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Corn Exchange - Manchester

Energy Statement in Respect of the Glass Extensions

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C	26/07/2013	Final Issue			
			Prepared by	Checked by	Verified by
		Initials	IC	SM	IC
		Signature	Ian Crook	Stephen Maddocks	Ian Crook

Executive Summary

The two glass extensions proposed on the Fennel Street façade of the Corn Exchange building represent only a minor increase in the energy demand of the building.

The increase in surface and floor area has a reduced effect by improving the U-value of the proposed vitrine construction when compared with the element of façade that is being replaced.

The area of façade that is being replaced with the glass extension represents only a small percentage (less than 3% of the total façade area, excluding the glass dome) and hence the increase in relative U-value is even less significant when considered against the whole energy footprint of the building.

The energy saving proposals include new improved efficiency boilers, new chillers, new air handling units incorporating ECDC motors, and most significantly heat recovery on air handling systems which do not exist in the current installation. The energy saving proposals outweigh the increased energy demand imposed on the building by the glass extensions.

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1. The Proposed Scheme

1.1 Retail Unit Types

The current retail units within the Corn Exchange building include a mixture of standard A1 shop units and also A3 restaurant type units. The A3 restaurant units have historically benefitted from the most stable business profiles .

The proposed scheme creates a greater retail footprint, by utilising the whole of the Lower Ground Floor footprint which is currently public circulation and Mall space, and also brings the internal shop fronts further into the central atrium zone.

The proposal is that all the retail space at Ground and First Floor, plus some area at Lower Ground Floor will be assigned as A3 food and beverage retail space. This has a nett increase in the servicing requirement of the retail areas, discussed later in this document.

In addition two of the proposed Ground Floor A3 units on the Fennel Street façade are proposed to be extended outwards from the existing façade, with mainly glass formed extensions.

1.2 The Glass Extensions

On Fennel Street façade, two mainly glass boxes are proposed to extend the footprint of the retail units G.08 and G.09 with a single shared vitrine and G.10 with a slightly smaller vitrine solely for that retail unit. The glass extensions are proposed to extend from the building by approximately 3 meters, the larger area extension incorporating units G.08 and G.09 having a width of approximately 21.7 meters and a footprint size of 65 meters^2. The smaller extension for unit G.10 extends to the same dimension from the building façade, but has a width of approximately 16.m metres and a footprint of 49 metres^2.

The existing façade on Fennel Street, where the glass extensions are proposed, would be opened up such that the glazed shop front areas form an opening from the main retail area to the glass extensions. The existing steps from the retail units to the current street level are to be generally retained to account for the difference in floor level from the main shop area to the extension space at each of the individual retail units. The floor level differential changes along the Fennel Street façade which is slightly sloping

The detail of the extension construction has yet to be defined, but will be a predominantly double glazed formation .

2. Servicing Strategy

2.1 Heating

The glass extensions shall generally be serviced from the retail tenants individual piped supplies which are derived from Landlord central boiler plant and presented within the units as valved connections with a heat meter.

Low level trench or surface mounted radiators at the perimeter of the glazed extensions will be installed as part of the baseline shell works. These shall be to offset the extension heat loss in part, and also to ensure no cold down draughts from the glazed curtain walling. These will be connected to the Tenant after the heat meter and before the valved connections for the retail tenant to work off with their own shop fit out servicing.

It is envisaged that the servicing would be by means of four pipe fan coil units from the heating and chilled water connections provided, and that high level slot diffusers within the ceiling void bulkhead at the line of the existing façade would allow the delivery of either heated or cooled circulation air to the glass extension space to supplement the perimeter heating.

2.2 Cooling

The glass extensions shall generally be serviced from the retail tenants individual piped supplies which are derived from Landlord central chiller plant and presented within the units as valved connections with a heat meter.

It is envisaged that the servicing would be by means of four pipe fan coil units from the heating and chilled water connections provided, and that high level slot diffusers within the ceiling void bulkhead at the line of the existing façade would allow the delivery of either heated or cooled circulation air to the extension space.

2.3 Lighting

The lighting to the glass extension space will be part of the specific retail tenant fit out, however it is envisaged that this will comprise wall mounted fittings at the line of the existing façade. This may need to be supplemented with task lighting fed from low level power distribution to achieve the tenant fit out requirement.

3. The Energy Implication of the Glass Extensions

3.1 Existing Façade Omission

The existing external façade at the glass extension positions will become an internal separation line, with the masonry column piers retained and the existing glazed shop front openings removed to open the retail units up to the extension areas.

The existing façade has single glazed shop front units, which represent a proportion of 54% of the Vitrine elevational area, with the remaining 46% being the solid masonry column piers. Assuming U-values of 5.16 w/m²k for the glazing (CIBSE Guide A (2006) table 3.23) and 0.72 w/m²k for the masonry (CIBSE Guide A – Table 3.49 1(b)), this equates to an area weighted U value of 3.12 w/m²K.

3.2 The Glass Extensions U-Value Increase of the Facade

Considering the larger of the two glass extensions with a 4.4m high glass cube having a footprint of 21.7m x 3m, a façade area of (21.7 x 4.4) 95.48m² is replaced with a glass box. Surface areas of the new glass total ((3x4.4)+(3x4.4)+(21.7x4.4)+(21.7x3)) 187m². The new exposed floor area is (21.7x3) 65m². With assumed U-values of 1.8 for the double glazing units and 0.35 for the exposed floor , this generates a total UA figure for the glass extension of 359 w/k (not including infiltration).

Comparatively the area of façade which would now be internal (21.7 x 4.4) and using the area weighted U-value above results in a UA figure saved of 297 w/k.

If both glass extensions are considered as per the larger, this would still represent a steady state energy demand increase of less than 125 w/k, and given a winter condition of -4℃ and an internal temperature of 21℃, this would be 3.1 kW of additional heating energy.

The relative increase in U-value with the incorporation of the glass extensions is limited by the use of envelope materials with better thermal properties, which offsets the increase in surface area and volume. Whilst this is clearly an increase, it needs to be considered in perspective. The elevational area of the existing building façade which is affected by the construction of the glass extensions represents less than 3% of the total building façade (excluding the dome) and as such the net impact of the glass extension addition on the whole building energy profile becomes comparatively small.

4. Mitigating Actions to Reduce Energy Consumption

4.1 Change of Retail Unit Assignment

The Retail provision in the proposed scheme gives a nett increase to the current retail areas, this maximises the rental potential of the building but creates increased servicing requirements. The assignment of all the retail spaces at Ground and First Floor levels as A3retail usage also creates increased servicing requirements for cooling provision and also ventilation. The increase in retail unit ventilation requirement is more than offset by the reduction that has been gained with the reduced area and more so by the change in servicing strategy of the central Atrium space.

The existing installation provides heating and cooling via an all air system delivering approximately 14 m^3/s of air which is heated or cooled, into the existing Mall. In the proposed scheme the footprint is slightly reduced, but the ventilation strategy is to utilise a displacement ventilation system. This introduces low velocity air at low level to create a comfort zone to a height of 2.5m to 3.0m and above this, the air is allowed to stratify, with extract out at high level. This has allowed the ventilation system to the central Atrium area to be reduced to 3.0 m^3/s, a saving of some 11m^3/s.

With the increased ventilation need to allow all the retail spaces to be A3 usage, there is an increase in the overall increase in the total ventilation rate that is delivered to the development of approximately 5 m^3/s. The reduction of volume for the Atrium ventilation system has limited the overall increase in the air handling requirement. Creation of new plant space at Lower Ground floor, to house the A1 retail and Atrium air handling units, this allows the existing plant spaces to be re-used to house the new air distribution plant.

4.2 Energy Saving Considerations

The original central Landlord gas fired boilers have been replaced in the last year. The new models provide a more efficient heat transfer to the low pressure hot water heating system. The full potential of energy saving with the higher efficiency boilers is not yet being fully realised, as the original base build BMS control system is still giving a less than optimum effectiveness. The full potential of the improved efficiency should be realised with the replacement of the base build BMS system in the current development refurbishment cost plan.

The existing Landlord central chillers have little more than 5 years of economic useful life, and as such are being replaced as part of the proposed development refurbishment works.

The load requirement for the new chillers is greater than the original selection, due to the introduction of full A3 retail unit at ground and First floor levels, plus the introduction of a single A1 retailer at Lower Ground floor, that would also utilise the space that is currently Mall area at Lower Ground. Allowance for process heat rejection of below ambient (chilled and/or frozen) food displays and storage. The chilled water feed for the A1 retailer process load shall be from a separate pumped circuit, sized purely for that load. This allows the heat rejection for the potential food store process cooling to operate on an independent 24hr time clock whilst allowing the rest of the general retail space cooling to be switched off.

Options will be reviewed for different types of chiller to include free cooling and other energy saving options. It is envisaged that the high efficiency free cooling or turbo core type chillers will not be able to be utilised due to the increased footprint area needed. The chillers will need to be larger in any case to offset the higher cooling load demand.

The air handling units are being replaced with new units, and a number of energy saving considerations will be incorporated;

Electronically Commutated Direct Current (ECDC) motors will be utilised wherever possible – these provide a more efficient fan drive than standard Alternating Current (AC) units, and have much improved performance when used in conjunction with speed control

The existing ventilation systems have no heat recovery provision, and this wastes a lot of energy, heating and cooling of air supplies is the biggest single load requirement of a mechanically ventilated building. The new air handling units shall all incorporate heat recovery. Where possible (such as the Lower Ground A1 Retailer) and the supply and extract unit can be mounted in a double stacked arrangement, a thermal wheel heat recovery will be utilised to maximise the effectiveness of energy recovery (typically 75-80% efficient). Generally the air handling units for supply and extract cannot be arranged in this manner, as we are working within the constraints of the existing plant spaces at the upper floor levels. Where the supply and extract units are remote from each other run around coils will be utilised, accepting the fact that these systems are less effective(45-55% efficient) Incorporating heat recovery on the ventilation units will be the single largest energy saving element within the proposed development.

No heat recovery will be possible for the new Atrium ventilation system. A displacement type ventilation system allows the Atrium area to be serviced with the minimum of air volume, by considering only the occupied zone, and allowing the higher volume of the dome area to experience temperatures outside the usual range for human comfort. The existing smoke extract fans will be utilised for exhaust of the displacement make-up air

volume, and heat recovery from this would require major intervention at the glass dome, which is ideally to be avoided.

5. Conclusion

The glass extensions create an increase in the building footprint and an increase in the area of exposed façade. The existing fenestration to be enclosed by the glass extensions is single glazing and hence the glazed facades of the extension will be more efficient. The net increase in external façade as a result of the glass extension incorporation is a low percentage of the overall façade area and hence the increase in energy usage for the whole development is accordingly low.

Despite a nett increase in the volume of air delivered to the building (minimised by a reduction in the Atrium supply ventilation), there are a number of mechanisms by which the energy usage of the building is to be reduced. Replacement of the central plant with new equipment will allow better efficiencies (central boilers, air handling units and central chillers) and replacement of the BMS controls systems will allow the more efficient plant to operate in the most effective manner, this maximising the energy saving potential.

The biggest single improvement to the building energy demand is the incorporation of heat recovery to the ventilation plant. Heat recovery will be maximised with the use of thermal wheels, where the plant orientation allows. Predominantly the supply and extract systems are remote from one another and run-around coil heat recovery will be utilised. A 40-50% heat recovery of the energy used to temper the fresh air delivery can be realised. The existing installation has no heat recovery on the ventilation systems.

The energy saved in the development by replacement of central plant and more importantly incorporation of heat recovery on the ventilation systems, outweighs the additional energy required by the incorporation of the glass extensions with additional footprint and external facade areas.