ARUP

File Note

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1-2 Stephen Street: Cooling Hierarchy Compliance Statement

This statement has been prepared in support of proposals for the installation of a new direct expansion cooling system at 1-2 Stephen Street. The ground floor tenant is proposing to install additional cooling via external condensers at the level 1 roof. This is to facilitate a specific tenant requirement for increased resilience and modified occupied hours by a SME in the creative industry. The nature of their business does not allow natural ventilation and demands an independent cooling and heating system in (or under) the tenant's own control.

This direct expansion outdoor units cannot be positioned on the roof at the top of the building as this is too far away from the indoor units.

This Statement has been prepared with input from Arup who are providing services advice to the landlord, Derwent London. The proposed system shall operate independently to the existing building wide heating and cooling systems.

The works undertaken by the tenant are limited to fit-out works and are not altering the façade of the building. To support the planning application for the new plant enclosure this statement demonstrates how the development and proposed tenant works have considered the cooling hierarchy.

1. Cooling Hierarchy

The cooling hierarchy as described in the London Plan and Camden Council requirements are expressed in this section.

1.1 London Plan

Policy SI 4 - Managing Heat Risk

Development proposals should minimise adverse impacts on the urban heat island through design, layout, orientation, materials and the incorporation of green infrastructure.

> Major development proposals should demonstrate through an energy strategy how they will reduce the potential for internal overheating and reliance on air conditioning systems in accordance with the following cooling hierarchy:
>
> Reduce the amount of heat entering a building through orientation, shading, high albedo materials, fenestration, insulation and the provision of green infrastructure.
>
> Minimise internal heat generation through energy efficient design.
> - Manage the heat within the building through exposed internal thermal mass and high ceilings Provide passive ventilation.
> - Provide mechanical ventilation.
> - Provide active cooling systems.

The policy requires that passive ventilation should be prioritised, taking into account external noise and air quality in determining the most appropriate solution. The increased use of air conditioning systems is not desirable as these have significant energy requirements and, under conventional operation, expel hot air, thereby adding to the urban heat island effect. If active cooling systems, such as air conditioning systems, are unavoidable, these should be designed to reuse the waste heat they produce.

1.2 Camden Council

The Local Plan states that:

- Active cooling (air conditioning) will only be permitted where its need is demonstrated and the steps in the cooling hierarchy are followed (Local Plan policy CC2).
- Development is expected to reduce overheating risk through following the steps in the cooling hierarchy. All new development should submit a statement demonstrating how the cooling hierarchy has been followed (Local Plan policy CC2).
- All developments should seek opportunities to make a positive contribution to green space provision or greening.

Cooling hierarchy

All developments should follow the cooling hierarchy outlined below, to reduce the risk of overheating and subsequent reliance on active cooling:

1. **Minimise internal heat generation through energy efficient design, considering the following:**

- Layout and uses: locate any spaces that need to be kept cool or that generate heat on cooler sides of developments.

- Reducing heat gains e.g. including low energy lighting.
- Seal/ insulate heat generating processes.
- Reduce the distance heat needs to travel and insulate pipework.
- Design layouts to promote natural ventilation e.g. shallow floor plans and high floor to ceiling heights.
- Consider evaporation cooling which cools air through the evaporation of water.
- Consider 'free cooling' or 'night cooling', which uses the cooling capacity of ambient air to directly cool the space.

2. Reduce the amount of heat entering a building in summer:

- Consider the angle of the sun and optimum daylight and solar gain balance.
- Orientate and recess windows and openings to avoid excessive solar gain.
- Consider low g-values and the proportion, size and location of windows.
- Make use of shadowing from other buildings.
- Include adequate insulation.
- Design in shading: e.g. include internal courtyards, large shade-providing trees and vegetation, balconies, louvers, internal or external blinds, and shutters.
- Make use of the albedo effect (use light coloured or reflective materials to reflect the sun's rays).
- Include green infrastructure e.g. green wall, green/blue roofs and landscaping, to regulate temperatures.
- Reduce the amount of heat entering a building in summer.

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

4. Passive ventilation:

- Natural ventilation, openable windows, the 'stack effect' system.
- Design layouts to promote natural ventilation e.g. shallow floor plans and high floor to ceiling heights.
- Consider evaporation cooling which cools air through the evaporation of water.
- Consider 'free cooling' or 'night cooling' which uses the cooling capacity of ambient air to directly cool the space.

5. Mechanical ventilation:

- Ensuring the most efficient system possible.
- Consider mechanical ventilation with heat recovery.

6. Active cooling:

- Ensuring they are the lowest carbon options.
- Ground Source Heat Pumps and Air Source Heat Pumps can be used in reverse to provide cooling to buildings.
- Water based cooling systems also reduce the need for air conditioning by running cold water through pipes in the floor and/or ceiling to cool the air.

2. Stephen Street Design Compliance

The objective of this section is to demonstrate compliance of the proposed works for new plant equipment at Stephen Street with the policies presented above. The works are limited to fit-out works within the ground floor spaces and cooling and heating system associated with this fit-out. Alterations to the fabric of the building are not within the scope of this fit-out.

2.1 Cooling Hierarchy – Design Principles

The tenant fit-out design either adopts base-build design principles or includes fit-out design that complies with the cooling hierarchy as summarised in the table below:

Cooling Hierarchy reference	Base-build design	Tenant fit-out
Energy efficient design	The base-build design is the conversion of double height recording studios into office spaces. This has repurposed the space and saved significant embodied carbon compared to a new build, however means that there wasn't an opportunity to alter massing or form to suit natural ventilation.	Evaporative cooling was considered however the water consumption and maintenance impact required for an evaporative system was too onerous. Low energy lighting will be used to reduce heat gains in the space.
Summer overheating	Shading applied to the south facade to limit solar gains. Building geometry provides self-shading to reduce solar gains Building canopy provides shading to the West and North West facades. Elements of green infrastructure provided on the "ground floor roof".	Further measures to control overheating not necessary.
Thermal mass	Building construction in-situ reinforced concrete.	Exposing elements of thermal mass reduces peak cooling load and improves thermal comfort.
Passive ventilation	Building location at ground floor level in terms of noise and air quality means natural ventilation has not been included in the base-build design.	Passive ventilation not included in tenant fit-out as works do not include facade.

	Deep plan building layout also makes natural ventilation hard to apply here.	
Mechanical ventilation	The base-build mechanical ventilation is retained with high efficiency heat recovery and low-energy fans.	Tenant fit-out adopts base-build system
Active cooling	The existing building cooling is provided by air cooled chillers. This is in the process of being replaced with air source heat pumps which are installed but not yet commissioned.	The tenant fit-out will use a VRF system the incorporates heat recovery during periods of simultaneous heating and cooling and smart control to facilitate higher efficiencies through the use of variable refrigerant temperatures.

2.2 Cooling solution

As passive ventilation wasn't found to be viable (due to existing building form and tenant fit-out scope not including facades) the proposed design is for cooling provided by a VRF system. The size of this system is reduced due to the efficiency measured detailed in the cooling hierarchy response.

Another consideration of the fit-out design is the ability for the cooling system to operate independently of the base-build system. This provides the tenant with enhanced resilience, the ability to operate outside of conventional business hours and the ability to have lower air supply temperatures.

These requirements would not be required for a conventional office tenant however this tenant is a media company. Specifically, a post-production facility with different operating requirements than a conventional office.

2.3 Energy modelling

An energy model of the proposed development was developed and used to analyse and optimise the base-build design. The model has also been updated to reflect the proposed tenant fit-out.

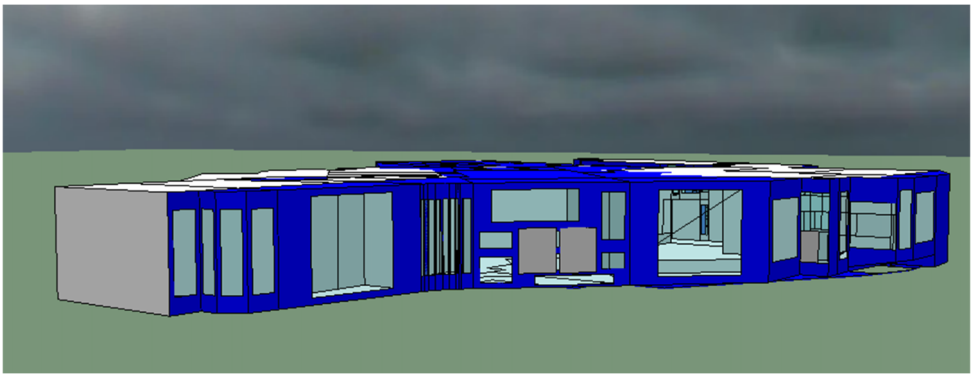

Figure 1 IES model snapshot

The key energy modelling results are as follows:

- Existing base-build systems (gas boilers and air cooled chillers) – 16.9kgCO_2/m²
- Proposed tenant fit-out (VRF system) – 6.3kgCO_2/m²

Compared to the existing base-build gas boiler and air cooled chiller the proposed tenant plants provides a significant reduction in Building CO_2 emission rate

3. Conclusion

The Cooling Hierarchy has been fully considered and where feasible appropriate passive measures have been implemented to reduce the cooling demand before consideration has been given to energy efficient air conditioning.

Given the location of the building and in order to maintain adequate comfort levels, acoustics and indoor air quality, all the spaces within the buildings are intended to be comfort cooled. To facilitate specific tenant requirements for higher cooling loads, increased cooling resilience and modified occupied hours an independent cooling system is proposed to cool specific areas of the building.