p3r engineers ltd
70 Cowcross Street
London EC1M 6EJ

Tel: 0207 490 7848
mail@p3r-engineers.co.uk

PTEQ at Royal Central School of Speech and Drama.
Cooling Hierarchy Report
12.09.2024

1.0 Introduction

The Royal Central School of Speech and Drama is a prominent institution specializing in the arts of drama, theatre, and performance, located in near Swiss Cottage, London. The school is adding a new building within its campus, which consists of office spaces and PTEQ (Performance Technology and Experience Quality) Lab.
In line with current Greater London Authority (GLA) Guidance, the project PTEQ at Royal college of Speech and Drama has been designed to ensure the building is not vulnerable to overheating; to instigate consideration of the risk of overheating with the proposed development, the design team have followed the guidance within the London Plan, which consider the control of overheating using the Cooling Hierarchy.

The London Cooling Hierarchy is a framework established by the GLA to promote energy efficiency and sustainability in cooling systems across London. The hierarchy outlines a set of priorities for how cooling should be approached, focusing on reducing the overall demand for cooling and minimizing environmental impact.

2.0 Passive Design

The National Planning Policy Framework emphasises the need to take account of climate change over the longer term and plan new developments to avoid increased vulnerability to the range of impacts arising from climate change. The UK Climate Impacts Programme 2009 projections suggest that by the 2080's the UK is likely to experience summer temperatures that are up to 4.2°C higher than they are today.

Accordingly, designers are to ensure buildings are designed and constructed to be comfortable in higher temperatures, without resorting to energy intensive air conditioning. The overheating risk has been mitigated through passive measures by applying cooling hierarchy Policy SI 4 Managing heat risk of the London Plan 2021

1. Minimise internal heat generation through energy efficient design.

The internal gains are minimised with energy efficient lighting design and insulating the services to reduce the heat gains. The project will be designed to best practice thermal insulation levels as noted under below.

U-values (W/m^2K)	Current building regulations minimum*	Values for the proposed extension
Walls	0.26	0.18
Floors	0.18	0.16
Roofs	0.16	0.15
Opaque door	1.6	1.6
Windows and glazed doors	1.6	1.2 (G-value 0.35)
Air permeability	$8m^3/m^2h$ at 50 Pa	$5m^3/m^2h$ at 50 Pa

Not only does good insulation assist in reducing heat losses in the winter, but it also has a significant impact on preventing heat travelling through the build fabric during the summer.

p3r engineers ltd
70 Cowcross Street
London EC1M 6EJ

Tel: 0207 490 7848
mail@p3r-engineers.co.uk

2. Reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and wall

The development site is within high rise building areas of London which will suffer the impact of the heat island effect.
However, the proposed building will have significant topographical solar shading from the existing building and trees. Northwest and northeast are shaded by West Block, Embassy extension and the Main building, and the Southeast of the building is shaded by tall trees – essentially reducing the potential solar gains to minimal levels during the afternoon after the peak occupancy periods.
The southwest facing glazing in the multifunction space will have internal blinds. The design will introduce a high percentage of glazing to the main facades to ensure significant levels of internal daylight and reduced reliance on artificial lighting for office spaces.

These same large, glazed area are afforded protection from excessive solar gain during the summer months using a high specification low g-value glazing. A lower g-value indicates better performance in blocking solar heat, which can help reduce cooling loads in warm days.

The ground floor roof will benefit from Green roof, which provide shade to the roof surface, and reduces the amount of heat absorbed by the building.

Table below confirms the building complies with limiting solar gain check. The report is generated from VE IES thermal modelling software.

Limiting solar gain check

	Space (included in analysis)	Floor	Glazing as % floor area	Glazing category	Predominant orientation[8]	Solar gain limit[1]		Shading data[7]			
						Pass/Fail	Solar gain / limit [2,3]	Glazing g value[4]	Internal blinds used?[5]	External shades used?[5]	Local shading devices used?[5]
	Sort A-Z	Hi/Lo	Hi/Lo	Sort A-Z	Sort A-Z	Sort A-Z	Hi/Lo	Hi/Lo	Sort A-Z	Sort A-Z	Sort A-Z
	Apply		40.0				1.1	0.5			
Actual model	GF-Break Down	000	54	Side Lit	SE	Pass	0.58	0.35	No	No	No
	GF-Accessible Toilet	000	0	Side Lit	N/A	N/A	0.00	0.00	No	No	No
	FF-Multi Function Space	001	27	Side Lit	SW	Pass	0.13	0.35	Yes	No	No
	FF-Research	001	12	Side Lit	SE	Pass	0.15	0.35	No	No	No
	FF-Accesible Toilet	001	0	Side Lit	N/A	N/A	0.00	0.00	No	No	No
	GF-PTEQ Lab	000	0	Side Lit	N/A	N/A	0.00	0.00	No	No	No

Solar gain check passed

Notes:

1. Limiting Solar Gain is a check that spaces have appropriate passive control measures to limit the effects of solar gains;
2. When the solar gain limit is exceeded by a small amount (with ratio < 1.3) consider the glazing specification and blinds;
3. When the solar gain limit is exceeded by a large amount (with ratio > 1.5) consider glazing area, external shading, the glazing specification and blinds;
4. Glazing g value; see derived parameters in Apache>constructions; this typically ranges from 0.1 for highly reflective to 0.8 for clear glass (double glazed)-optimal solar/light is approx 0.4-0.5;
5. Shading options defined with the construction in Apache>constructions;
6. If Local shade rooms types are defined and Suncast has been utilised their impact will be included in the result;
7. If more than one glazed construction is specified for the space the largest by area is reported;
8. Orientation & external shading strategy; shades on the north facades have little impact, shades on east & west facades need to work for low sun angles to be effective (consider vertical fins), horizontal shades on south facades work well however recess / vertical shades can also improve early & late performance.

3. Manage the heat within the building through exposed internal thermal mass and high ceilings

p3r engineers ltd
70 Cowcross Street
London EC1M 6EJ

Tel: 0207 490 7848
mail@p3r-engineers.co.uk

The new build structure is expected to be a structural steel fame with concrete floors, offering thermal mass that is able to absorb heat during the summer months, which can then be ventilated during the evening or overnight.

4. Passive ventilation

All glazing is designed to have opening areas to introduce high levels of natural levels of "purge" ventilation to further assist in the reduction of overheating risks/cooling loads in main occupied areas.

5. Mechanical ventilation

The current proposals are for the internal spaces to be mechanically ventilated to ensure an appropriate level of fresh air in these potentially densely occupied spaces with stable temperature, this will also protect occupants from exposure to potential poor air quality and increased noise levels in this central London location.

3.0 Cooling Demand

The PTEQ Lab would require a robust set of building service to support its advanced research and technologies activities. These services are essential to creating an optimal environment for experimentation, development, and performance. The lab should be maintained at a stable temperature and humidity level, which is crucial for both the comfort of users and the proper functioning of sensitive equipment. Systems will be continuously monitored and to environmental conditions to prevent damage to high-tech equipment and ensure accurate experimental results. To ensure the comfort within the lab, it is proposed the building will have active cooling with high efficiency heat system.

The above passive design measures have been incorporated into the final designs, and as per the GLA guidance, the building's cooling demand has been calculated to ensure that the buildings actual cooling demand in less that the notional Part L models.

As can be seen from the below table, BRUKL extract, cooling demand for the actual building is less than the notional.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	169.2	21.2	12.6	1.3	0	3.73	4.48	3.8	6
	Notional	180.3	26.8	18	1.6	0	2.78	4.63	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	187	0	61.7	0	0	0.84	0	1	0
	Notional	227.4	0	44.8	0	0	1.41	0	----	----

"Be Lean" BRUKL Extract - Cooling Demand