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Bristol Creative College

PASSIVHAUS Student Competition

in partnership with

TARMAC A CRH COMPANY

DESIGN PHILOSOPHY

The campus consists of the primary school, secondary school, and common facilities. The builidings are grouped with the same function, which can be operated separately resulting in the reduction in the unnecessary energy consumption.

The buildings were oriented along the south-west axis to enrich the benefit of the wind direction. Also, avoids the direct glare from the south. However, the saw-tooth facade was placed facing the south to maximise the use of the sun and act as the shading for the classrooms. The classroom buildings were designed with the small floor plate to utilise the daylighting and enchance the cross ventilation, healthy air quality, thermal comfort, and noise control.

PROJECT FACTS

Educational	Bristol	25,000 m²
Building Use	Location	TFA

PASSIVHAUS STRATEGY

Airtightness

Airtightness membrane is fully filed on the interior side of the facade to meet the 0.6 ach @ 50 Pa airtightness target.

Shading and summer ventilation

This design uses mix-mode ventilation in which the mechanical ventilation is the primary system and the natural ventilation is used only in summer to reduce the overheating risk with the noise attenuating control consideration. Also, the classroom is designed to face the north where its overheating risk and glare would be controlled.

Heating

In winter, the MVHR unit is integrated with the BIPVT system to provide the mechanical ventilation. The air flow would be accelerated and be preheated in the duct behind the PV panel, delivering to MVHR and AHU system. Then, the under-floor air delivery system would deliver the heated air to the occupied room.

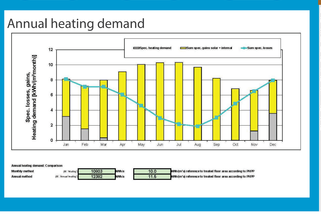
Comfort

All passive strategies would contribute the indoor temperature remaining above the 20°C and have the least risk above 25°C in summer with suitable relative humidity. Also, the annual overheating for classroom is only 1.2% of all a year.

PREDICTED PERFORMANCE

U-Values	Heating demand	Form Factor
Walls 0.108 Floor 0.118 Roof 0.118 Windows 0.640 W/m²K	10 kWh/m²yr (Classroom building)	2.8 (Classroom building)

Annual heating demand



INTEGRATED TECHNOLOGY

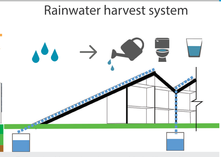
BIPVT

PV is one of the renewable technologies (solar thermal water, ground source heat pump, and biomass fuel) used in this campus. PV panel is the potential renewable technology in Bristol. There are about 80,000 rooftops suitable for the solar electric, which is one-third of all rooftops in Bristol. The PV were placed in the south facade due to the most potential orientation. Also, PV could act as the shading for the classrooms.

34.6% reduction of primary energy consumption

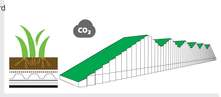
38.3% reduction of CO2 equivalent

Rainwater harvest system



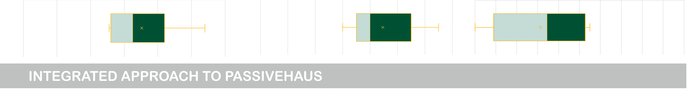
Rainwater Harvest system combied with on-site grey recycle system can collect the rainwater for toilet flushing, gardening, and drinking water.

Green roof



Total green roof in the campus can sequestrate 1.7 CO_2 ton/year. Also, it can act as the natural filter for the fresher air.

Primary energy of all buildings (kWh/m²yr)

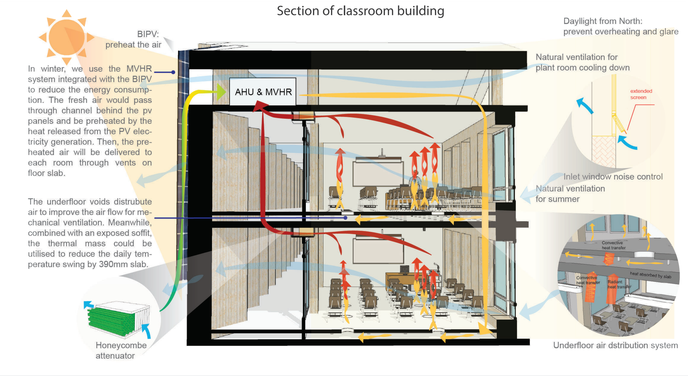


Heating demand of all buildings (kWh/m²yr)

Range of overheating risk of all buildings

INTEGRATED APPROACH TO PASSIVEHAUS

Section of classroom building

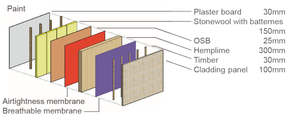


MATERIALS

Wall (0.108 W/m²K)

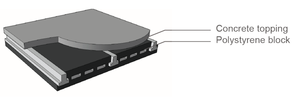
The wall structure is chosen from the **GREEN guide A+** and **highest BREEAM** lifecycle impact requirement and is modified by the hemp-lime as the new thermal insulator to reach 0.108 W/m²K.

Hemp-lime is a sustainable material, which has low U-value, good airtightness, lightweight, low thermal conductivity, noise control, **carbon sequestration** and thermal damping.



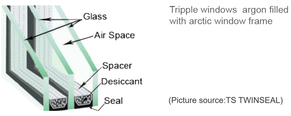
Ceiling and floor (0.118 W/m²K)

Concrete with polystrene block is chosen as the material for ceiling and floor. It could provide good thermal mass to maintain the stability of the indoor temperature and reduce the risk of overheating.



Window (0.7 W/m²K)

The triple glazing with Argon infilled and the arctic frame are chosen to use in the campus.The final window U-value is around 0.7 W/m²K, which meets the Passivhaus standard.



Acknowledgements

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UK PASSIVHAUS STUDENT COMPETITION

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