# DESIGN BRIEFING NOTE 01 - UNDERFLOOR COOLING

Due to the lack of adequate openings to provide free cooling to the Belsize Park Gardens project active cooling is required to mitigate summertime overheating to many of the spaces. For the purpose of this study it has been assumed that simultaneous heating and cooling will not be required by the nature of the buildings operation and the BMS providing a Winter/Summer changeover will be provided. This significantly simplifies the primary plant.

The most cost-effective way to provide active cooling to the building is to utilise, where possible, the distribution systems and emitters used to provide heating. This is relatively straight forward for the distribution system but in the case of the emitters this approach can only be used for certain emitter types and is pretty much limited to radiant systems (Ceilings and Floors) or air based systems (Fan Coil Units).

The current design intent is for underfloor heating to be provided throughout the building to the occupied areas. We have therefore tested the use of Underfloor cooling systems to see which spaces are possible to meet the overheating criteria utilising underfloor cooling.

**Underfloor Cooling**
When using underfloor cooling there is the possibility of generating condensation on the floor surface if it is cooled below the dew point of the internal air. To mitigate the risk the space air temperature and Relative Humidity (RH) must be monitored to ensure that floor temperature remains above a safety offset above the calculated dew point. This limits the output per m² of the floor. Typical estimated outputs from the floor range from 20-40 W/m².

To ensure we do not overestimate the cooling effect we have consulted with one of the larger UFH/UFC suppliers to determine what their typical range would be and this is lower than the theoretical upper output. A summary of outputs against typical floor Build ups is given in the following table. This is based on the more detailed information provided by Thermofloor presented in the accompanying A3 Sheet. Notably the installation must be an 'in screed' system if we are utilising it for cooling.

| Surface Finish | Max Resistance (R-Value) [m² .K/w] | Output [W/m². K] | Notes |
|---|---|---|---|
| Vinyl (up to 3 mm) | 0.170 | 29 | Pipe centres = 150mm<br>F/R temps = 15/20°C<br>Screed 75mm λ = 1.2 W/mK<br>Cooling Set point = 26°C |
| Tiles | 0.037 | 27 | |
| Carpet/Carpet Tiles | 0.100 | 22 | |
| Engineered Timber | 0.150 | 20 | |

For the purpose of the study the output from the floor was tested at 20, 30 and 40 W/m² output bands and the overheating results are presented in detail on the accompanying sheet.

**Fan Coil Units**
The modelling results show that at an assumed maximum upper output of 30 W/m² a number of the spaces still require additional cooling provided by the introduction of fan coil units (FCUs).The use of slim 'residential' units should help limit the overall effect of introducing these but allowance will need to be made within the design to accommodate the FCUs where required. Datasheets for a possible range with a unit depth of 171mm (circa 200mm void depth) are provided separately.

There is a further discussion to be had regarding the consistency of approach across the occupied spaces and final confirmation of how we are to progress the design.

**Cooling Plant**
In the previous design iteration, the ASHPs were not providing cooling so were not selected with this as one of their parameters. The Clade units that are currently allowed for within the design cannot provide cooling and we will be reviewing the options available to minimise any cost uplift that the cooling will introduce. We will advise on this under separate cover.

**Modelling Results**

| Location | Operative temperature (TM 52/CIBSE) (°C) - % of occupied hours in range | | | | | | Comments |
|---|---|---|---|---|---|---|---|
| | 20 W/m² | | 30 W/m² | | 40 W/m² | | |
| | % time > 26 (max. 5%) | Pass/Fail | % time > 26 (max. 5%) | Pass/Fail | % time > 26 (max. 5%) | Pass/Fail | |
| FF General Classroom 1 | 8 | Fail | 5.9 | Fail | 4.2 | Pass | |
| FF General Classroom 2 | 10.3 | Fail | 7.7 | Fail | 5.7 | Fail | Fan Coil unit Required |
| FF Music Practice Room | 5.3 | Fail | 2.2 | Pass | 0.8 | Pass | |
| FF Music Room | 11.3 | Fail | 7.5 | Fail | 4.8 | Pass | Fan Coil unit Required |
| FF Music Tech Room | 11 | Fail | 6.9 | Fail | 4.2 | Pass | Fan Coil unit Required |
| FF Photo Studio 02 | 11 | Fail | 7.6 | Fail | 4.9 | Pass | Fan Coil unit Required |
| FF Photo Studio 03 | 7.7 | Fail | 4.8 | Pass | 2.8 | Pass | |
| FF Student Common Room | 10.5 | Fail | 6.8 | Fail | 4.1 | Pass | Fan Coil unit Required |
| FF Study Room | 11.4 | Fail | 8.8 | Fail | 6.8 | Fail | Fan Coil unit Required |
| GF Accounts office | 5.8 | Fail | 4.4 | Pass | 2.4 | Pass | |
| GF Cafe Kitchen and Storage | 5.6 | Fail | 4.8 | Pass | 3.8 | Pass | |
| GF Cafe/Gallery | 5.4 | Fail | 3.5 | Pass | 1.8 | Pass | |
| GF Dark Room | 8 | Fail | 6.2 | Fail | 4.7 | Pass | Fan Coil unit Required |
| GF Drama/Dance Studio | 3.5 | Pass | 1.6 | Pass | 0.7 | Pass | |
| GF Main-use Hall | 11.7 | Fail | 11.7 | Fail | 11.2 | Fail | Fan Coil unit Required |
| GF Photo Studio (Dark) | 5.6 | Fail | 3.3 | Pass | 1.5 | Pass | |
| GF Principals Office | 5.4 | Fail | 3.7 | Pass | 1.5 | Pass | |
| GF Shower/Changing Area | 7.2 | Fail | 7.1 | Fail | 7 | Fail | Fan Coil unit Required |
| GF Staff Room | 5.2 | Fail | 3.7 | Pass | 1.9 | Pass | |
| GF Welfare Room | 3.5 | Pass | 1.5 | Pass | 0.7 | Pass | |
| SF Art Studio | 9.3 | Fail | 6.1 | Fail | 4 | Pass | Fan Coil unit Required |
| SF General Classroom 3 | 12.9 | Fail | 10.1 | Fail | 7.6 | Fail | Fan Coil unit Required |
| SF General Classroom 4 | 12.8 | Fail | 10.2 | Fail | 7.3 | Fail | Fan Coil unit Required |
| SF General Classroom 5 | 13.8 | Fail | 11.5 | Fail | 8.9 | Fail | Fan Coil unit Required |
| SF General Classroom 6 | 11.2 | Fail | 8.7 | Fail | 6.4 | Fail | Fan Coil unit Required |
| SF Graphics Studio 01 | 8.4 | Fail | 3.9 | Pass | 1.3 | Pass | |
| SF Graphics Studio 02 | 12.4 | Fail | 9.7 | Fail | 7.4 | Fail | Fan Coil unit Required |
| SF Graphics Studio Store | 10.6 | Fail | 8.6 | Fail | 6.3 | Fail | Fan Coil unit Required |

MAX FORDHAM

MAX FORDHAM

## UNDERFLOOR COOLING OUTPUTS FOR TYPICAL FLOOR BUILD UPS

Outputs are quoted against a typical 75mm sand/cement screed outputs will differ for thinner screed systems

Thermo-Floor
underfloor heating & cooling since 1986

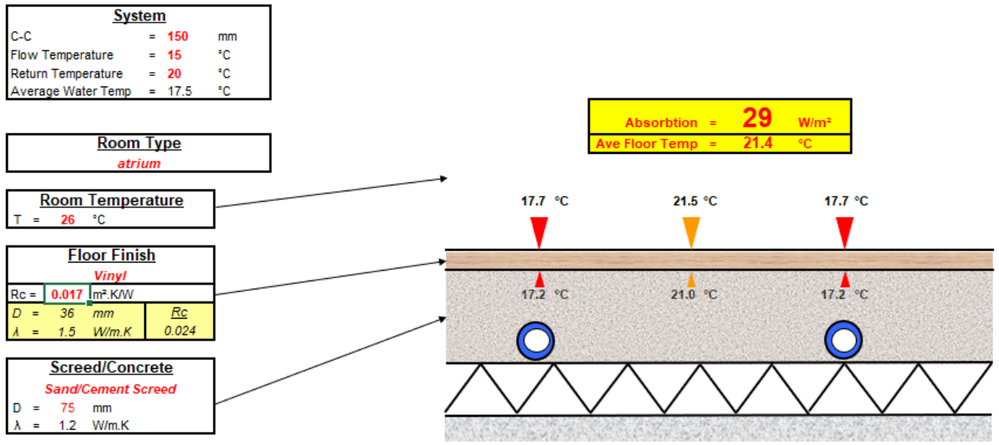


**Figure 2 - 2-3mm Vinyl Floor (Max. R of 0.17 m².K/W)**

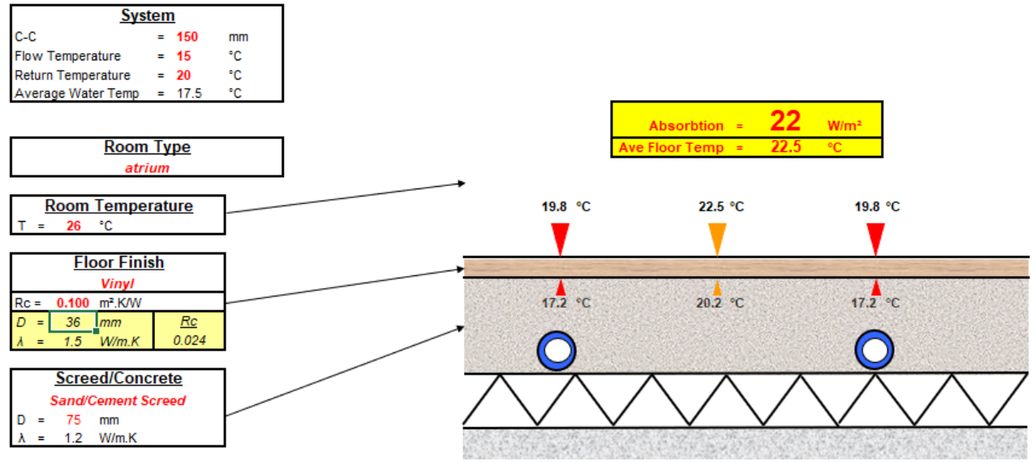


**Figure 1 - Contract Carpet/Carpet Tiles (Max. R of 0.100 m².K/W)**

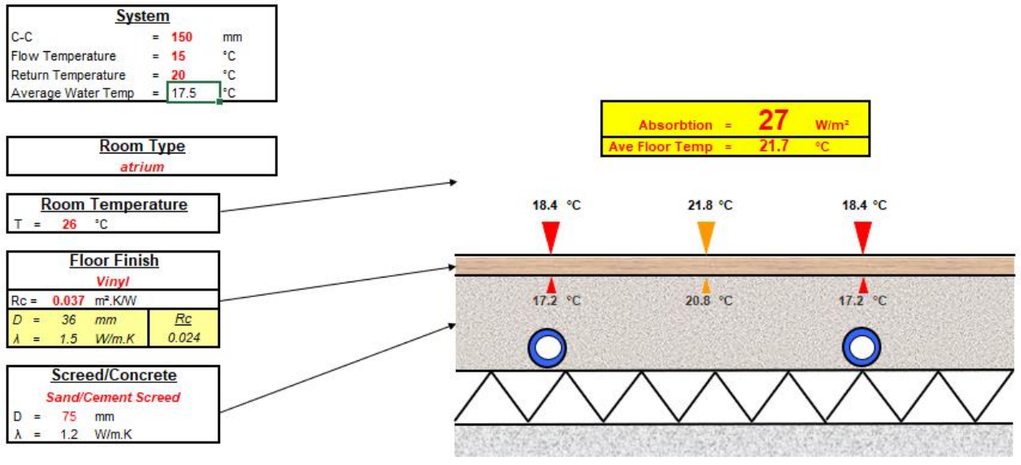


**Figure 4 - Tiled floor (Max. R of 0.037 m².K/W)**

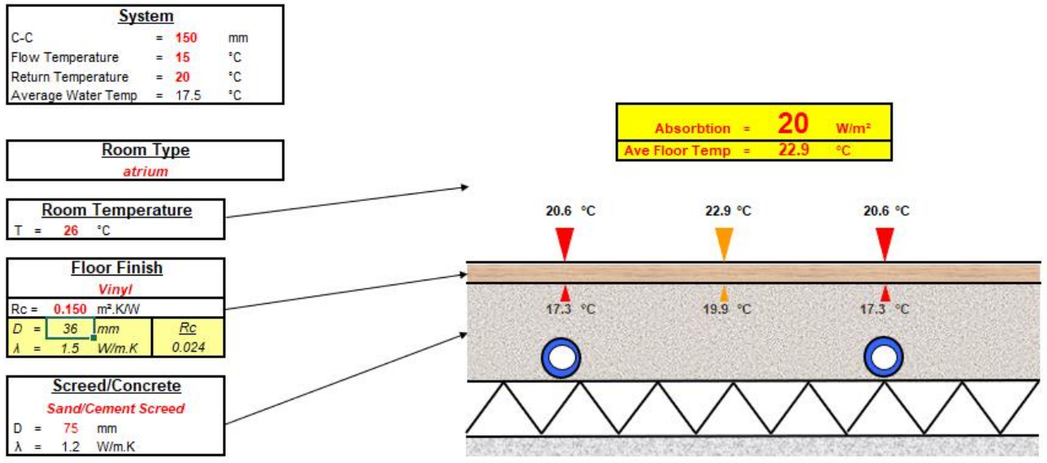


**Figure 3 - 15mm Engineered Timber + 3mm Underlay (Max. R of 0.150 m².K/W)**