Simpler Alternatives to the BRE approved details with Thermoblock

Introduction

Thermoblock is an approved product in the BRE's Thermal Details and Products Scheme. The details recommended by the BRE shown on the website and certificates are to achieve the ultimate levels of insulation with minimal thermal bridging. For example, detail 600376 uses Thermoblock at the wall to floor junction as well as a layer of internal wall insulation behind the plasterboard.

Including that additional layer of insulation will not always be practical or desired so this report indicates what the ψ value will be without having that additional layer of wall insulation.

Background to the Calculation Method

In the calculations, COMSOL Multiphysics 5.3 has been used for the CFD calculations to obtain the overall heat transfer from the room to outside. The evaluation has been conducted on the wall-ground floor junction (*insulation above slab*) junction type. The calculations have been validated with BRE calculation of thermal details with reference number of 600376. Also, the material properties and layers dimensions have been obtained from the BRE calculation report. The thermal conductivities of the different materials are presented in the following table. The value of the wall and floor overall heat transfer coefficient have been calculated using the BRE u-value calculator while the domain size and the boundary conditions are selected according to ISO-10211:2007

In this report, six different models have been presented as alternatives to the BRE 600376 model designed to provided. The first three are just to validate the investigation: model 01 is an exact repeat of junction 600376 calculated to the BRE method. Model 02 is exactly the same but the calculation is modified so it can be accurately used with COMSOL software. Model 03 shows the negligible effect of using a common 60mm screed layer instead of 25mm layer thickness.

The following thermal conductivities were used in this thermal modelling.

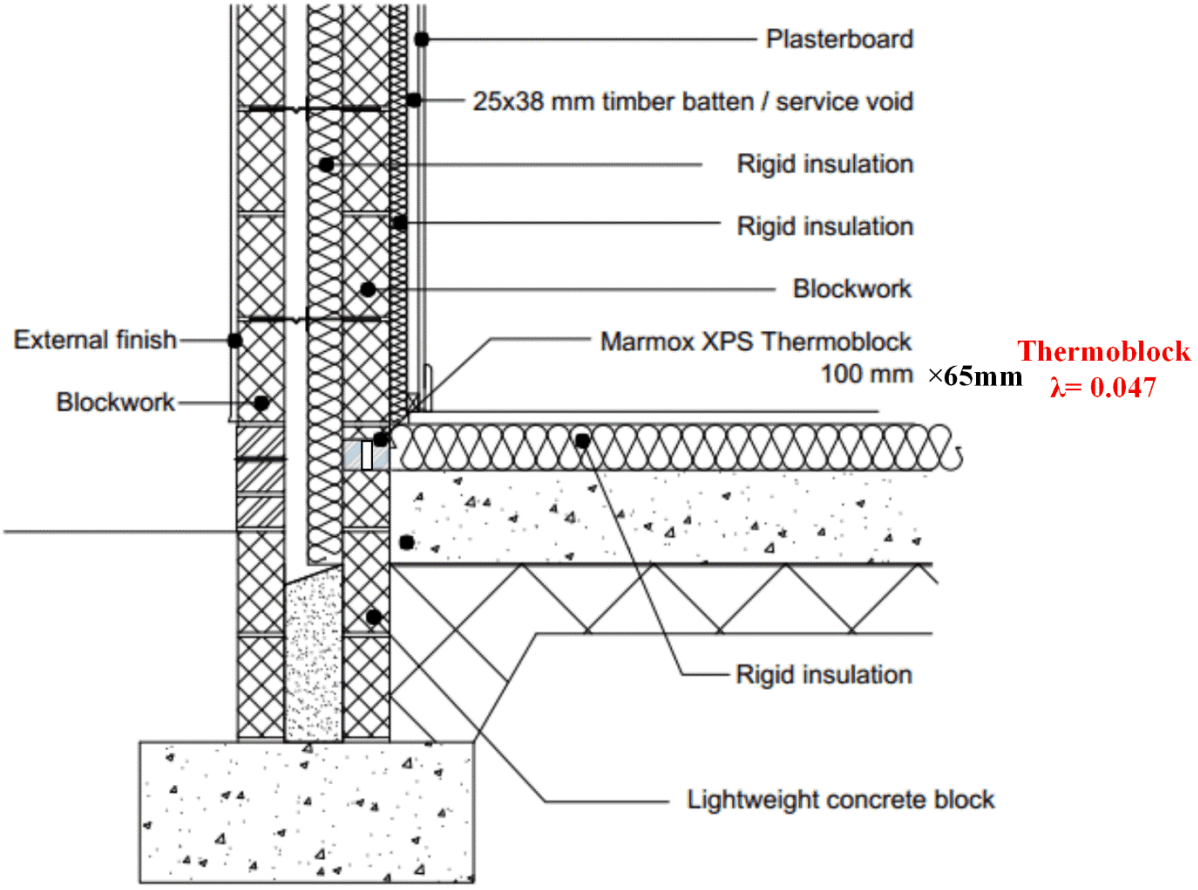
Material	Thermal conductivity (W/m·K)	Material	Thermal conductivity (W/m·K)
XPS Thermoblock (BRE value)	0.047	Timber	0.13
Brick	0.77	Mineral wool (wall)	0.032
Concrete block	1.13	Rigid insulation (wall)	0.023
Lightweight concrete block	0.19	Mineral wool (floor)	0.035
Screed/ infill concrete	1.15	Rigid insulation (floor)	0.022
Dense concrete	2.30	XPS foam (Marmox value)	0.033
Render	1.00	Epoxy Concrete (Marmox value)	0.13
Plasterboard	0.21		

- To provide a baseline value – i.e. the ψ value when no Thermoblock is used, the Thermoblock has been removed from this model and the ψ value calculated in model 04.

- In model 05 the thermoblock has been used alone without the wall inside rigid insulation. This would be the popular alternative to the full BRE detail. The ψ value is

- In model 07, a thicker thermoblock with height of 100 mm has been used.

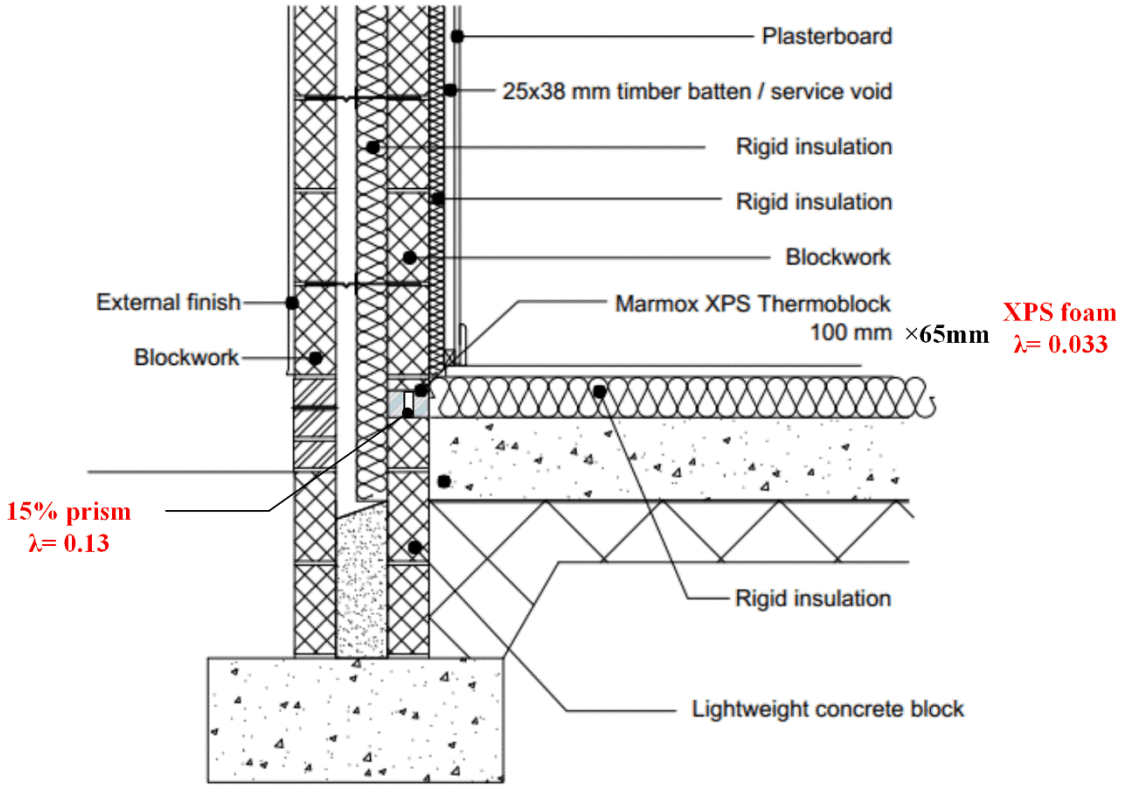
Case 01



Results

- ψ=0.0316
- F_{rsi} = 0.9553

Case 02



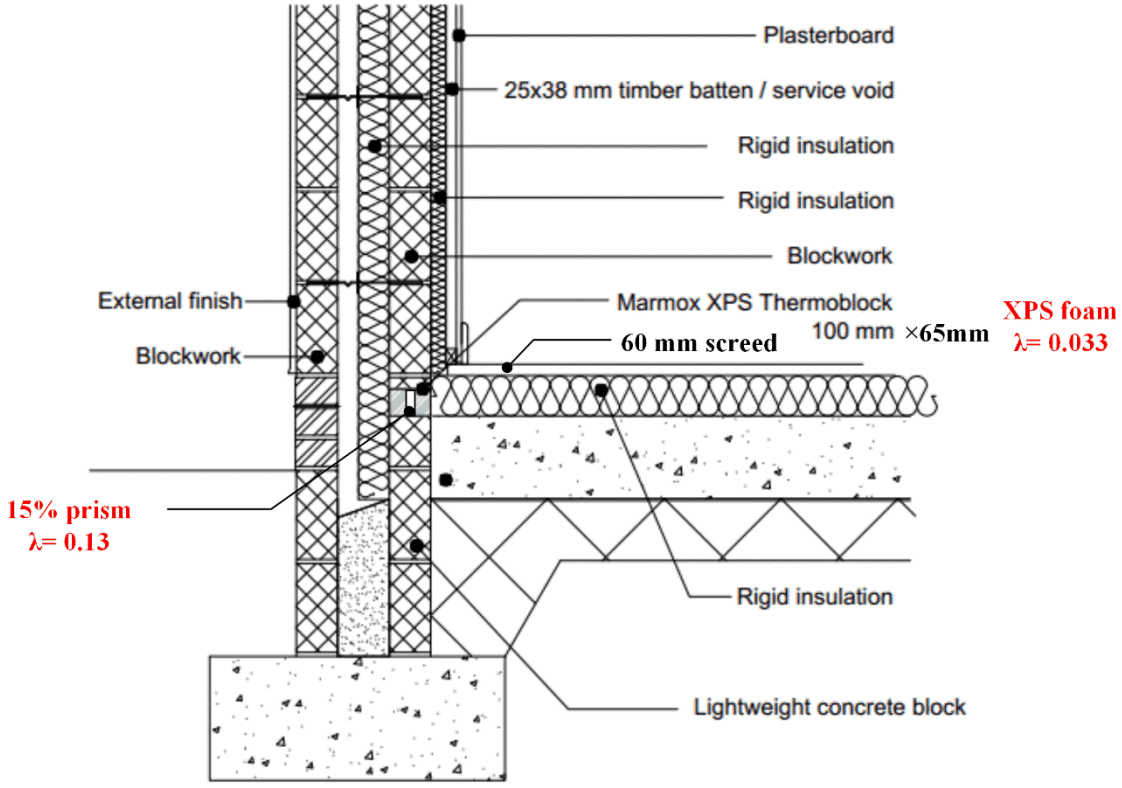
Modifications

- **Do not use equivalent thermal conductivity for the thermoblock**

Results

- **ψ=0.0315**
- **F_{rsi} = 0.95535**

Case 03



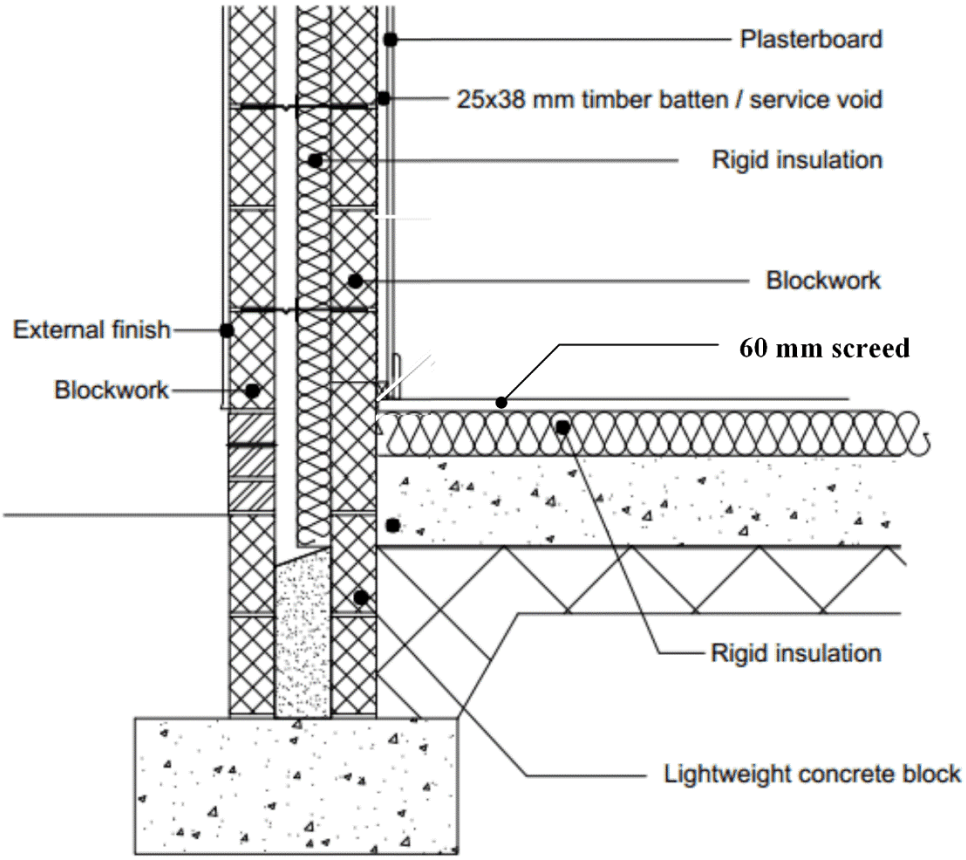
Modifications

- **Do not use equivalent thermal conductivity for the thermoblock**
- **Use 60 mm screed instead of 25mm**

Results

- **ψ=0.0321**
- **F_{rsi} = 0.9548**

Case 04



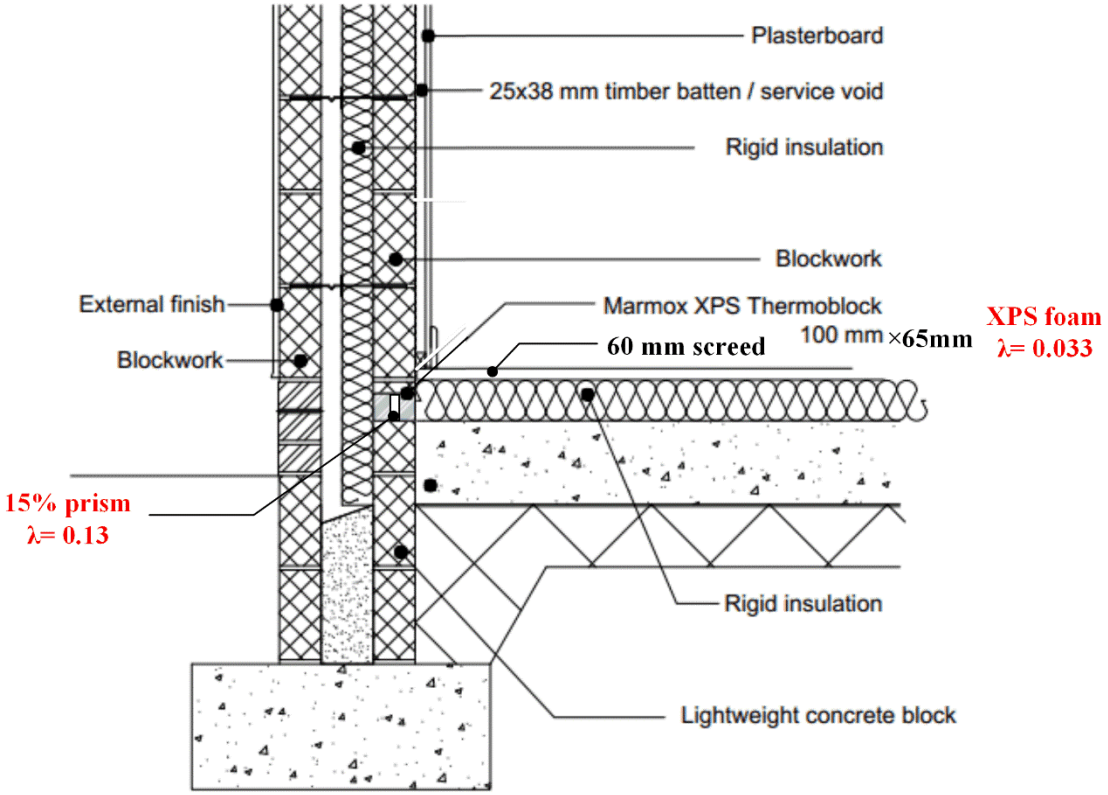
Modifications

- **Remove wall inside rigid insulation layer and the thermoblock**

Results

- **ψ=0.13435**
- **F_{rsi} = 0.90455**

Case 05



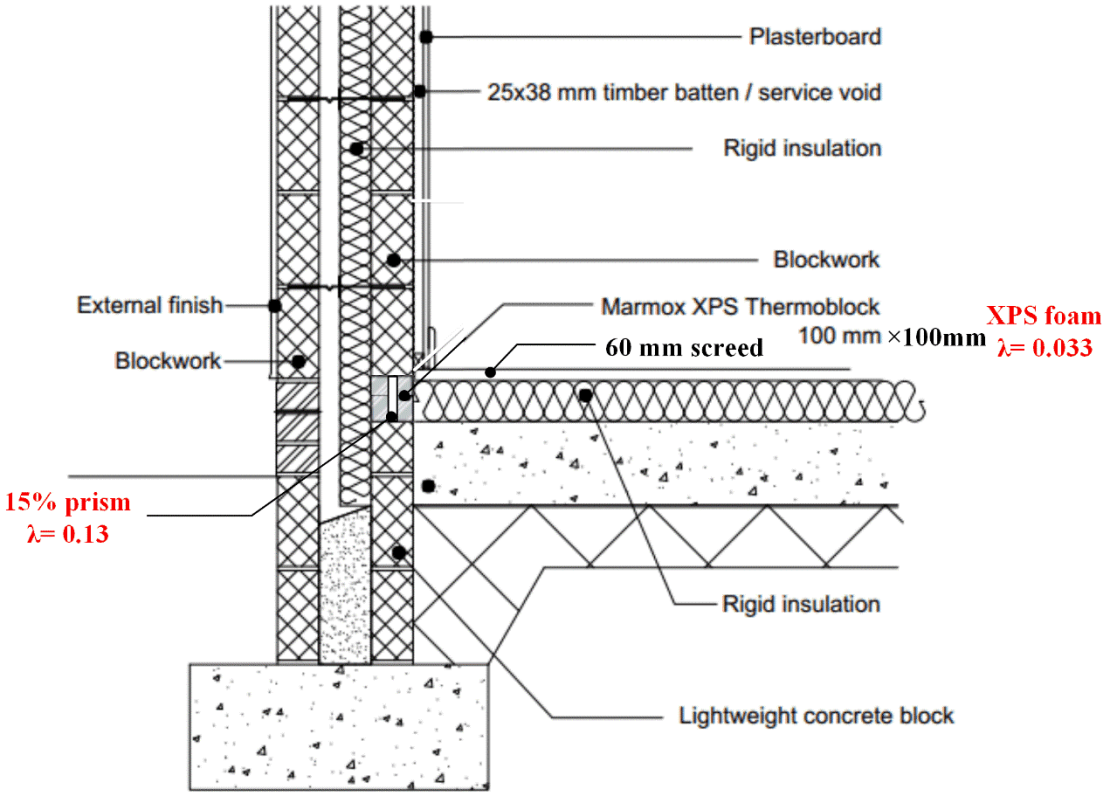
Modifications

- **Do not use equivalent thermal conductivity for the thermoblock**
- **Use 60 mm screed instead of 25mm**
- **Remove wall inside rigid insulation layer**

Results

- **ψ=0.0828**
- **F_{rsi} = 0.92635**

Case 07



Modifications

- **Do not use equivalent thermal conductivity for the thermoblock**
- **Use 60 mm screed instead of 25mm**
- **Remove wall inside rigid insulation layer**
- **Use 100mm height thermoblock**

Results

- **ψ=0.066**
- **F_{rsi} = 0.9335**

Summary of Results

Case Number	Description	ψ	F
Model 01	thermal-details-903-600023	0.0316	0.9553
Model 02	thermal-details-903-600023 + with λ values for individual Thermoblock components.	0.0315	0.95535
Model 03	thermal-details-903-600023+ with λ values for individual Thermoblock components + with floor screed layer of 60mm	0.0321	0.9548
Model 04	thermal-details-903-600023 + with λ values for individual Thermoblock components + with floor screed layer of 60mm **without inside rigid insulation & without thermoblock**	0.13435	0.90455
Model 05	thermal-details-903-600023 + with λ values for individual Thermoblock components + with floor screed layer of 60mm **without the inside rigid insulation**	0.0828	0.92635
Model 07	thermal-details-903-600023 + with λ for the **100mm high thermoblock** + with floor screed layer of 60mm + **without the inside rigid insulation**	0.066	0.9335

Changing the screed thickness from 25mm to 60mm has no significant effect therefore all these models which include a 60mm screed can be compared, like-for-like with the BRE model.

Conclusions

- Without a Thermoblock the ψ value is 0.134W/mK.
- Placing a 65mm high Thermoblock at the wall to floor junction reduces this to 0.083 and using a 100mm high Thermoblock takes this down further still to 0.066W/mK which is half what the ψ value would be without a Thermoblock
- Including the additional internal rigid wall insulation reduces the ψ value further still to 0.032W/mK

A value of 0.83 is clearly not as good as 0.032 but is nevertheless significantly better than typical construction details with enhanced conventional insulation at this junction.