

NO.3 CIRCLE SQUARE – LOUVRES ADDITIONAL INFO

This note has been provided to explain the inherent relationship between operational and embodied carbon and the building's M&E systems. It also summarises the architectural implications of introducing additional louvres and a decorative screen (or similar):

Operational Carbon

Operational carbon and its associated industry, statutory and local authority targets are largely determined by the energy consumption of a building, namely its M&E systems. The lighting, power, heating, cooling and ventilation requirements of a building all significantly contribute to a building's energy consumption. Building accreditations such as NABERS seek to ensure that a building effectively installs M&E systems by ensuring that a building's efficiency is maximised and its energy consumption reduced, as far as possible.

From a mechanical perspective heating and cooling, and ventilation systems are the two biggest contributors to this. It is recognised that the ventilation and heating and cooling systems do not operate independently, and so a key part of any design process is to ensure that these systems are complementary. On this basis, the detailed analysis for No.3 Circle Square stipulated that a central air source heat pump system (ASHP) would be the most efficient method for managing the heating and cooling throughout the building.

Ventilation

Whilst heating and cooling form part of the wider M&E, the ventilation strategy for No.3 Circle Square has informed the existing extent and design of the louvres.

It is recognised that generally there are three ways the ventilation system can be designed: naturally ventilated; mixed mode; and mechanically ventilated.

Natural Ventilation – Discounted

In city centre locations with contemporary buildings natural ventilation is rarely used, largely due to air quality and acoustic concerns. A fully naturally ventilated building would also significantly limit the heating and cooling strategy for a building. In addition, where fan coil units are used (generally the case for most H+C systems), a consistent air pressure is required to operate effectively and efficiently - this cannot be guaranteed with natural ventilation.

Wet systems (such as UFH or radiators) would typically be used where a building is naturally ventilated which are generally not as energy efficient as the use of an ASHP.

A natural ventilation strategy was discounted for No.3 Circle Square, as part of early analysis and design development process.

Mixed mode – Discounted

Mixed mode ventilation, utilising a mix of natural and mechanical ventilation results in similar challenges and concerns as naturally ventilated buildings (i.e. air quality and acoustic). It is also recognised that often where mechanical ventilation is used alongside natural ventilation the system is operated inefficiently – for example where windows are left open while the building is in heat mode, so heat escapes.

A mixed mode ventilation strategy was discounted for No.3 Circle Square, as part of early analysis and design development process.

Mechanical Ventilation - Proposed

Detailed analysis undertaken as part of the early design development process for No.3 Circle Square determined that mechanical ventilation would provide the best would operate best if the building was mechanically ventilated – specifically via Mechanical Ventilation with Heat Recovery (MVHR) units.

These are ceiling mounted units spaced throughout the perimeter of the floorplates, adjacent to external windows in a regular pattern (corresponding with the Interpon Bronze Louvres and the hit/miss brickwork on the upper levels). It is recognised that these are becoming increasingly popular as MVHR units offer a significantly better operational efficiency, when compared with central Air Handling Units.

The use of an MVHR system for No.3 Circle Square mandates that the facade of the building includes louvres. As the louvres are generally machined metal panels, there is a need for these to be designed efficiently to minimise their contribution to the embodied carbon on the building.

Louvre Efficiency

The efficiency of a louvre is based on the percentage of free area it offers. The (typical) louvre design that is proposed for No.3 Circle Square is the most efficient available, with 50% free area provided.

The introduction of a decorative louvre or over panel would result in a reduced percentage of free area percentage. To overcome this there would be a need to increase the quantity or size of louvres to increase the overall free air capacity available to support the operational requirements of the ventilation system (behind the louvre).

Early in the design process of No.3 Circle Square the available areas on the façade of the building were identified. As such the location and extent of louvres was fixed, prior to the planning submission or grant of planning permission. The existing extent of louvres on the façade is therefore fixed and so presents a constraint which needs to be worked within.

As a result there is only one feasible option to overcome a reduction in free area (associated with the introduction of a decorative louvre or panel) – the option would be to increase the velocity of air traveling through the (now smaller) available free area to achieve the required flow rate (which is determined by building regulations). This increased velocity will:

- increase the noise output from the louvres/ grilles;
- require larger ventilation units to be installed;
- require more attenuation; and
- result in the consumption of considerably more energy to drive the system.

It is important to recognise the ‘squared’ relationship between resistance and the energy required to overcome this – in practice where there is a doubling of the resistance (due to the reduced free area), quadruple the amount of energy would be required to achieve the same airflow. As such the introduction of a decorative louvre or panel would result in a significant increase in the consumption of energy.

In summary, the increase in materials from the introduction of a decorative louvre or panel, and the significant increase in operational energy requirements would impact the buildings operational carbon, by generating additional carbon emissions.

Embodied Carbon

Embodied carbon is the energy consumption required to make the component parts of a building. This includes (but is not limited to): the core, frame, floor slabs, facade, paint, plasterboard, carpet and M&E. These elements contribute to a building's overall carbon footprint which is measured in kilograms of CO₂ per m² of gross internal area.

The proposed louvres for No.3 Circle Square are a machined metal design. These are the most efficient design of louvre that is practically possible for the scheme to utilise. The proposed louvre design has been informed

by a detailed understanding of the necessary requirements for the building, for example weather proofing – the louvres are required to ensure that heavy rain and dirt stays out of the mechanical system.

As set out above, changing the louvres (by introducing a decorative louvre or panel) would result in a less efficient design (in terms of percentage free area). The reduction in free area would result in a need to increase the overall size and/ or area of louvres on the facade. Increasing the amount of louvre area, or reducing the efficiency of the louvre design would increase the embodied carbon associated with each – the introduction of more louvres and the introduction of a decorative louvre or panel would result in additional material requirements which would need to be machined and transported (therefore increasing the embodied carbon of the building overall).

In addition, a greater area of louvres would detrimentally affect the building's thermal performance and air tightness. For example, the introduction of more louvres, would trigger the need to consider replacing the existing façade or glazing system for the building with a more efficient alternative to ensure high thermal and air tightness performance criteria.

Architectural Implications

As set out above, the design of No.3 Circle Square is well progressed, and the detailed design is based on the previously submitted and approved drawings for aluminium louvres (as per the original consent).

Programme and Costs

On site, construction is well underway, with the steelwork erection well advanced. In addition façade element package designs are well developed with specialist sub-contractors, with some elements in fabrication. Changing the design at this stage would incur significant programme delays and costs.

Given the stage of works and project programme it is therefore not feasible to fully examine the extent of additional louvres that would be required for the decorative louvre or panel option - this would incur significant costs associated with looking at a re-design of the entire building.

A summary of the architectural implications and considerations are set out below:

- Weather and Acoustics - The proposed weather louvres are required to seal the building as they are set on the building façade with no protective overhangs or similar. The suggested decorative panel/ perforated screen element would need to be used in conjunction with the louvres for weathering and acoustic attenuation purposes. The decorative panel/ screen would therefore serve no purpose other than aesthetic.
- Visual Consistency - The design of the substation doors (3no. double doorsets) to Cloak Street is prescribed by Power On. They can only be provided by 1 approved manufacturer (Sunray). These doors are louvred and cannot be altered. Visual consistency to the Cloak Street elevation is considered to be important, and so the same louvres are proposed on each elevation (see page 4 louvre/ vent panel options appraisal).
- Operational Carbon:
 - Efficiency and Energy Consumption - The addition of a decorative panel/ screen over the louvres reduces the efficiency of the louvres by reducing the percentage of free area and therefore increasing the resistance to airflow. This impacts on the performance and requires increased energy consumption to overcome the increased resistance. Louvres are the most efficient way of achieving free area for ventilation intake and extract, thereby reducing operational carbon in terms of reduced energy consumption for the building.

- Thermal Performance – the thermal performance of louvres and decorative panels is poorer than other façade elements (e.g. brickwork, curtain walling). Increasing the extent of louvres and decorative panels / screens on the façade of the building would reduce the overall thermal performance of the building and adversely impact on operational carbon.
- Embodied Carbon:
 - Louvres and decorative screens utilise more material to fabricate adversely impacting on embodied carbon.
 - Louvres and decorative screens are larger in size/ volume/ weight impacting on transport/handling and adversely impacting on embodied carbon.
- Structural Design: Louvres are currently designed to sit in front of structural steelwork (primary columns and beams and secondary steel) such that the steel is not expressed on the facade. The additional +150mm clear zone required between the louvres and decorative screen (required) to achieve technical performance) would push the decorative screen beyond the face of the façade brickwork (see page 11 louvre/ vent panel options appraisal).
- Aesthetic Design: Pushing the louvres back into the building would:
 - Fundamentally change the aesthetic design and weathering line of the elevations - all steel work would become 'exposed' and therefore be expressed. These would require insulating and over cladding. (see illustration page 5 louvre/ vent panel options appraisal; red structural steel zones running horizontally at mezz floor level would become expressed).
 - Result in loss of internal area.
 - At ground floor and mezzanine levels - impact on clear width of escape routes (where corridors are to rear of façade) and so the internal general arrangement floor plans would need to be re-designed.

Summary

In summary, the proposed approach to louvres (as designed), is intrinsically linked to decisions that were made on the design and mechanical strategies of the building ahead of the planning submission and planning approval for No.3 Circle Square.

At this stage it is not possible to revise the design and approach to louvres – this would result in significant design alterations (M&E and architectural), programme impacts and increased costs associated with this. In addition, a revised approach to the louvres, namely the introduction of decorative louvres or panels, would significantly compromise the carbon and performance targets of the building.