



# Design Review Panel Response Statement

41 Beach Road

Emsworth, PO10 7HR

July 2023



*As of the current writing, 41 Beach Road would be **the first Passivhaus (PH) Premium property in the UK**. As a pioneering Passivhaus (PH) Premium property the envisioned development is set to generate a large excess of energy, enough to power three buildings of similar size. This ambitious project also aims to achieve a **'True' Whole Life Zero Carbon'** designation, solidifying its position as one of the most sustainable and environmentally friendly low-carbon buildings in the country.*

## 1. Introduction:

- 1.1. Since January 2023, Ecospheric has been offering Passivhaus design expertise for the 41 Beach Road project. Our consultancy services followed a Design Review Panel (DRP) presentation where the sustainability and energy efficiency aspirations of the project were praised, but recommendations were made for these aspirations to be tested against an industry recognised metric, such as PassivHaus.
- 1.2. As PassivHaus Designers, and a pioneering experimental development firm, Ecospheric created a groundbreaking sustainability design, aiming to become the first of its kind in the UK.
- 1.3. This evolved design supports the planning application under paragraph 133 of the NPPF (National Planning Policy Framework):

"Local planning authorities should ensure that they have access to, and make appropriate use of, tools and processes for assessing and improving the design of development. These include workshops to engage the local community, design advice and review arrangements, ... In assessing applications, local planning authorities should have regard to the outcome from these processes, including any recommendations made by design review panels."



And 134b of the NPPF (National Planning Policy Framework):

"Significant weight should be given to development which reflects local design policies and outstanding or innovative designs which promote high levels of sustainability."

As part of the DRP process a second review round commenced in order to reflect upon the revised scheme and independently confirm whether the project now reflects outstanding design expected of a replacement building in this sensitive location. This document acts as a response to the queries raised by the DRP during the second review, in readiness for a full plans planning submission.

## 2. Design Review Panel Second Round Feedback:

The following comments associated with sustainability have been extracted from the second round of DRP feedback:

- 2.1. "beneficial for further justification to be provided regarding how the sustainability strategy is to be achieved with the proposed aesthetic of the building, and more importantly how the thermal bridge requirements for passive house standards are going to be met; to ensure that the stated aspirations can be achieved."
- 2.2. "85% reduction in operation carbon, that may benefit from substantiation. If a PHPP calculation has been undertaken, including the summary page might be beneficial, and the notes relating to insulation etc could be expanded with detailed specifics, including U-Value of walls, and materials and plant specifications."
- 2.3. "The analysis addresses solar gain in relation to Passivhaus, however, this approach might be considered out of context and could benefit from a more comprehensive discussion. Evidence of design development beyond the single concept design presented may also enhance the understanding of the project's progression."
- 2.4. "It is currently unclear how the continuous junction around the floor and roof slab will achieve the stringent thermal bridge requirements of passive house standards, especially given the proposed steel construction, which is to be clad in concrete on the outside. It is suggested that Passive House standards are unlikely to be achieved with a continuous thermal bridge as designed, and the sustainability statement seems to brush over this point rather than address it in any robust manner: "Thermal bridge reduced design - Defined by the Passivhaus institute as having no installation psi value exceeding 0.01 W/m<sup>2</sup>K. This is very difficult to achieve in practice, yet our initial THERMmodelling demonstrates that this is possible for all opaque elements of the building." This is not to say that the proposal is not highly sustainable, but passive house is likely to be tricky unless a thermal bridge junction can be designed and included within the PHPP."

## 3. Ecospheric has provided response to the following comments from the Design Review Panel:

- 3.1. *"beneficial for further justification to be provided regarding how the sustainability strategy is to be achieved with the proposed aesthetic of the building, and more importantly how the thermal bridge requirements for passive house standards are going to be met; to ensure that the stated aspirations can be achieved."*

- 3.1.1. The verification page from the PHPP model summarises how the sustainability strategy will be achieved. In order to obtain a PassivHaus certification the building will undergo a rigorous compliance process and, it is crucial to demonstrate to the PassivHaus Institut (PHI) appointed UK certifier that the proposed design addresses thermal bridges effectively.

Given this, when pursuing PassivHaus certification for a project, one can be confident in minimal thermal bridging and effective prevention of moisture or condensation issues. For example, in the case of 41 Beach Road, the proposed fabric basis poses no interstitial moisture risk. Nevertheless, the certification process remains rigorous, and any concerns would prompt the certifier to request a complete Hygrothermal analysis using tools like WUFI or similar software. This ensures the building will perform as intended based on the initial modelling and meet the desired standards.

The Verification page from PHPP confirms that the criteria are met. The space heating demand is 11.2 kWh/m<sup>2</sup>a compared to the maximum allowable value of 15.4 kWh/m<sup>2</sup>a, indicating a significant contingency of 4.2 kWh/m<sup>2</sup>a to account for any unforeseen thermal bridging.



| Specific building characteristics with reference to the treated floor area                                                                                                                                |                                                                                                |                                   |   |                        |     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|-----------------------------------|---|------------------------|-----|
|                                                                                                                                                                                                           |                                                                                                | Treated floor area m <sup>2</sup> |   | Alternative criteria   |     |
| Space heating                                                                                                                                                                                             | Heating demand kWh/(m <sup>2</sup> a)                                                          | 351.0                             |   | 15                     | -   |
|                                                                                                                                                                                                           | Heating load W/m <sup>2</sup>                                                                  | 11                                | ≤ | -                      | 10  |
|                                                                                                                                                                                                           |                                                                                                | 10                                | ≤ |                        |     |
| Space cooling                                                                                                                                                                                             | Cooling & dehum. demand kWh/(m <sup>2</sup> a)                                                 | -                                 | ≤ | -                      | -   |
|                                                                                                                                                                                                           | Frequency of overheating (> 25 °C) %                                                           | 1                                 | ≤ | 10                     | -   |
|                                                                                                                                                                                                           | Frequency of excessively high humidity (> 12 g/kg) %                                           | 0                                 | ≤ | 20                     | -   |
| Airtightness                                                                                                                                                                                              | Pressurisation test result n <sub>50</sub> 1/h                                                 | 0.6                               | ≤ | 0.6                    | -   |
| Non-renewable Primary Energy (PE)                                                                                                                                                                         | PE demand kWh/(m <sup>2</sup> a)                                                               | 21                                | ≤ | -                      | -   |
| Primary Energy Renewable (PER)                                                                                                                                                                            | PER demand kWh/(m <sup>2</sup> a)                                                              | 17                                | ≤ | 30                     | 17  |
|                                                                                                                                                                                                           | Renew. energy generation (in rel. to projected building footprint area) kWh/(m <sup>2</sup> a) | 104                               | ≥ | 120                    | 101 |
| I confirm that the values given here have been determined following the PHPP methodology and based on the characteristic values of the building. The PHPP calculations are attached to this verification. |                                                                                                |                                   |   | Passive house Premium? | Yes |

3.1.2. In order to demonstrate that the project achieves this requirement, THERM models of key junctions will be employed during the stage 4 technical design to calculate Psi values, which quantify the extent of heat loss. These models also establish isotherms, ensuring internal surface temperatures remain above the condensation threshold, safeguarding against hygiene concerns arising from excessively low temperatures.

John Palmer, representing the UK Passivhaus Trust, presents a compelling argument in favour of using the Passivhaus certification process to ensure high-quality buildings, effectively addressing issues like thermal bridging and optimising building performance. This analysis highlights the limitations of typical SAP-based, BRE-specified approaches, which fail to address the true challenges of achieving 'True Zero Carbon.' Such definitions overlook significant energy demands from household appliances, cooking, and spa/swimming pools, relying on averaged climate datasets and resulting in significant performance gaps. In practice, energy consumption can be 50% higher on average, and in some cases, exceed 200%, putting national carbon targets at risk.

Conversely, a study of over 2000 Passivhaus buildings showed a much narrower performance gap, typically ranging between 0-10% and often less than 5%, providing a more accurate representation of building energy performance.

3.2. "85% reduction in operation carbon, that may benefit from substantiation. If a PHPP calculation has been undertaken, including the summary page might be beneficial, and the notes relating to insulation etc could be expanded with detailed specifics, including U-Value of walls, and materials and plant specifications."

3.2.1. The summary page from the PHPP model is above. The estimated operational carbon for this building (allowing for a 5% Passivhaus performance gap) is 1085 kgCO<sub>2</sub>e /year. Carrying out the same calculation for the same building but as though it were built to the notional values in Building Regulations Part L (with a typical 50% performance gap) results in an estimated operational carbon for this building of 6290 kgCO<sub>2</sub>e / year. Thus the current design represents an ~83% reduction. This figure specifically excludes onsite renewable energy generation in order to highlight the fantastic passive design savings achieved, however in reality the overall carbon reduction would be larger as presented in the [Sustainability Statement](#).

3.2.2. For reference a U - value summary for the building fabric is shown below:



| Summary                        |                               |           | Average U-value<br>[W/(m²K)] |
|--------------------------------|-------------------------------|-----------|------------------------------|
| Thermal envelope<br>Areas [m²] | Area group                    | Group no. |                              |
| 351.00                         | Treated floor area            | 1         |                              |
| 20.76                          | North windows                 | 2         | 0.798                        |
| 22.80                          | East windows                  | 3         | 0.820                        |
| 62.94                          | South windows                 | 4         | 0.896                        |
| 9.88                           | West windows                  | 5         | 0.920                        |
| 10.33                          | Horizontal windows            | 6         | 0.560                        |
| 0.00                           | Exterior door                 | 7         |                              |
| 355.31                         | External wall - ambient       | 8         | 0.153                        |
| 0.00                           | External wall ground/basement | 9         |                              |
| 258.79                         | Roof / ceiling - ambient      | 10        | 0.127                        |
| 240.12                         | Floor slab / basement ceiling | 11        | 0.151                        |

In order to provide more clarity around the proposed U-Values of the three principal construction elements the following building assembly descriptions capture what has been allowed for at this point in the design process:

|                                  |  |              |  |
|----------------------------------|--|--------------|--|
| Description of building assembly |  | Assembly no. |  |
| Brick walls                      |  | 01ud         |  |

|                                                       |            |                              |            |
|-------------------------------------------------------|------------|------------------------------|------------|
| Orientation of building assembly (or P <sub>u</sub> ) |            | Interior insulation?         |            |
| Adjacent to (or P <sub>u</sub> )                      |            | U-value supplement [W/(m²K)] |            |
| 2-Wall                                                |            |                              |            |
| 3-Ventilated                                          |            |                              |            |
| Area section 1                                        | λ [W/(mK)] | Area section 2 (optional)    | λ [W/(mK)] |
| Area section 3 (optional)                             | λ [W/(mK)] | Thickness [mm]               |            |
| Brick                                                 | 0.770      |                              | 105        |
| Knauf dritherm ultimate                               | 0.032      |                              | 100        |
| Poroton block T8-MW                                   | 0.080      |                              | 240        |
| Steico internal                                       | 0.038      |                              | 0          |
| 6mm e-cork, 4mm reabilita cal, 1mm regency            | 0.500      |                              | 11         |
|                                                       |            |                              |            |
|                                                       |            |                              |            |
|                                                       |            |                              |            |
| Percentage of sec. 1:                                 | 100%       | Percentage of sec. 2:        |            |
|                                                       |            | Percentage of sec. 3:        |            |

|                                           |            |                       |       |
|-------------------------------------------|------------|-----------------------|-------|
| Heat transmission resistance coefficients |            | Total thickness [cm]: | 45.6  |
| Interior P <sub>u</sub> :                 | 0.13 m²K/W |                       |       |
| Exterior P <sub>u</sub> :                 | 0.13 m²K/W | U-value [W/(m²K)]:    | 0.153 |

|                                       |  |              |  |
|---------------------------------------|--|--------------|--|
| Description of building assembly      |  | Assembly no. |  |
| Roof-45mm x 300mm   joist 400 spacing |  | 02ud         |  |

|                                                       |            |                              |            |
|-------------------------------------------------------|------------|------------------------------|------------|
| Orientation of building assembly (or P <sub>u</sub> ) |            | Interior insulation?         |            |
| Adjacent to (or P <sub>u</sub> )                      |            | U-value supplement [W/(m²K)] |            |
| 1-Roof                                                |            |                              |            |
| 3-Ventilated                                          |            |                              |            |
| Area section 1                                        | λ [W/(mK)] | Area section 2 (optional)    | λ [W/(mK)] |
| Area section 3 (optional)                             | λ [W/(mK)] | Thickness [mm]               |            |
| Magply                                                | 0.190      |                              | 20         |
| Steico floc                                           | 0.038      | timber-I-joist flange        | 0.130      |
| Steico floc                                           | 0.038      | Timber I- joist web          | 0.130      |
| Steico floc                                           | 0.038      | Timber I- joist web          | 0.130      |
| magply                                                | 0.190      | Timber I- joist web          | 0.130      |
| service void                                          | 0.140      | timber battens               | 0.130      |
| gypsum plaster board                                  | 0.190      |                              | 12         |
| Plaster skin                                          | 0.190      |                              | 3          |
| Percentage of sec. 1:                                 | 83%        | Percentage of sec. 2:        | 8.8%       |
|                                                       |            | Percentage of sec. 3:        | 2.5%       |

|                                           |            |                       |       |
|-------------------------------------------|------------|-----------------------|-------|
| Heat transmission resistance coefficients |            | Total thickness [cm]: | 36.9  |
| Interior P <sub>u</sub> :                 | 0.10 m²K/W |                       |       |
| Exterior P <sub>u</sub> :                 | 0.10 m²K/W | U-value [W/(m²K)]:    | 0.127 |



|                                  |  |  |  |              |  |
|----------------------------------|--|--|--|--------------|--|
| Description of building assembly |  |  |  | Assembly no. |  |
| Concrete floor                   |  |  |  | 03ud         |  |

|                                                 |                        |                           |                        |                                   |                        |
|-------------------------------------------------|------------------------|---------------------------|------------------------|-----------------------------------|------------------------|
| Orientation of building assembly (or $R_{si}$ ) |                        | 3-Floor                   |                        | Interior insulation?              |                        |
| Adjacent to (or $R_{se}$ )                      |                        | 2-Ground                  |                        | U-value supplement [ $W/(m^2K)$ ] |                        |
| Area section 1                                  | $\lambda$ [ $W/(mK)$ ] | Area section 2 (optional) | $\lambda$ [ $W/(mK)$ ] | Area section 3 (optional)         | $\lambda$ [ $W/(mK)$ ] |
| concrete                                        | 2.100                  |                           |                        |                                   | 200                    |
| PIR Rigid polyurethane foam                     | 0.022                  |                           |                        |                                   | 140                    |
| geotextile membrane                             | 0.300                  |                           |                        |                                   | 1                      |
|                                                 |                        |                           |                        |                                   |                        |
|                                                 |                        |                           |                        |                                   |                        |
|                                                 |                        |                           |                        |                                   |                        |
|                                                 |                        |                           |                        |                                   |                        |
|                                                 |                        |                           |                        |                                   |                        |
| Percentage of sec. 1:                           | 100%                   | Percentage of sec. 2:     |                        | Percentage of sec. 3:             |                        |

|                                           |               |                         |       |
|-------------------------------------------|---------------|-------------------------|-------|
| Heat transmission resistance coefficients |               | Total thickness [cm]:   | 34.1  |
| Interior $R_{si}$ :                       | 0.17 $m^2K/W$ | U-value [ $W/(m^2K)$ ]: | 0.151 |
| Exterior $R_{se}$ :                       | 0.00 $m^2K/W$ |                         |       |

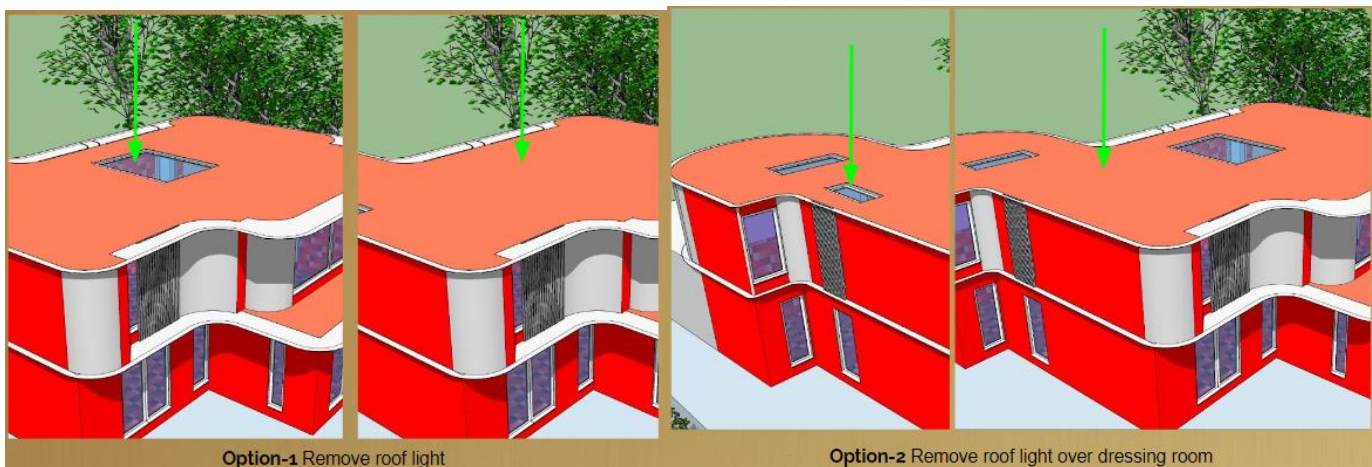
3.2.3. The current sustainability statement outlines all the key plant items designated for the project. It offers precise details on manufacturers, models, and performance statistics for these items, wherever possible at this stage of the design.

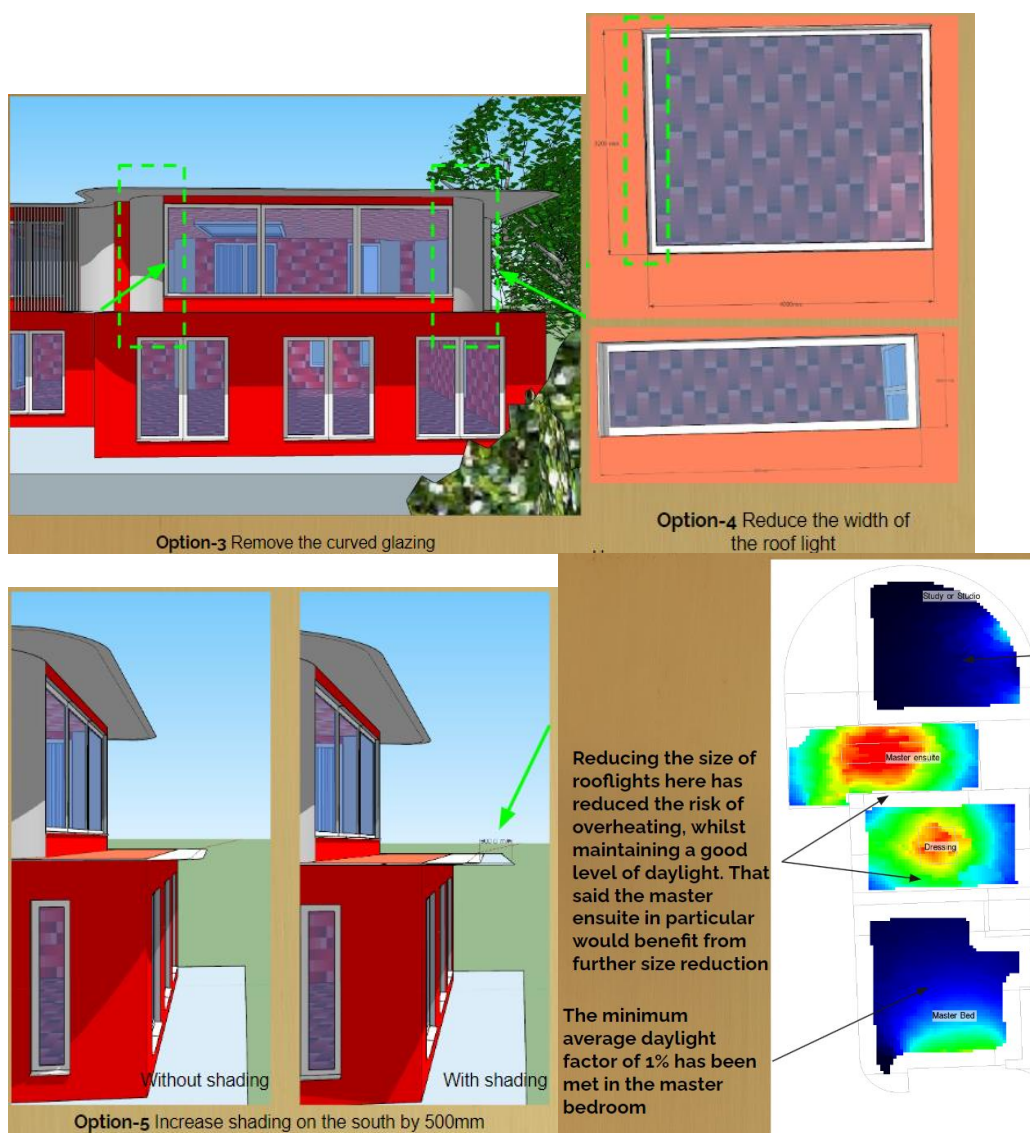
3.3. "The analysis addresses solar gain in relation to Passivhaus, however, this approach might be considered out of context and could benefit from a more comprehensive discussion. Evidence of design development beyond the single concept design presented may also enhance the understanding of the project's progression."

3.3.1. The following statement has been extracted from the SS:

**"Daylight Optimisation** - Glazing is typically both 6 times worse performing per  $m^2$  of opaque fabric and 6 times more expensive. It also acts as the primary cause of overheating. Each of these negative characteristics need optimising against daylighting and framing principal views. Design Builder Dynamic Simulation Model (DSM) is capable of optimising the building on a room by room basis enabling the design team to minimise the glazing proportion whilst satisfying the RIBA standards for daylighting. The inherent massing design of the proposed dwelling aims to take advantage of passive solar gains in the colder months whilst reducing overheating potential through the adoption of solar shading optimised using PHPP and Design Builder DSM with specifically designed window reveals and roof overhang."

3.3.2. The design development went through multiple iterations and only a single concept was chosen as an example in the SS in interests of brevity. To aid understanding of the design progression further evidence of options consider to find a balance between daylight and excessive summer solar gains is shown below:





3.4. "It is currently unclear how the continuous junction around the floor and roof slab will achieve the stringent thermal bridge requirements of passive house standards, especially given the proposed steel construction, which is to be clad in concrete on the outside. It is suggested that Passive House standards are unlikely to be achieved with a continuous thermal bridge as designed, and the sustainability statement seems to brush over this point rather than address it in any robust manner: "Thermal bridge reduced design - Defined by the Passivhaus institute as having no installation psi value exceeding  $0.01 \text{ W/m}^2\text{K}$ . This is very difficult to achieve in practice, yet our initial THERM modelling demonstrates that this is possible for all opaque elements of the building." This is not to say that the proposal is not highly sustainable, but passive house is likely to be tricky unless a thermal bridge junction can be designed and included within the PHPP."

- 3.4.1. When undergoing PassivHaus certification, stringent control measures are applied to manage thermal bridging effectively. The PassivHaus Institute (PHI) has set a threshold of  $0.01 \text{ W/m}^2\text{K}$ , below which no thermal bridging needs to be considered. If a proposed junction lacks sufficient evidence from manufacturer information or previously modelled details to prove thermal bridging performance below this figure, THERM modelling becomes necessary. If the junction returns a Psi value greater than  $0.01 \text{ W/m}^2\text{K}$ , it is classified as a thermal bridge and must be included in the PHPP model to account for the additional heat loss it causes.
- 3.4.2. There are two key limits associated with thermal bridges. The first limit relates to the overall space heating demand, and the threshold of  $15 \text{ kWh/m}^2$  varies based on the inherent building performance. If the thermal bridges are particularly problematic or contribute significantly to heat loss, they may deplete the contingency and cause the property to fail in meeting the required thresholds. The second limit pertains to individual thermal bridges being so severe that they cause internal minimum surface temperatures to drop below the condensation threshold, resulting in failure on hygiene grounds.

3.4.3. Although the detailed design stage has not yet been completed, as we have not progressed to RIBA stage 4, the thermal break solutions outlined below, along with the thermal bridge allowance already incorporated into the proposed PHPP model (section 3.1.1) and the remaining contingency before breaching the certification threshold, provide clear evidence that this building is poised for certification.

3.4.4. When working with PassivHaus projects that have continuous junctions associated with balconies and steel to steel connection across the thermal envelope, Ecospheric typically specifies a number of thermal break components from companies such as Farrat and Schöck. The following are typical details that are specified and the associated Psi/Chi values that can comfortably work within the PassivHaus certification criteria:

3.4.4.1. Farrat TBK - Certified Passivhaus Component:



| Component                 | Thermal bridge coefficient X [W/K] | Max. amount/m [P./m] | Min. distance [m] |
|---------------------------|------------------------------------|----------------------|-------------------|
| FARRAT TBK** with IPE 140 | 0.132                              | 0.80                 | 1.25              |

3.4.4.2. Schöck Isokorb

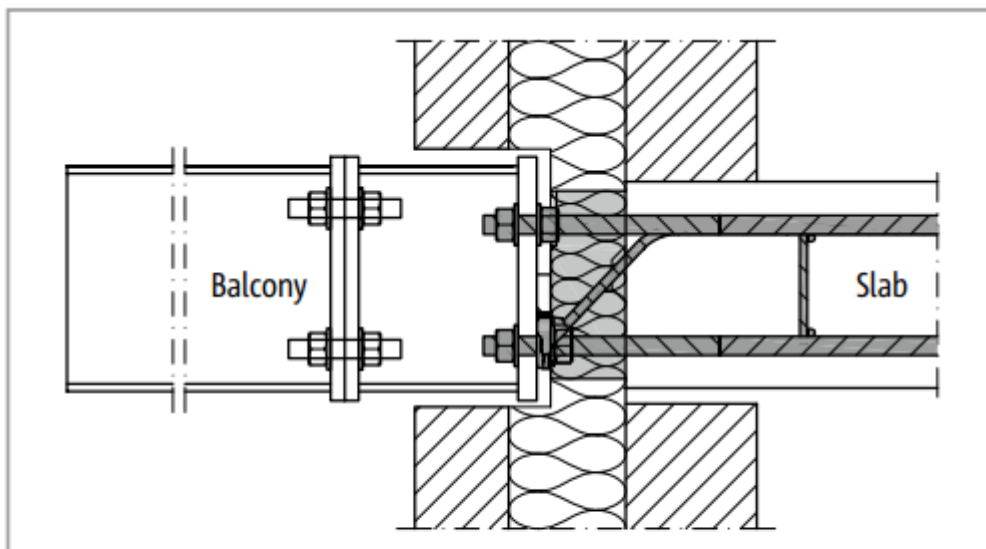
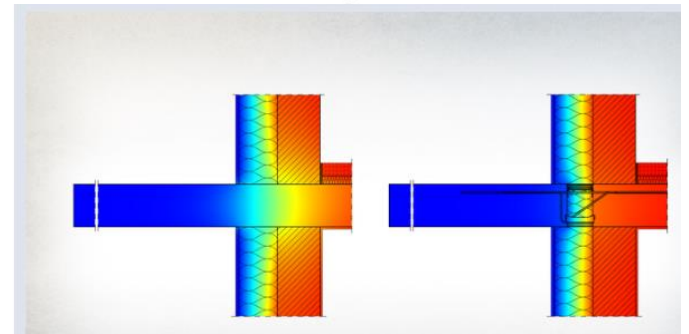


*Fig. 13: Schöck Isokorb® T type SK: Insulating element inside the core insulation; stub bracket between the Isokorb® and the balcony to enable flexible installation.*



## THE CHALLENGE AND THE SOLUTION

Energy loss occurs when structural components that penetrate the building envelope provide a pathway that allows heat to more easily pass through and escape to the outside. These areas are known as thermal bridges. In addition to the energy loss that occurs with thermal bridging, structural damage often occurs due to the formation of condensation and mould. The heat loss can be prevented by ensuring continuous thermal insulation at the building envelope. Load-bearing thermal insulation modules such as Schöck Isokorb® are an ideal solution, providing not only thermal insulation, but also structural integrity.



3.4.4.3. Example calculation showing the resulting thermal bridge values for a balcony connection with and without a thermal break.

| Description                   | Q (W)  | 2D/3D (W/K) | $\psi$ (W/mK) | $\chi$ (W/K) |
|-------------------------------|--------|-------------|---------------|--------------|
| No connection                 | 13.333 | 0.124       | 0.177         |              |
| Model 1 - Direct connection   | 24.620 | 0.688       | 0.983         | 0.564        |
| Model 2 - Pad connection 10mm | 23.096 | 0.612       | 0.874         | 0.488        |
| Model 3 - Pad connection 20mm | 24.527 | 0.683       | 0.976         | 0.560        |
| Model 4 - KS14 H200           | 14.878 | 0.201       | 0.287         | 0.077        |

3.4.5. With our extensive experience in certifying PassivHaus buildings, we hold great confidence in this building's certification potential. We invite the planners to condition this certification to ensure all desired targets are met, and the build quality is upheld.

