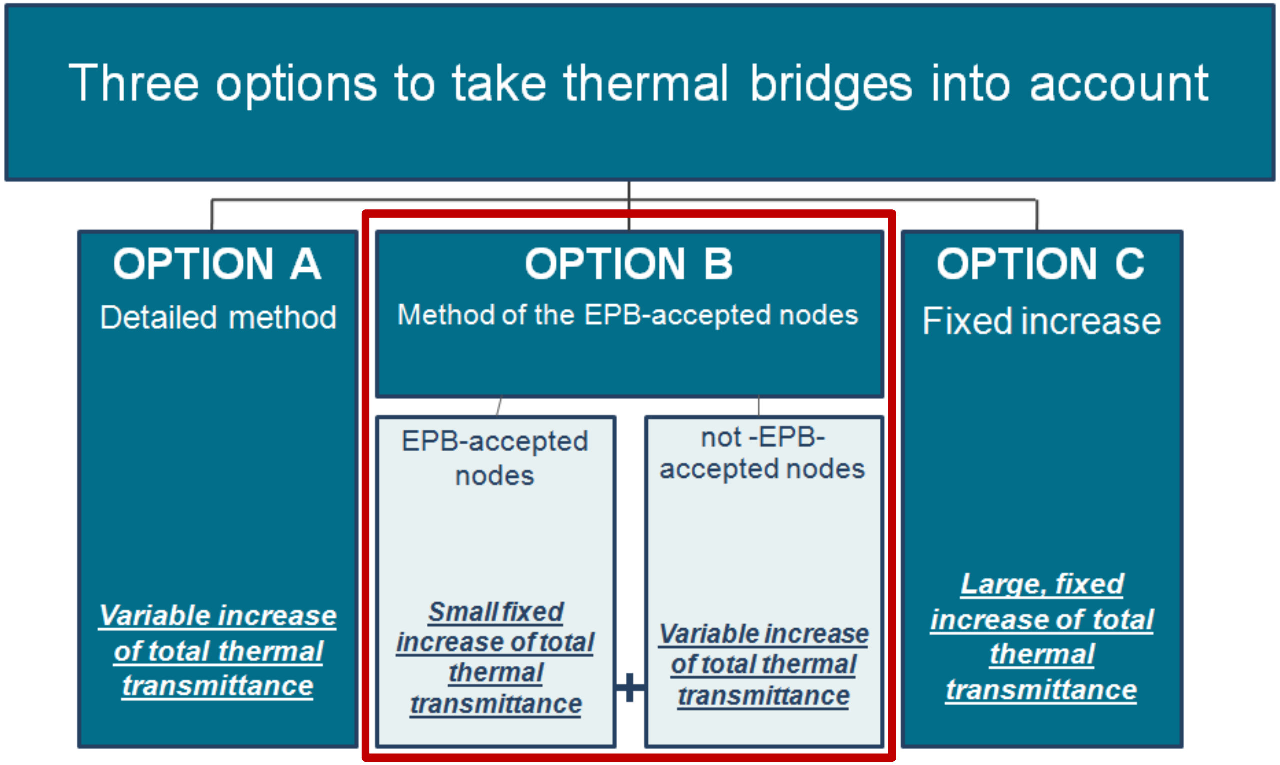
Required minimum heat flow path length: $l_{heat\ flow\ path} \geq 1$ meter

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.



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