Environmental Sustainability Plan

Buildings T2-T3

King's Cross Central
General Partner Ltd

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King's Cross

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KXC T2-T3

Environmental Sustainability Plan

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GLOSSARY

AD	Approved Documents (Building Regulations)
AHU	Air Handling Unit
BER	Building Emission Rate
BREEAM	Building Research Establishment Environmental Assessment Method
CHP	Combined Heat & Power Generation
CCHP	Combined Cooling, Heat & Power Generation (Tri-Generation)
CO2	Carbon Dioxide
DE	District Energy
DHW	Domestic Hot Water
ESCO	Energy Service Company
GREEN GUIDE	The 'Building Research Establishments Green Guide to Specification (3rd Edition)
GLA	Greater London Authority
LTHW	Low Temperature, Hot Water
MSCB	Multi Service Chilled Beams
PV	Photovoltaic Cells/Panels
S106	Deed of Planning Obligations Pursuant to Section 106 of the Town and Country Planning Act 1990
TER	Target Emission Rate
TIMSA	Thermal Insulation Manufacturers and Suppliers Association
HVAC	Heating, Ventilation & Air-Conditioning
Part L2	This refers to 'Approved Document L2A' of the building regulations which sets down the minimum performance and energy efficient measures which will have to be achieved by the King's Cross Central Zone B buildings.
Lean	The efficient use of energy by the Building Services equipment within the building domain.
Clean	The efficient supply of energy (Heat, Power, Cooling, etc.) for the building domain.
Green	The use of renewable technologies to supply energy (Heat, Power, Cooling, etc.)

Executive Summary

Building T2-T3 is located in the Development Zone T north side of the King's Cross Central development. Located over Development Plots, T2, T3 and T4, the building is proposed to comprise one large block, which may be brought forward together, or as two individual buildings, referred to as the northern and southern blocks, within this report. The building is predominantly office use, with a Public Health Care Centre (PHCC) and retail uses at ground floor level. A Full description of the building is provided in the Urban Design Report, included with this submission.

Building T2-T3 will achieve a very high standard of sustainability. The majority of the building is proposed to be office, and as such, the building has been registered since concept design stage under the BREEAM New Construction Offices 2014 scheme, and will achieve a minimum rating of 'EXCELLENT', with an aspiration to achieve 'OUTSTANDING'.

The combination of energy efficient measures and the sourcing of heat, cooling and power from the low-carbon district energy system will result in an overall annual carbon reduction in excess of 39% relative to the 2013 Part L target emission rate (TER).

In summary, the main environmental and sustainability measures that are provided in this report to address Condition 17 of the Outline Planning Permission for the site, and the relevant obligations of the associated S106 Agreement. with deference 2004/2307/P. These include but are not limited to the following:

Condition 17(A) Energy efficiency measures

- Passive design features will be prioritised to reduce the energy demand on associated systems. These features will include high performance glazing, enhanced building fabric and improved air tightness.
- Full thermal analysis has been performed on the building's façade to optimise the performance of the shading device in order to reduce solar heat gains to the perimeter zones. This reduces the dependence on the air conditioning in the space and ensures that the occupants experience thermal comfort.
- A Building Management System will be specified to efficiently control all building systems.
- The installation of displacement ventilation systems with indirect evaporative cooling to maximise the mechanical services free cooling potential.
- The installation of energy efficient lighting with a high efficacy and intelligent controls, including presence detection and daylight dimming to greatly reduce the electrical consumption of the artificial lighting installation. The atria will help daylight penetrate into the office cores, reducing dependence on artificial light.

Condition 17(B) Reduction in carbon emissions

Excluding the contribution of the low-carbon district energy system, the development could achieve a 20% improvement over the target emission rate under the 2013 Building Regulations through the combination of passive design features and energy efficient systems.

Condition 17(C): Provision of Green / Brown roofs

The T2 and T3 buildings will include approximately 1,797m2 of green/brown roof, split between the Building T2 and T3. The green/brown roof will incorporate a mix of species sympathetic to the local environment aimed at maximising biodiversity. Planting will include ornamental grasses, wildflower meadows, groundcover planting, small native trees and shrubs, as well as brown roof

The inclusion of a combination of terraces on the east, west and south facades at levels 7-10 shall enable incoming tenants to further enhance these spaces with planters.

Condition 17(D): Energy supply

The connection of Building T2-T3 to the KXC district energy supply system to allow it to take advantage of the low-carbon benefits associated with combined heat and power. The district energy system will meet all of the chilled water, heating and hot water demand for the building. It will also generate electrical power which will be fed into the National Grid, thereby offsetting a significant percentage of the buildings' demand.

The use of a low-carbon energy supply and the aforementioned passive design measures, energy efficient systems selection and intelligent controls result in Building T2-T3 achieving an overall reduction in CO_2 of 39% against the Part L 2013 TER.

Condition 17(E): BREEAM Rating

As stated above, an initial BREEAM pre-assessment has been carried out and has identified that the building design has an indicative score of 70.25%, representing an 'Excellent' BREEAM rating. The project team has also identified those credits which will be targeted with an aspiration to achieve an 'Outstanding' BREEAM rating.

Condition 17(F):

The provision of significant areas of green and brown roofs will be provide valuable habitats for wildlife including insects, invertebrates and birds. Bird and bat boxes will be incorporated during construction of the building to provide nesting habitats and shelter.

Condition 45: Drainage

The site-wide drainage networks and overall strategy has been designed using SUDS principles to provide an overall peak flow reduction of 10% (based on a 1 in 30 year storm). The site-wide drainage strategy has set maximum peak flow limits to each plot to ensure that the site-wide maximum discharge to the existing combined sewer will not exceed 2292 l/s. Building T2-T3 will be designed so that the foul and surface water discharges will not exceed these set limits.

S106 - Section AA: Water

The specification of rainwater harvesting for the flushing of WC's and sanitary supply shut-off valves to reduce demand for mains water.

The installation of low water use sanitary ware fittings in conjunction with the rainwater harvesting systems will be provided to reduce the internal water use. A minimum of 40% of the available BREEAM water credits will be achieved resulting in a total consumption figure approximately twenty to thirty percent lower than typical water consumption.

S106 - Section Y: Construction materials and waste

The minimisation of packaging used to protect construction materials and assemblies in transportation. Any packaging will be returned wherever possible to be re-used. In addition, to minimise site wastage at the construction phase, prefabrication off-site will be utilised whenever possible.

In addition to Section 106 requirements, the project contractor may have its own corporate construction targets, which will be applied to the proposed development.

The targeting of maximum credits under the BREEAM for Offices 2014 assessment for 'Man 3 -

Responsible construction practices, which includes monitoring and reducing resource use and its waste production.

An early appraisal of the likely construction materials and their carbon footprint has been undertaken. Materials with low levels of environmental impact will be specified wherever practicable. In addition, to minimise site wastage at the construction phase, prefabrication will be utilised whenever possible.

S106 – Section X: Environmental Sustainability Energy
The building will include a fuel cell with a minimum capacity of 250kW in the T2 Building with potential for larger capacity dependant on the outcome of an ongoing feasibility study.

S106 - Section Z: Waste
The circulation of a simple Environmental Sustainability 'user' guide to occupants, including information on waste and recycling.

The allocation of a sizeable waste store for Building T2-T3 at basement level will enable the future separation of waste and recyclable materials.

Contents

1. INTRODUCTION

This Environmental Sustainability Plan (ESP) has been prepared to explain the contribution that the proposed development of Building T2-T3 will make to the sustainable development of the King's Cross Central ('KXC') site.

Specifically, this document addresses the strategies that have been included within the design of Building T2-T3 in order to satisfy the planning conditions of the King's Cross Central ('KXC') outline planning permission (ref. 2004/2307/P) dated 22 December 2006 (the 'Outline Planning Permission') and obligations in the associated Section 106 Agreement related to sustainability. In particular, it seeks to address Planning Condition 17 and each of the six sub-sections listed in the same condition, giving details of the strategies adopted and demonstrating that the building achieves a very high standard of sustainability for a building of this scale in an urban environment. Additionally, reference is made to the actions taken to comply with Planning Condition 45 and the relevant obligations from the Section 106 agreement, namely those contained in Section AA, Section Y and Section Z.

This ESP should be read in the context of the other plans and documents forming the Building T2-T3 submission, including the Urban Design Report, the Planning Compliance Report and BREEAM pre-assessment, the latter being included within this document in Appendix A.

2. RESPONSE TO PLANNING CONDITIONS

2.1 CONDITION 17(A) – ENERGY EFFICIENT MEASURES

"The Environmental Sustainability Plan shall explain how the proposed building design realises opportunities to include design and technology energy efficiency measures."

2.1.1 Overview

Building T2-T3 has been developed to minimise its annual energy consumption in order to reduce its annual energy consumption.

Whilst the offsetting of electrical energy and the heating supplies to each building will be provided via the low-carbon KXC Energy Centre, the project team recognise the need to reduce energy consumption demand of both the building and its users through the application of the following design methodologies:

Passive Design – The design of the building façade and specification of a high-performance envelope. A well-designed external envelope can significantly reduce energy demand, and the need to reduce space heating demand, optimise daylight, and control summer solar gains has had a strong influence upon the design of the building and its facades. The integration of the concrete structure into the architecture through the use of exposed soffits and a displacement ventilation cooling strategy allows the use of thermal mass to minimise cooling loads.

Active Design - The specification of energy efficient equipment (for example, intelligent and high efficacy lighting systems, variable speed pumping etc.) all linked and monitored via the Building Energy Management System, to reduce energy consumption when the building is in use.

By embracing passive and active design, Building T2-T3 will also be 'future-proofed' to ensure it is adaptable to climate change and the future operational needs of the tenant, and is capable of accommodating future low/zero carbon technologies.

2.1.2 Passive Design

Building T2-T3 aims for the highest standards of environmental sustainability for a major office development using a combination of complementary passive design features to obtain very low carbon emissions.

- high levels of insulation and air tightness in the external envelope;
- high levels of thermal mass, by virtue of the exposed concrete structure which reduces the peak mechanical cooling load;
- optimal proportion of glazing and solid panels within the façade to minimise heat gains, with louvres used to reduce solar gain where maximum visual transparency is required;
- high levels of control over solar gain through projecting fins on the northwest and west facades;
- good internal daylight levels due to medium-depth floorplates large floor to ceiling heights, enhanced by the central atria.
- office floor to ceiling height over 3m allowing high levels of natural daylight penetration;
- high efficiency and intelligent lighting systems to reduce energy demand;
- high efficiency plant

Façade Design

The facades of Building T2-T3 have been iteratively developed through detailed thermal modelling analysis using the DCLG-approved software IES Virtual Environment 2014 and Ecotect to deliver optimum percentages of glazing, taking into account the amount of solar transmission through the fenestration in order to reduce the required capacity of any cooling plant whilst maximising visible light transmission to allow natural daylight to penetrate deep within the floor plates, reducing the reliance on artificial light and conserving energy. The solar shade has been carefully constructed to offer maximum shading whilst not limiting the view out for occupants and capturing the design intention of the development.

The façade has been designed to exceed the Part L limiting fabric parameters, resulting in further energy savings by reducing the heat transmission by the fabric. Careful consideration to any thermal bridges, the air tightness of building fabric junctions and the prefabrication of any suitable components should reduce the effect of cold bridging and result in a significantly more air tight building than the Part L limit for new non-domestic development.

The project team has acknowledged from the outset that the glazing performance specification for this building in terms of solar, thermal and light transmittance is a key driver to minimise energy usage. The natural form of the building means that controlling solar gain on the east and west facing facades is key to limiting cooling loads along the perimeter. The built up locale will provide a large amount of low level shading, whilst the shading device will protect the east façade from high level solar gains as the sun tracks across the building.

The glazing parameters have been specified to deliver optimum performance when used in conjunction with the shading device, and with consideration for the percentage of façade that will be glazed. All thermal modelling has been undertaken without any internal blinds fitted, as these will be fitted by tenants as an option to control glare into the space during the winter months when low angle sun may strike the façade. Blinds also reduce the solar gain into the space, but to represent the base build these were not included on the model.

Large roof lights with atria extending down through the building with full internal glazing will allow natural light to penetrate deep within the floor plate. This means that the uniformity of natural light across the tenanted areas will allow daylight dimming to be utilised over a larger area.

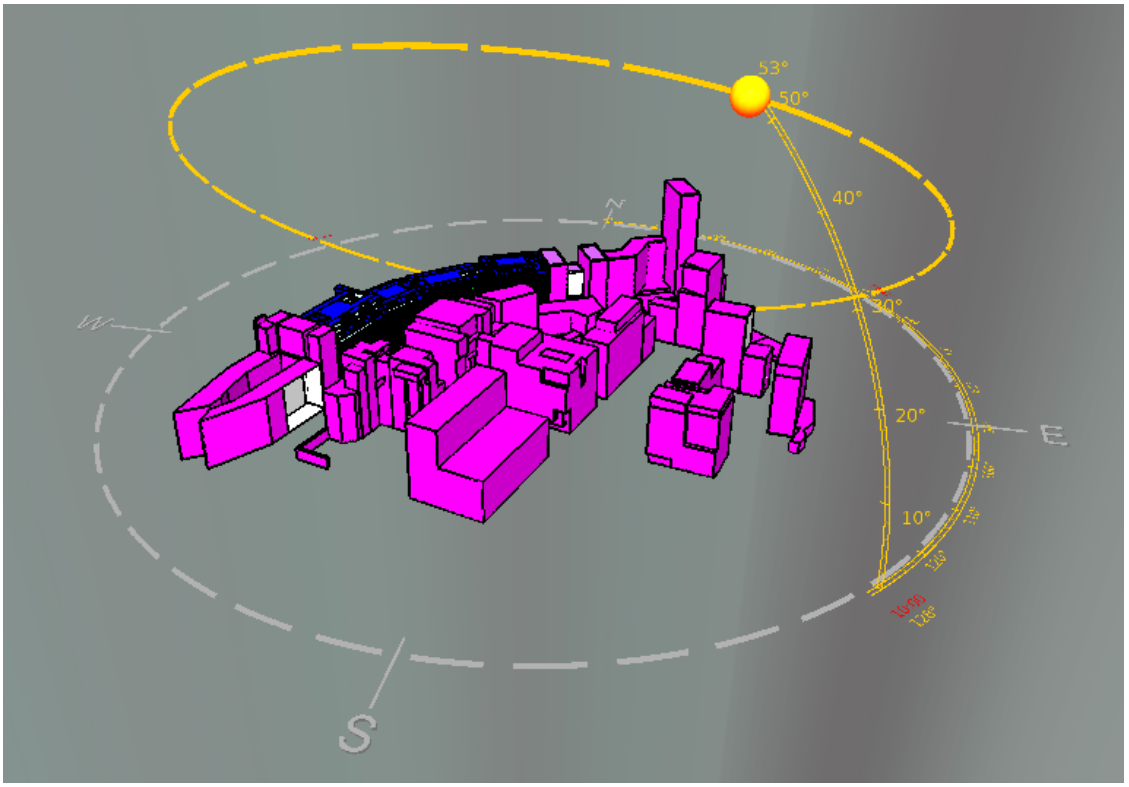


Figure 1 - Angle of Sun at 10:00 in July

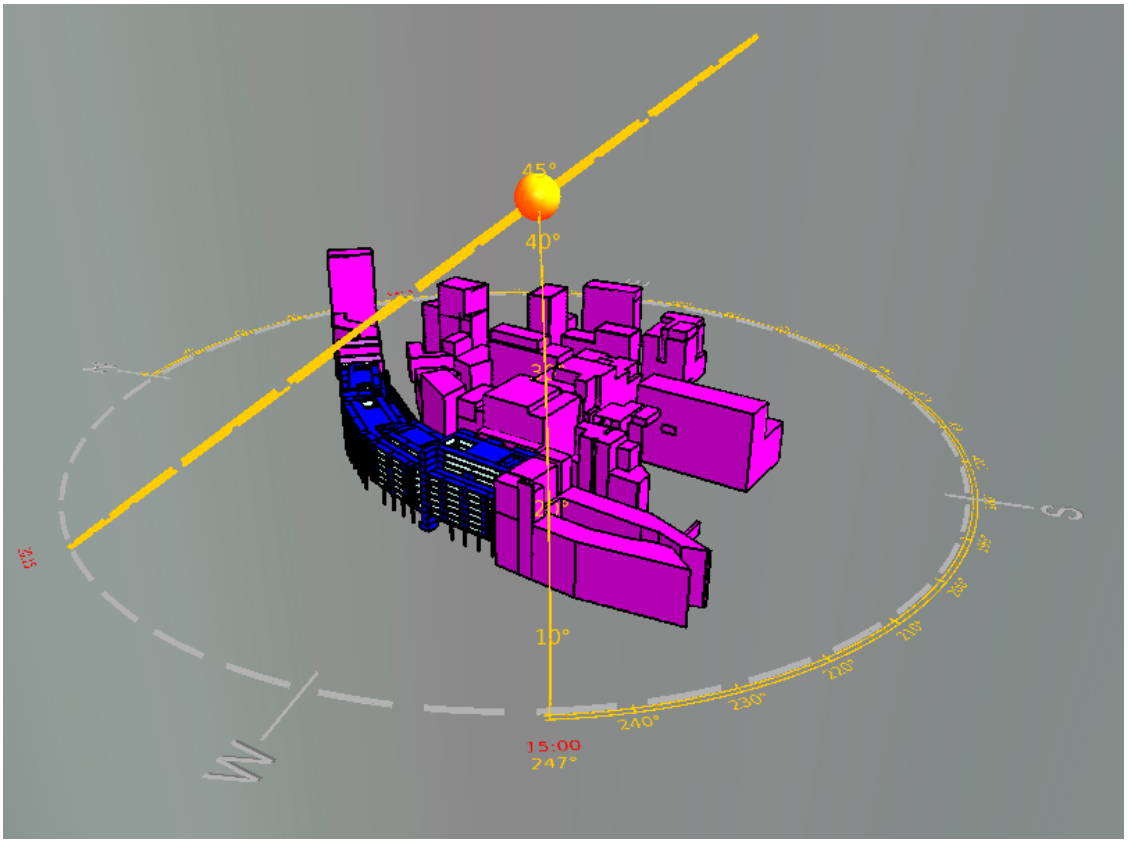


Figure 2 - Angle of Sun at 15:00 in July

Natural Daylight

As stated previously the external facades have been optimised to minimise direct solar gains whilst maximising daylight provision into the occupied areas.

The proposed roof lights and glazed atria will allow daylight to penetrate down to the third floor. The shading device's brise soleil at high level will act as light shelves, reflecting light back onto the underside of the concrete soffit at each floor level, helping the daylight filter further into the floor plate.

The high performance glazing will have a high visible light transmission coefficient to ensure that the useful light from the surrounding environment is transmitted into perimeter zones. As mentioned before, daylight dimming will allow for artificial lighting usage to be reduced where there is adequate daylight.

Scope for Using Thermal Mass

Building T2-T3 has been designed with inherent high thermal mass through the specification of exposed concrete ceilings in the office areas. The exposed concrete can store 'coolth' due to its high density, high specific heat capacity and moderate thermal conductivity, the combination of which makes concrete an excellent thermal mass.

During the summer much of the heat gain within the development is absorbed by the thermal mass in the floors, walls and ceiling. Having a high thermal mass means that the fabric can absorb a significant amount of heat before the surface temperature of the material begins to change. A further benefit of concrete is that the relatively low surface temperature results in a beneficial cooling effect for occupants, allowing a slightly higher air temperature to be tolerated than would be otherwise possible.

The development will allow cool night air to ventilate the spaces at night, removing the heat that has slowly built up during the day. This ensures that each morning, the concrete can begin to again start to absorb more heat gains without warming the internal space. This effect helps offset the peak cooling load, resulting in a reduced peak cooling load, decreasing the annual cooling energy consumption and improving thermal comfort for the building's users.

2.1.3 Active Design

Building Energy Management System and Metering

A comprehensive Building Energy Management System ('BEMS') will be installed to monitor and report overall energy consumption. The system will highlight any out of range consumption figures and readings, allowing a preventative approach through interrogation and resolution of potential problems.

Metering of energy usage on all floors allows building owners / occupiers to view and interrogate where potential energy savings can be made throughout the building.

Ventilation

A displacement ventilation system is proposed for the building to provide ventilation and cooling to the office areas. The system will consist of centralised air handling plant supplying air to the occupied zone via floor grilles fed by a raised floor plenum. Displacement ventilation achieves excellent indoor air quality resulting from pollutant stratification (illustrated below) and high levels of fresh air. The displacement system has potential for reduced maintenance and lower energy consumption than alternatives such as fan coil unit based systems.

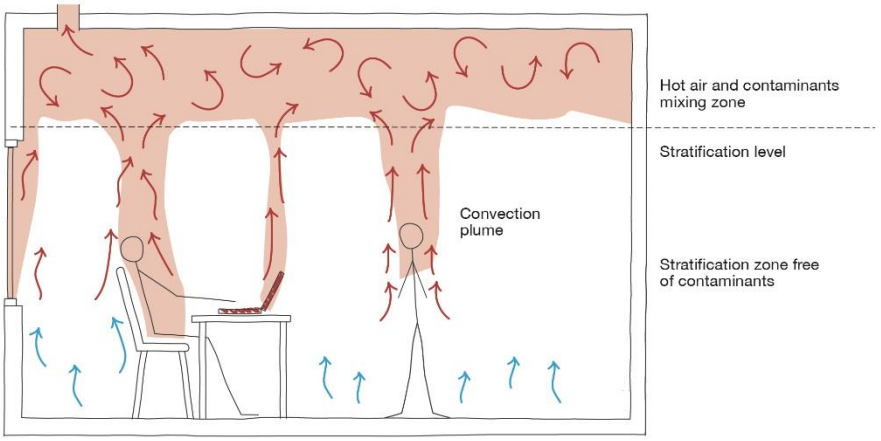


Figure 3: Principle of displacement ventilation

As displacement ventilation utilises higher supply air temperatures (typically 18°C) to avoid cold drafts the system will be provide free cooling when ambient temperature for a significant proportion of the year. Free cooling involves using external fresh air to directly cool the space rather than mechanically cooling provided by the chilled water system.
Any cooling and heating required by the chilled water system will be provided by the low carbon district cooling and district heating systems resulting in extremely low overall carbon emissions from the system.

Variable Air Volume

Due to the east/west orientation of the site there is potential for significant variation in cooling load during the day as the sun moves from east to west. To minimise energy consumption associated with the displacement systems fans the building will be zoned with internal and perimeter zones (as illustrated below), and a variable

air volume strategy will be adopted.

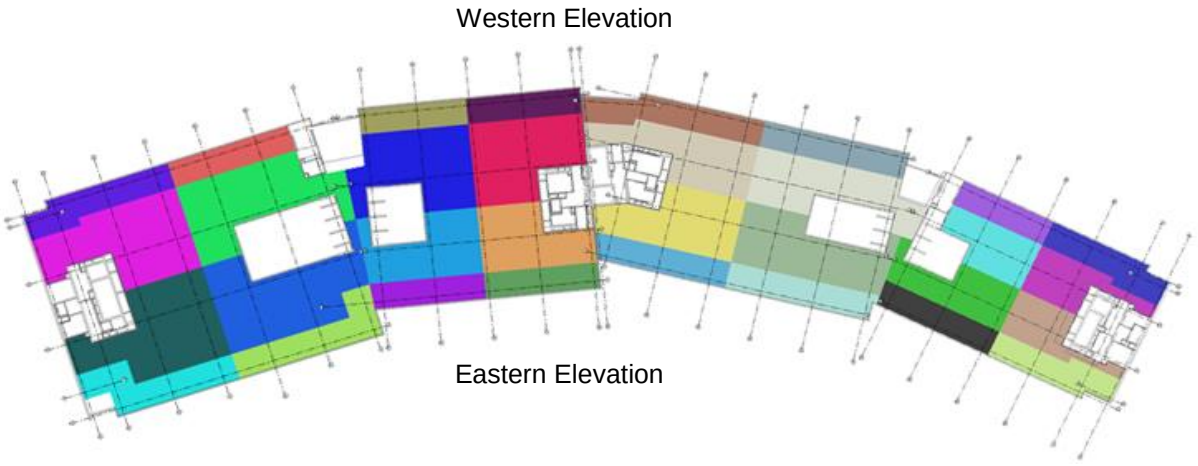


Figure 4: Typical Displacement System Zoning

Each zone will be provided with variable air volume boxes controlled by local temperature sensors allowing the required airflow to each zone to be minimised. Air handling units will be supplied with variable speed fans which will modulate airflow in response to demand. It is anticipated that the variable air volume strategy will reduce annual fan energy consumption significantly over a typical year compared to a constant volume strategy. The variable air volume boxes will also allow the flow to each zone in the building to be monitored to further enhance the buildings energy monitoring capability.

Heat Recovery Systems

A heat recovery system will be utilised in the services design to cool or heat fresh air by recovering heat/coolth from the exhaust air stream. A thermal wheel system will be specified which will typically provide the highest level of heat recovery drastically reducing the buildings heating and cooling demand and associated energy consumption.

The thermal wheel consists of a rotating thermal storage honeycomb which transfers heat or coolth from the exhaust air stream to the fresh air. The wheel rotational speed is controlled to optimise the level of heat recovery depending on the buildings cooling or heating demand and external conditions.

Indirect Evaporative Cooling

To maximise the free cooling benefit of the displacement system indirect evaporative cooling will be included in the systems design. Indirect evaporative cooling is the process of cooling air through humidification (for example by drawing air through a wetted pad) then using this cool moist air to reduce the temperature of dry air (using a heat exchanger such as a thermal wheel) that is then supplied to the building.

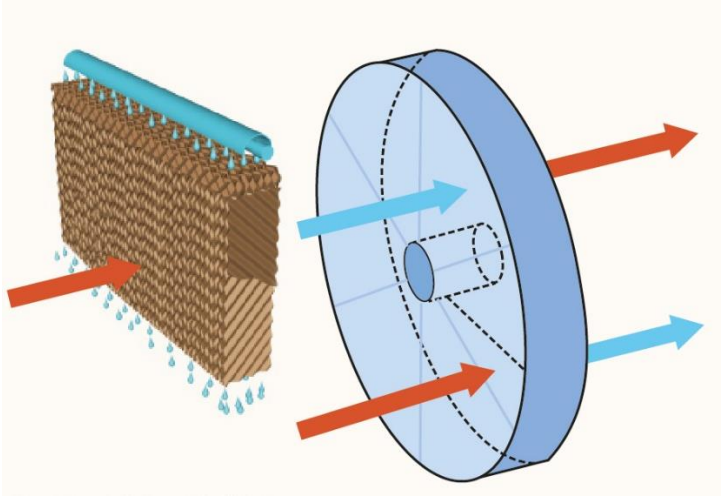


Figure 5: Indirect Evaporative Cooling Process

Indirect evaporative cooling will be achieved through the use of an evaporative wetted pad located in the extract air stream of the ventilation system prior to the air handling units thermal wheel. The combination of indirect evaporative cooling and displacement ventilation is anticipated to reduce the demand for chilled water by approximately 90% over a typical year when compared to a more traditional fan coil unit. The graph below shows the conditions for each hour in a typical year and the extent of free cooling that can be achieved with the proposed system.

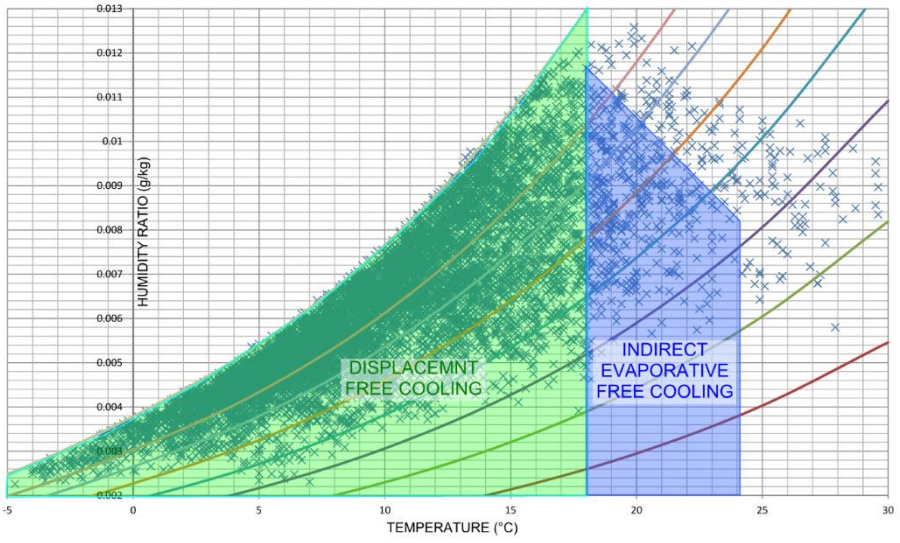


Figure 6: Indirect Evaporative Free Cooling Potential

Scope for Intelligent and High Efficacy Lighting Systems

The lighting specification predominantly comprises of five different area types, offices, core facilities – toilets, stairs etc., lift lobbies, receptions, and back of house areas – plant, stores, and cycle stores. Each area type's light fittings will be limited to the required lux level intensity set out by LG7 and BS standards for the function of that space. The largest area, open plan offices for example; will generally be limited to provide an intensity of 300-400lux at working plane and will be lit using high efficacy lamps. The

selection and specification of lights will therefore limit the energy consumption and cooling requirement to offset the lighting heat gain. All areas will be provided with high frequency ballasts to improve the energy efficiency and occupant wellbeing by preventing flickering. The tenant will be provided with a fit-out guide which will detail the potential benefits; including the payback potential, if they were to install LED lighting when they carry out modifications for their tenancy.

All Lighting in the offices, cores, and back of house – cycle stores, will be controlled by presence detectors (PIR's) which will monitor occupancy and switch off lighting when the area has been vacant for a set length of time. In addition, lighting provided within the office perimeter will be controlled via intelligent dimming that will adjust the lighting intensity according to the level of daylight detected. Lighting within the stairs, and lift lobbies will be on timed control to ensure it is switched off to reduce energy consumption.

Power Factor Correction

Power factor correction will be provided to 0.95 or higher to improve the efficiency of the electrical supply. A lagging power factor will cause inefficiencies as it means that a greater amount of energy is required to produce the power that is consumed.

A motor is one example of the many items of equipment within a building which will cause a lagging power factor. Ensuring that the power factor correction is at 0.95 or higher will keep inefficiencies to a minimum. For example for a 1kVA requirement; if the power factor was reduced to 0.8, 1.25kVA would be required to meet the 1kVA demand.

Heating

All the building heating demand will be provided by the district heating system supplied with heat by the low carbon KXC Energy Centre and new Fuel Cell. On this basis no boilers will be installed within the building.

Heating will be provided to the displacement ventilation air handling units, and trench heaters located throughout the buildings perimeter zones to offset any heat loss through the buildings facades.

The low carbon heating system will also serve the domestic hot water load for the showers on the first floor and the office wash hand basins throughout the building.

Chilled Water

All the buildings chilled water demand will be provided from the low carbon KXC Cooling Pod located to the west of the T2-T3 site negating the need for chillers within the building. The cooling pods will utilise a combination of high efficiency electric chillers and absorption chillers which utilise the district heating system to generate chilled water while minimising energy consumption and associated emissions.

High Efficiency Variable Speed Pumps

Both the chilled and heating water systems will utilise variable speed pumps to circulate water throughout the building. The buildings control system will include sensors throughout each system to monitor demand of each zone and subsystem and allow pumps to operate at the minimum possible speed allowing for significant reductions in annual energy consumption.

Climate Change Adaptability & Future Flexibility

Displacement ventilation provides significantly higher levels of fresh air than alternative systems such as fan coil units. On this basis the building will have significant flexibility for future adaption as the ventilation system is capable of supporting increased occupancy levels by providing supplementary cooling without the need for major modifications to increase the available fresh air.

2.2 CONDITION 17(B) REDUCTION IN CARBON EMISSIONS

"The Environmental Sustainability Plan shall explain the reduction in carbon emissions achieved through building design and technology measures, compared with the emissions permitted under the national Building Regulations prevailing at the time the application for the approval of reserved matters is submitted."

2.2.1 Overview

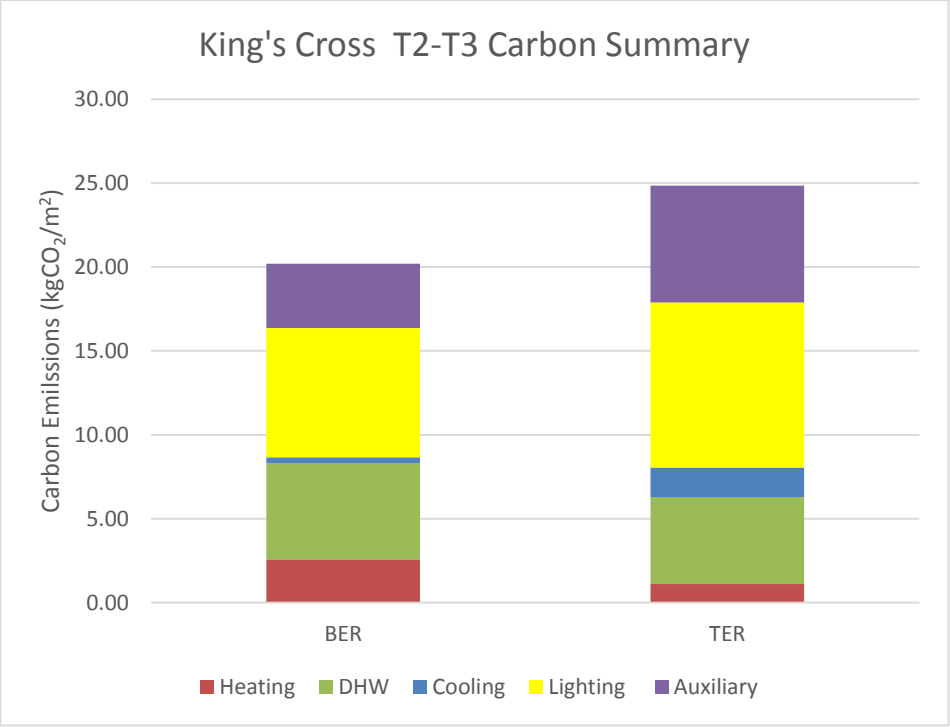
The T2-T3 development is primarily a new build office and therefore is assessed under Part L2a of the 2013 Building Regulations for England. To comply with both the requirements of the National Planning Policy Framework (NPPF) the estimated energy consumption and carbon dioxide emissions for the development have been based upon the National Calculation Methodology (NCM).

A dynamic simulation model (DSM) was created using the approved software IES Virtual Environment 2014, and the energy assessment was undertaken using the VE Compliance module, set to the 2013 Building Regulations. All passive design measures and energy efficient systems as described on preceding pages were modelled and the contribution of the King's Cross district heating and cooling network was accounted for within the seasonal efficiencies of systems.

To comply with Part L of the Building Regulations, the T2-T3 development must achieve 5 criteria, of which 3 can be assessed at design stage, with the remaining 2 dependent on contractual works, commissioning and post occupancy evaluation. A full explanation of the criteria is provided in Appendix A. The requirement for the development to achieve a Building Emissions Rate (BER) lower than the notional carbon dioxide emissions, otherwise known as the Target Emissions Rate (TER), is Criterion 1 of the Part L requirements.

The KXC S106 Agreement targets each new building to achieve carbon emissions at least 5% lower than Part-L of the prevailing Building Regulations (i.e Building Regulations 2013) using good passive design and energy efficiency measures only such as those set out in Section 3.1.2 & Section 3.1.3. On the basis of these measures alone (i.e. disregarding the carbon savings that will be achieved by utilising the low carbon district energy system and any renewables), the carbon emissions for Building T2-T3 are expected to be 20.2 kg CO_2/m^2. This represents a 19% reduction over the Part-L2 2013 TER. Consequently the building exceeds the target 5% reduction set by the S106 Agreement.

	Part L 2013	
$kgCO_2/m^2$	BER	TER
Heating	2.58	1.11
DHW	5.72	5.19
Cooling	0.36	1.74
Lighting	7.70	9.84
Auxiliary	3.83	6.96
Total	**20.19**	**24.84**
	Improvement	**19%**


King's Cross T2-T3 Carbon Summary
30.00
25.00
20.00
15.00
10.00
5.00
0.00
Carbon Emilssions (kgCO2/m2)
BER
TER
Heating
DHW
Cooling
Lighting
Auxiliary

2.3 CONDITION 17(C): PROVISION FOR GREEN AND/OR BROWN ROOFS

“The Environmental Sustainability Plan shall explain the specification for any green and / or brown roof.”

The KXC Outline Planning Permission defines Zone T as a priority zone for green and/or brown roofs. Hence, it is proposed that a high level of both green and brown roof will be provided on the various roof levels of the T2-T3 building. The building will include approximately 1,797m^2 of green/brown roof, covering multiple planting typologies including ornamental grasses, wildflower meadows, groundcover planting, small native trees and shrubs, as well as brown roof. The plant species selected specifically incorporate a high degree of native planting and species which offer high ecological value. The above typologies will be split between all building sections, with approximately 1,079m^2 of T2 and 718m^2 on T3.

A suitably qualified ecologist has provided ecology advice on the types of species which will be planted within the allocated zones. The ecologist will also write a five year bio-diversity action plan.
In addition to the aforementioned planting provisions, the paved terrace areas on levels 08 and 09 are provided as amenity space for occupants. These areas provide the opportunity for additional container planting by the tenants.

The ecological enhancement and biodiversity arising from the provision of these roof and terrace spaces are recognised within the building’s BREEAM assessment.

2.4 CONDITION 17(D): REDUCTION IN CARBON EMISSIONS

"The Environmental Sustainability Plan shall explain how energy shall be supplied to the building, highlighting:

a. How the building relates to the site-wide strategy for district heating incorporating tri-generation from distributed combined heat and power;
b. How the building relates to the strategy for using bio-fuel boilers to supplement the energy supplied through the district heating system;
c. The assessment of the cost-effectiveness and reliability of the supply chain and bio-fuels;
d. Any other measures to incorporate renewables.

2.4.1 Overview

The T2-T3 site will be served by the existing King's Cross district heating system operate by Metropolitan. The existing district heating system is fed by conventional gas fired CHP plant located in the T1 energy centre. The fuel cell proposed as part of the T2-T3 development will connect into the existing district heating network and supplement the existing system's capacity.

The heating for the development will therefore be supplied by the in situ district network. The main energy centre for the development houses the Combined Heat and Power units that help offset grid electricity and result in the delivery of heat with a carbon intensity of 0.0719kgCO_2/kWh of heat energy. The district cooling network has been calculated to have an associated carbon intensity of approximately 0.1039kgCO_2/kWh.

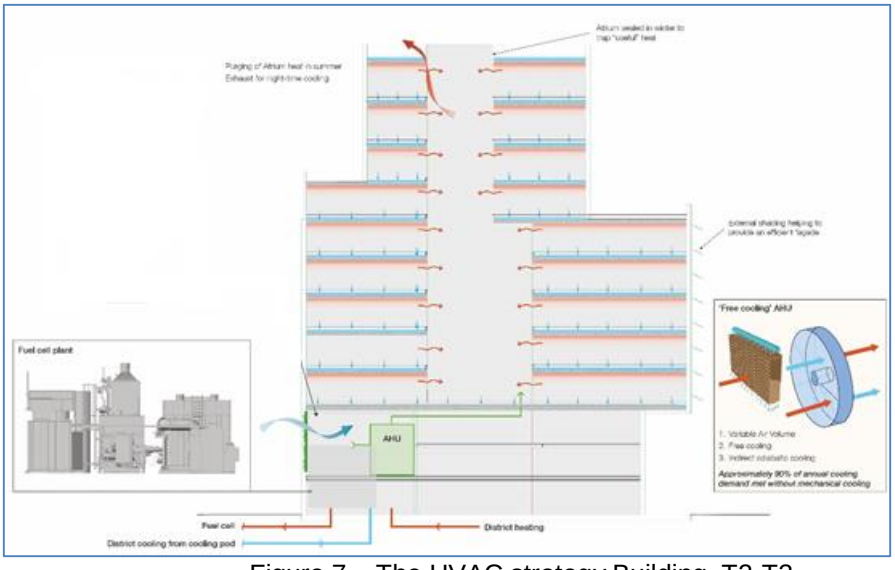
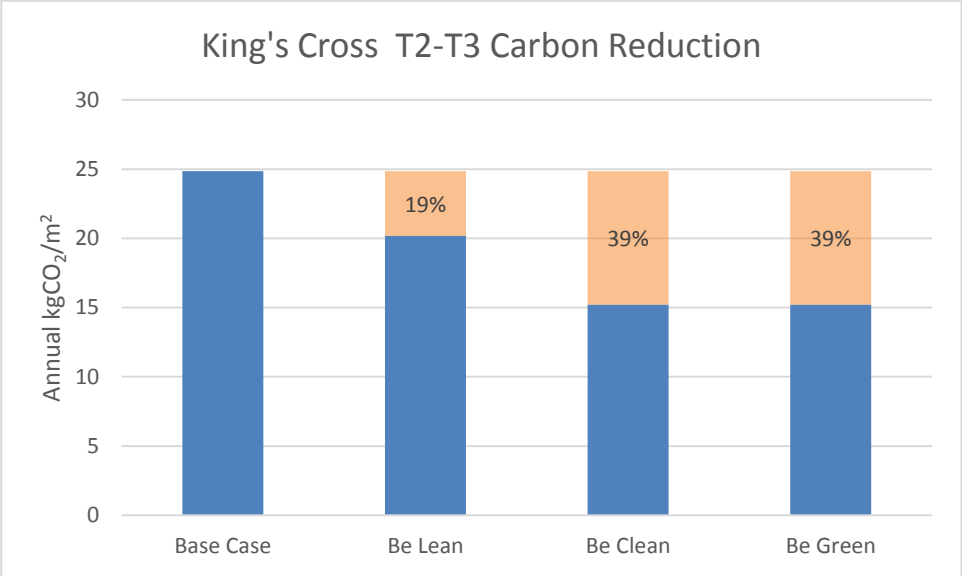


Figure 7 – The HVAC strategy Building T2-T3

2.4.2 CO_2 Savings Arising From the KXC Energy Centre

Figure below shows the CO_2 savings that could be expected from connecting Building T2-T3 to the KXC Energy Centre.
This equates to an additional reduction in CO_2 emissions from 20.2kgCO_2/m^2 to 15.20kgCO_2/m^2 and a combined improvement of 38.7% lower than the Part L 2013 target of 24.84kgCO_2/m^2



	Absolute (kg)	kgCO_2/m^2	Reduction
Base Case	1217786	24.84	0%
Be Lean	989819	20.19	19%
Be Clean	745183	15.2	39%
Be Green	745183	15.2	39%

2.4.3 Renewables

A range of low and zero carbon (LZC) energy were investigated to assess whether they could help the building further reduce its CO_2 emissions. The feasibility of each technology has been assessed with regard to the potential contribution each could make to supply a proportion of the building's delivered energy requirement, whilst considering the technical, planning, land use and financial issues.

In summary, the review, had the following outcomes:

- Wind turbines – The output from wind turbines is highly sensitive to wind speed. Hence, it is essential that wind turbines are sited away from obstructions, with a clear exposure or fetch for the prevailing wind. In urban environments such as the King's Cross area it is difficult to achieve the high and consistent wind speeds that would make the operation of these turbines viable, unless they could be located where there is a locally high wind speed or located on the roof of the Building T2-T3, where obstructions and other surrounding buildings would not interfere with the wind flow. As the building is located within the St. Paul's viewing corridor and within the King's Cross St. Pancras Conservation Area, the turbines could not be sited without disruption to the skyline that would not be considered appropriate. Mounting turbines on the roof of Building T2-T3 would compromise the preferred design feature of green/brown roofs. For these reasons, turbines are not considered viable for Building T2-T3.

- Solar hot water – Solar thermal collectors utilise solar radiation to heat water for use in buildings. The optimum orientation for a solar collector in the UK is a south facing surface, tilted at an angle of 30^o to the horizontal. Solar collectors are typically designed to meet a development's base heat load for domestic hot water requirement. For a building of this time, domestic hot water usage is a minor component of the energy consumption. The proposed domestic hot water system utilising the district heating is the preferred system, as the complexity of integrating solar thermal collectors and the necessary storage means that solar hot water is not viable to this development.

- Ground source heat pumps – Ground source heat pumps differ from air source heat pumps in that they extract heat from the ground and pump it into a building to provide space heating and to pre-heat domestic hot water, resulting in an increase Seasonal Energy Efficiency Ratio (SEER). In the summer months the process can be reversed and heat can be rejected into the ground, improving the SEER of the cooling system. Ground source heat pumps require relatively balanced heating and cooling demands to work effectively, as otherwise as heat is extracted or rejected to the ground in unbalanced amounts, the ground can cool down or warm up, reducing the efficiency of the system until it becomes less efficient than a traditional arrangement. The large size of the development means that extensive piles or trenches would need to be excavated for the site, with an associated capital cost. The proposed district heating and cooling network offers a lower carbon heating and cooling alternative and as such, ground source heat pumps are not considered viable for this scheme.

- Photovoltaics – Photovoltaic solar cells convert solar energy directly into electricity. The cells consist of two layers of silicon with a separating chemical layer. The incoming solar energy charges the electrons held within the chemical. The energised electrons move through the cell into a wire creating an electrical current. A study into the feasibility of onsite electrical generation using south facing photovoltaic panels orientated at 30^o to the horizontal on the roof of the development to meet a proportion of the development's electrical demand has been undertaken. The study indicates that as the preferred design solution for the roof is accessible terraces and green/brown roofs, photovoltaic panels could not be installed in areas large enough to deliver more than a token contribution to electrical

generation. A life cycle cost analysis over 20 years indicates that this is not a cost effective method of reducing CO_2 emissions. Therefore, photovoltaic panels are not considered a viable technology for this scheme.

In conclusion, Building T2-T3 will make the most out of the low carbon heating supply delivered from the KXC Energy centre and in conjunction with good passive and efficient active measures will enable the scheme achieve ≥35% carbon savings against the Part-L2 2013 TER

2.5 CONDITION 17(E) BREEAM RATING

"The Environmental Sustainability Plan shall explain how the proposed building has been designed to achieve a BREEAM rating of 'Very Good' or better."

2.5.1 Overview

BREEAM is a recognised methodology to drive improvement in the sustainability performance of buildings. The standards set by BREEAM are being used to maximise the effectiveness of the issue-specific strategies, including energy, water and waste, addressed in this Plan. The project team is fully committed to go beyond the planning objective for a 'Very Good' rating by securing an 'Excellent' rating with an aspiration to achieve 'Outstanding' for Building T2-T3.

The team has taken a holistic approach to every aspect of the buildings' design utilising passive and active design methodologies to ensure that a truly sustainable building is produced. The key design features covering energy, water and resource efficiencies, together with supplier and construction management and commissioning practice, all discussed in other sections of this Plan, fully embrace sustainability best practice and will contribute to delivering a high BREEAM rating.

A BREEAM Pre-Assessment has been carried out using the BREEAM New Construction 2014 scheme.

The Pre-Assessments predict that an 'Excellent' rating (minimum BREEAM score of 70%) will be achieved under BREEAM New Construction Offices 2014 scheme. The project team have also assigned target credits to strive for the 'Outstanding' rating, but this will also rely on how the building is used by incoming tenants. The full list of credits which are being targeted can be seen within the Pre-Assessment Report in Section 6, but are also summarised in Figure below.

It should be noted that the assessments are provisional on the basis that all of the documentary evidence required for a formal assessment (in the form of tender documents and drawings etc) is not yet available at this planning stage. Full evidence will be gathered in due course at the detailed design stages as the projects progress.

2.5.2 Building T2-T3: BREEAM Assessment

The provisional assessment tool for BREEAM New Construction Offices 2014 scheme predicts an overall score of 70.25% for Building T2-T3, which equates to an 'Excellent' rating. The assessment highlights the credits sought. Full details are provided in Section 6.

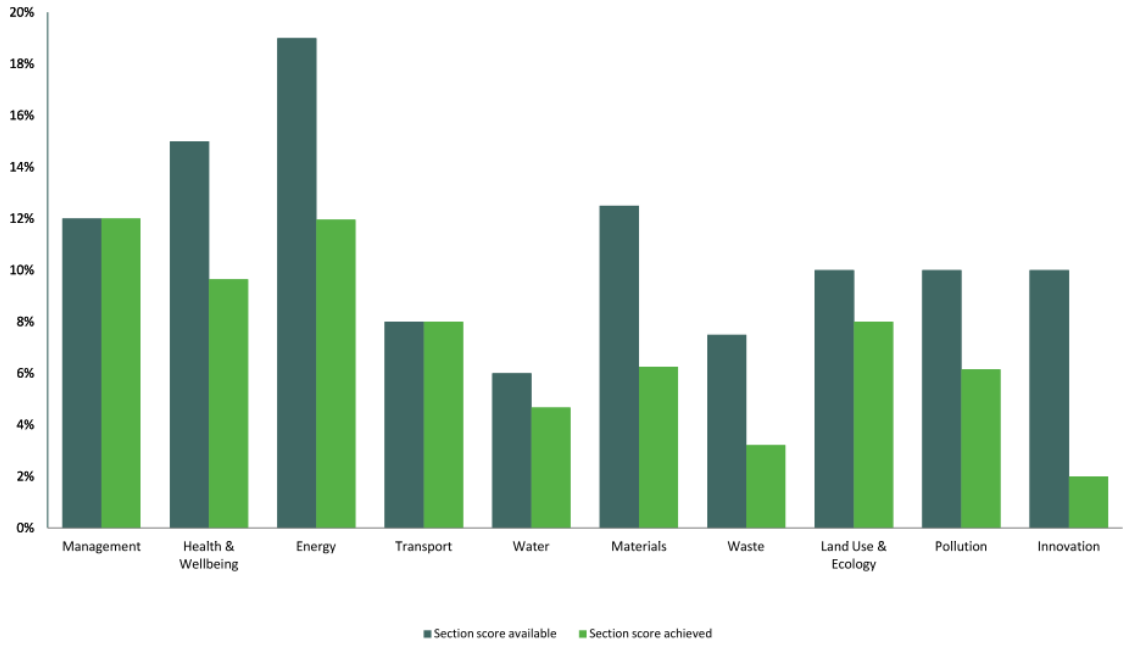
BREEAM®

BREEAM 2011 New Construction Assessment Report: Rating & Key Performance Indicators

Overall Building Performance

Building name	King's Cross Central Building Plot R7
BREEAM rating	Excellent
Total Score	71.89%
Min. standards level achieved	Excellent level

Building Performance by Environment Section



Environmental Section	No. credits available	No. credits Achieved	% credits achieved	Section Weighting	Section Score
Management	22	22	100.00%	12.0%	12.00%
Health & Wellbeing	14	9	64.29%	15.0%	9.64%
Energy	27	17	62.96%	19.0%	11.96%
Transport	9	9	100.00%	8.0%	8.00%
Water	9	7	77.78%	6.0%	4.67%
Materials	12	6	50.00%	12.5%	6.25%
Waste	7	3	42.86%	7.5%	3.21%
Land Use & Ecology	10	8	80.00%	10.0%	8.00%
Pollution	13	8	61.54%	10.0%	6.15%
Innovation	10	2	20.00%	10.0%	2.00%

2.6 CONDITION 17(F)

“The Environmental Sustainability Plan shall explain the incorporation of bird boxes, bat roosts and other wildlife features on the building.”

Building T2-T3 includes roof spaces at various levels. It is proposed that the roofs have a high level of plant coverage as described in relation to condition 17(c) (approximately 58% of buildable roof area). The use of predominantly native plants, including shrubs and trees, as well as the provision of brown roof areas, will make the roofs highly valuable in terms of biodiversity and wildlife habitat creation. The roof areas will provide habitat for insects, invertebrates and birds, including species such as the Black Redstart and swallows.

A diverse selection of ecological plant life, including wildflower meadows, ornamental grasses, native groundcover and shrubs, native trees and brownfield will be provided to enhance the ecological value of the site in-line with BREEAM requirements. The external lighting for these areas will be designed to be sympathetic to the wildlife populations.
Bird and bat boxes will be incorporated during construction of the building to provide nesting habitats and shelter.

In addition to the planting provision on the roofs and roof terraces, the paved usable terrace areas on levels 08 and 09 shall enable future tenants to locate additional features such as raised containers for shrub planting. The inclusion of such features will be encouraged within the ‘Building User Guide’ documentation issued to each incoming tenant.

A five year bio-diversity action plan will be prepared by a suitably qualified ecologist. The report will make recommendations to further enhance diversity of wildlife as well as plant species. KCCLP will adhere to these recommendations and appoint Broadgate Estates to manage and maintain the ecology on-site.

2.7 CONDITION 45

"The new drainage infrastructure within the site shall be designed to achieve a combined (storm and foul) peak discharge to the existing combined sewer of 2,292 l/s or less."

Site wide drainage infrastructure

The figure of 2292 l/s in the wording to Condition 45 describes the maximum peak (storm and foul) discharge which is permissible for the site as a whole to discharge to the existing combined sewers. The peak discharge will be split between the Camden Sewer and York Way Sewer (for areas north of the Regent's Canal) and the Camley Sewer / Fleet Sewer (for the areas south of the Regent's Canal).

The cumulative peak discharge from the many building plots and areas of infrastructure will exceed 2292 l/s under certain weather conditions. In these instances, the site wide drainage infrastructure, including online and offline attenuation (see below), will attenuate peak flows discharging from individual plots, adopted highway and public realm, enabling cumulative peak flows to be reduced to 2292 l/s or less.

The site wide surface and foul water disposal strategy can be summarised as follows:

- To provide separate surface and foul water networks, combining only at the final manhole prior to connection into the existing Thames Water sewerage network;
- To provide online attenuation (for example oversized pipe work) and offline attenuation (for example proprietary modular underground storage systems / tanks) to buffer peak flows generated within the site down to the agreed discharge rates into the existing Thames Water sewerage network;
- To ensure that no above ground flooding occurs during the worst case 1 in 30 year storm event;
- To ensure that no internal building flooding occurs during the worst case 1 in 100 year (+20%) storm event;
- To accord with PPS 25 and Sewers For Adoption 6th Edition;
- To discharge at various locations into the sewerage network; and
- To design the above infrastructure such that combined surface and foul water flows do not exceed 2292 l/s during a 1 in 30 storm event.

The site wide drainage infrastructure at King's Cross Central can be described in terms of three drainage infrastructure areas, incorporating both building plots and infrastructure/public realm. These are described below. Although plots T3, and T4 were originally assigned to as part of the northern area system the new combined development will direct all foul discharge to the Eastern Goods Yard system as shown in Tables 2 and 3.

Drainage Infrastructure Area	**Plot developments**	**Infrastructure / Public Realm**
Eastern Goods Yard	The Granary Complex, Q1, Q2, R1, R3, R4, R5, R7 & 8, S1, S2, T1, T2, J1, H1, K1, K2, K3, K4 and 50% of I1	Transit Street, Wharf Road, Goods Street, Granary Square, Cubitt Park and Handyside Park
Southern Area Infrastructure	A1, A2, A3, A4, A5, B1, B2, B3, B4, B5, B6, D1, D2, F1 and V1	The Boulevard, Goods Way, Station Square and Pancras Square
Remainder of the Northern Area including the Triangle Site	M1, M2, N1, N2, P1, P2, S3, S4, S5, T3, T4, T5, T6 and W1	Canal Street and Cubitt Square

Table 1: Drainage Infrastructure Areas

Table 3 and 4 identifies the assumed peak foul and surface water flows from each of the building plots in the Eastern Goods Yard and Northern Area which underpins the design of the site-wide infrastructure. The foul water figures are based on CIRIA 177 Variable Peaking Factor and the assumed foul water discharges from various land uses identified in Table 5. The surface water peak flows are based on a 1 in 30 year storm. It should be noted that it is most unlikely that the foul and surface water peak discharges from each individual plot will coincide with each other.

Generally, foul water discharges represent small but consistent flows subject to diurnal patterns. For example, residential properties will exhibit two peaks within their diurnal flow pattern, one in the morning and one in the early evening. Surface water discharges, on the other hand exhibit extreme variations in flow, directly related to rainfall intensity.

The surface water discharge from each plot development will have its own unique hydrograph (identifying the variation between flow and time – the peak of which only lasting for a few minutes in most cases). Each one of these peaks (within the hydrographs) combines within the main drainage infrastructure at different points in time during the storm event creating an averaged flow within the pipe network. These flows will discharge into the Thames Water network via flow hydraulic controls at the downstream end of each network. These hydraulic controls limit the discharges to a combined maximum of 2292l/s. Where the plot development discharges combine to produce flows in excess of the maximum allowable discharge, water will be held within the drainage infrastructure which has been specifically sized to accommodate these flows.

	Assumed Peak Flows (l/s) for plots in the Eastern Goods Yard	
Plot reference	**Surface Water (1 in 30 year event)**	**Foul Water**
G1	25	4.9
H1	15	0.2
J1	147	6.0
K1	24	0.9
K2	101	-
K3	150	2.4
K4	117	-
L1 - L7	1105	23.7
Q1 & Q2	191	2.4
R1	57	4.1
R3	128	3.3
R4	127	3.7
R5 (N & S)	173	7.7
R7 & R8	257	17.6
S1	158	13.0
S2	162	13.0
T1	192	4.7
T2	162	22.4
I1	25	6.6
N2	84	-
Total:	3400	136.3

Table 2: Peak Surface and Foul Water Flows Eastern Goods Yard

	Assumed Peak Flows (l/s) for plots in the Northern Area including the Triangle Site	
Plot reference	**Surface Water (1 in 30 year event)**	**Foul Water**
M1	107	16.2
M2	142	1.7
N1	252	5.5
N2	-	-
P1	255	7.9
P2	210	11.5
S3	156	5.3
S4	175	7.5
S5	149	5.5
T3	138	-
T4	101	-
T5	78	4.8
T6	133	10.9
W1	308	7.3
Total:	2204	83.8

Table 3: Peak Surface and Foul Water Flows Northern Area

Land Use	**Demand Options**	**Discharge to Sewer (l/day/hd)**	**l/s/head**	**Operational Hours**	**Population Density (m2 per person)**
Residential	-	152	0.0023457	18	36.2
Student Accommodation	-	152	0.0023457	18	19.5
Retail	Large Retail	26.6	0.0009236	8	40
Food/Drink	Customer/day 2hr sittings	28.5	0.0009896	8	1.4
Education	General	19	0.0006597	8	10
Business	Without Canteen	41	0.0014236	8	12
Hotel		133	0.0046181	8	20
Leisure	Sports club	142.5	0.0049479	8	40

Table 4: Foul water discharges from various land uses

2.7.1 Drainage Infrastructure

The drainage networks around the King's Cross Central development are being designed on SUDS principles providing an overall peak flow reduction of 10% (based on a 1 in 30 year storm).

Thames Water has approved in principle surface water discharges for four direct connections. The approved combined surface water discharge for Building T2-T3 (the total allowed for T2, T3, and T4 plots) is 401l/s. Further, the combined foul water flow is 22.2l/s for Building T2-T3. The figures in Tables 2&3 do not include for any public realm areas.

3. SECTION AA: ENVIRONMENTAL SUSTAINABILITY – WATER

Section AA of the Section 106 agreement places an obligation to use reasonable endeavours:

- *to incorporate within the detailed design water efficiency measures such that the design secures at least 40% of the potable water consumption credits available under the BREEAM methodology which represents a reduction of approximately 20-30% against typical water consumption;*
- *to incorporate one or more of groundwater abstraction, grey-water and black-water recycling and rainwater harvesting as alternative water supplies to meet 5% or more of the non-potable water needs and;*
- *to ensure that the design for the treatment of storm water run-off incorporates, where practicable, filtration, attenuation and other techniques that is consistent with current best practice on SUDS, to control the timing and volume of flows.*

3.1 WATER EFFICIENCY

Building T2-T3 will achieve very high standards of water efficiency through an approach that combines alternative supply via reclaimed water and internal water efficiency through design. The design teams have used the BREEAM criteria as their benchmark in driving down potable water consumption for the building.

The aim is to minimise internal and external potable water use within the development. Good water management can contribute to reducing the overall level of water consumption maintaining a vital resource and having environmental as well as cost benefits in the life-cycle of the building. The following water saving measures are being considered:

Dual Flush Cisterns on WC's - These units have the ability to provide a single flush of 4L and/or a full flush of 6L.

Flow Restrictors to Taps - Flow restrictors reduce the volume of water discharging from the tap. Spray taps have a similar effect.

Low Flow Showers - The average shower uses 15 litres of water a minute, by restricting the output of the showers in the development to a maximum of 8 litres/ min a 40% water saving can be achieved. Flow rate can be reduced down to 6 litres/ min without compromising on water pressure and hence should be considered.

Water Meters - In 1995 approximately 33,200 million litres of water a day were extracted in England and Wales, this increased to 44,130 supply. To reduce this figure, accurate information on usage is required for management of a building's consumption. Water meters will be specified on the main supply to each tenanted area.

Water efficiency measures will include 'auto shut-off' on all toilet areas and dual flush WCs. Together with reclaimed water, the incorporation of this sanitary ware will reduce the water consumption from the BREEAM

baseline figure of 7.0m^3 per person per year, down to below 4.2m^3 per person per year. This indicates a ≥40% improvement on the BREEAM baseline figure.

It is the intention of the project team to capture and re-use the grey-water from the basement showers to reduce the overall water usage.

3.2 ALTERNATIVE WATER SUPPLIES

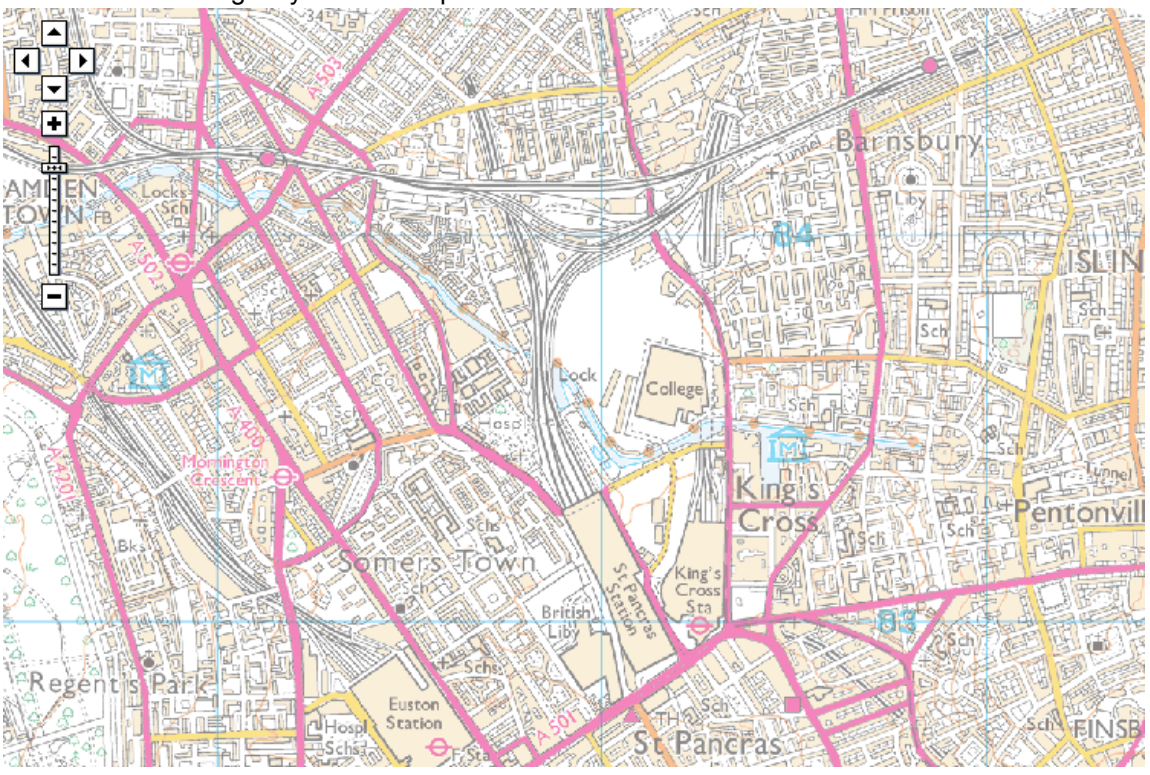
Rainwater harvesting is to be installed to provide an alternative water source for the building. Rainwater will be collected from roof areas (excluding green roof areas) and stored in rainwater tanks in the basement. The water will be filtered prior to entering the tanks. A booster pump will be used to deliver the water for the flushing of water closets and urinals. It is estimated that potable water consumption for flushing will be reduced by about 25% as a result of these water recycling measures.

3.3 SUSTAINABLE URBAN DRAINAGE

The site's drainage strategy will aim to reduce the impact of development on the natural drainage patterns, by retaining water on site by the incorporation of Sustainable Urban Drainage techniques (SUDs).

The incorporation of extensive areas of a 'Green Roof' on the T2 and T3 Buildings as described in section 2.3 will provide further reduction in the total surface water discharge volumes.

The Environment Agency's Flood Map indicates that the site is located within Flood Zone 1.



3.4 SECTION Y: CONSTRUCTION MATERIALS & WASTE

As Section Y of the S.106 Agreement imposes obligations to:

- *implement the Construction Materials and Purchasing Strategy;*
- *apply the Construction Materials and Purchasing Strategy to agreeing specifications and targets in contracts with contractors, designers and suppliers of services in relation to construction; and*
- *use reasonable endeavours:*

  I. to minimise packaging waste associated with the delivery of construction materials;

  II. to produce topsoil and subsoil that uses subsoil and crushed rubble from the site combined with organic material for use in areas of landscaping; and

  III. to achieve the Construction Targets.

3.4.1 Construction Materials and Purchasing Strategy

During the construction phase a large amount of waste material will be generated through construction, demolition and land clearing procedures. In building construction, the primary waste products in descending percentages are: wood, asphalt/concrete/masonry, drywall, roofing, metals, and paper products.

Prior to commencement on site a Site Waste Management Plan (SWMP) that complies with the requirements of current legislation and CSH will be prepared. This plan will identify the local waste haulers and recyclers, determine the local salvage material market, identify and clearly label site spaces for various waste material storage and require a reporting system that will quantify the results and set targets. As a minimum the SWMP will contain:

a. The target benchmark for resource efficiency e.g. m^3 of waste per $100m^2$ or tonnes of waste per $100m^2$;

b. Procedures and commitments for minimising non-hazardous waste in line with the benchmark;

c. Procedures for minimising hazardous waste;

d. Procedures for monitoring, measuring and reporting hazardous and non-hazardous site waste;

e. Procedures for sorting, reusing and recycling construction waste into defined waste groups either on site or through a licensed external contractor;

f. The name or job title of the individual responsible for implementing the above.

3.4.2 Packaging Waste

Packaging used to protect construction materials and assemblies in transportation will be kept to a minimum and wherever possible returned to be re-used. Volumes or weights of the packaging returned or recycled will be recorded as part of the SWMP and used to fulfil the relevant BREEAM criteria.

3.4.3 Soil

An Earthworks and Remediation Plan for Buildings T2-T3 has been prepared to accompany the Reserved

Matters Application to address Condition 18 of the KXC Outline Planning Permission dated 22nd December 2006 (ref. 2004/2307/P) and deliver appropriate site levels and ground conditions for the development and demonstrate compliance with Conditions 64 and 65. The plan addresses the nature and quantity of arising and the arrangements for their re-use or disposal as appropriate.

Due to the brownfield nature of the site, there are no natural topsoil or subsoil resources on site. Given the findings of a previous study undertaken to assess the suitability of site-won clay fill from the KXC site as a constituent of manufactured topsoil, it is not proposed to utilise the cut material. This is primarily due to the density, plasticity and poor drainage qualities associated with clay fill and therefore, manufactured topsoil derived from this material would not be suitable for use in permanent landscaping schemes such as brown or green roofs (which require a light weight substrate) or planted beds or tree pits. As such, it is recommended that imported organic material is used in these areas.

3.4.4 Construction Targets

A BREEAM rating of 'Excellent', with aspirations for 'Outstanding', will be the principal driver for the team's endeavours to achieve the best possible performance against the Construction Targets. BREEAM credits cover the Green Guide rating of the major building elements, the provision of floor coverings in offices, the environmental impacts of paints and varnishes, the use of recycled aggregate, the responsible sourcing of materials and the global warming potential of insulants, all matters addressed by the Construction Targets.

Under EU legislation the UK will have to ensure that less than a third of its waste is sent for burial in landfill sites by 2020 and the figure at present is about 80%. To achieve this target a number of measures are implemented, including landfill tax, aiming to discourage disposal of waste to landfill. Good waste management is a key component of sustainable development. Reducing waste is an important means of:

- Reducing unnecessary expenditure;
- Reducing the amount of natural resources used for production of new materials;
- Reducing energy for waste disposal;
- Reducing levels of contamination and pollution arising from waste disposal.

The proposed development will minimise the impact of waste in the environment where possible.

At this early stage the exact degree to which all the Construction Targets will be achieved cannot yet be determined, because the precise specifications and quantities of many of the materials have not yet been finalised.

4. SECTION X: ENVIRONMENTAL SUSTAINABILITY ENERGY

Section X of the Section 106 agreement places an obligation for the CHP installation within the development to include a fuel cell (minimum sized 250kW) to show-case such technology.

To meet this obligation, provision has been made within the T2 Building adjacent to the existing T1 energy centre to accommodate a fuel cell. The Energy Supply Company, Metropolitan King's Cross, is currently undertaking a feasibility study for a larger 1.4MW fuel cell, which is much larger than a 250kW fuel cell. As a result the spatial requirements within T2-T3 have been sized to accommodate the larger fuel cell option as well as the smaller option. Although the fuel cell itself does not form part of the T2-T3 project, it will contribute to reducing the emissions associated with the site district heating system because it produces extremely low levels of air pollution when compared to tradition combustion based CHP systems.

Figure 8: Example Fuel Cell Installation

5. SECTION Z: WASTE

Section Z of the S.106 Agreement imposes obligations to:

I. provide occupiers with Waste Information Packs and use reasonable endeavours to obtain feedback on the success or popularity of the initiatives contained within the Packs;

II. use reasonable endeavours to incorporate within the detailed design best practice design solutions that provide for waste segregation and storage areas and to maintain the solutions that are implemented;

III. provide and maintain segregated waste containers within the Public Realm areas at suitable locations and in appropriate numbers.

5.1.1 Waste Management

The detailed design phases will identify the potential waste streams that the development will produce. As a minimum, plans will be formulated to handle the separation, collection, and storage of common recyclable materials such as paper, glass, plastics, and metals. The collection points will be easily accessible to all of the users. As the development is intended to be used as an office, the focus will be on common office material such as paper and plastics rather than food waste.

The main aim will be to recycle as much waste as possible; this will be achieved by making sure that waste recycling facilities are strategically placed in convenient locations. A ventilated bin store located at the ground level will be provided to the T2 and T3 buildings, acting as a collective bin stores for the scheme.

5.1.2 Design Solutions

Waste stores have been provided for the use of all commercial tenants and these stores have direct access onto the servicing area. The waste stores have been sized for the storage of segregated waste streams (refuse, dry mix recyclables, glass and food waste). Waste containers will be clearly identified by the use of signage and colour coded bins to prevent contamination of recyclable and non-recyclable waste streams.

6. APPENDIX A - PART L2 ANALYSIS

6.1 OVERVIEW

Under the 2013 Building Regulations, all new developments must show compliance with the following five criteria. In order to authenticate the process, all approved software will produce an output report that will outline compliance with the criteria at both the as-designed and as-built stage. The five criteria to achieve compliance in are as follows:

1. Criterion 1 – the calculated CO2 emission rate for the building (the Building Emission Rate, BER) must not be greater than the Target CO2 Emission Rate (TER) which is determined through the National Calculation Methodology.
2. Criterion 2 – the performance of the individual fabric elements and fixed building services of the building should achieve reasonable overall standards of energy efficiency following the guidance of minimum fabric U-values as set out in the Approved Document and minimum efficiencies of fixed building services as described in the non-domestic compliance guide.
3. Criterion 3 – demonstrate that the building has appropriate passive control measures to limit solar gains. The intention is to limit solar gains during the summer period to either reduce the need for air conditioning or reduce the installed capacity of any specified air conditioning system.
4. Criterion 4 – the performance of the as-built building is consistent with the BER. Extra credits will be given in the BER/TER calculation where builders can provide robust evidence of quality assurance procedures in the design and construction phases.
5. Criterion 5 – the necessary provisions for enabling energy efficient operation of the building should be put into place, such as the production of a building log book. This log book should collect information from the operation and maintenance manuals along with the data used to calculate the BER and TER. The recommendations from the 'on-construction' EPC should also be provided to inform the building user on methods to improve the building performance.

As this document covers the design stage of the proposed development, criteria 4 and 5 have not been addressed. Criteria 4 covering the quality of construction and commissioning will be undertaken by the building Contractor following a commitment to achieve best practice certification under the Considerate Constructor's Scheme. Criteria 5 will be fulfilled through the creation of a Building User Guide that will contain both a Log Book and a User Guide to the building. The following sections will therefore outline the design response to criteria 1, 2 and 3 of the 2013 Building Regulations.

6.2 BUILDING CONDITIONS

6.2.1 Design Data Used for Calculations

The model was based on the following architect's drawings received on 02/07/2015:

- 1503(SK)092 – Ground Floor Plan Additional Areas
- 1503(SK)093 – Ground Floor Plan Mezzanine Additional Areas
- 1503(SK)094 – Floor Plan Level 1 Additional Area
- 1503(SK)095 – Floor Plan Level 2 Additional Area
- 1503(SK)096 – Floor Plan Levels 3 and 5 Additional Area
- 1503(SK)097 – Floor Plan Levels 4 and 6 Additional Area
- 1503(SK)098 – Floor Plan Level 7 Additional Area
- 1503(SK)099 – Floor Plan Level 8 Additional Area
- 1503(SK)100 – Floor Plan Level 9 Additional Area
- 1503(SK)101 – Floor Plan Level 10 Additional Area

Further to this, the façade was based upon the following SketchUp model, including proposed shading device 6, as received on 06/07/2015:

- 1503 East Envelope Screen 1

6.2.2 Description of Development

The T2-T3 site is a proposed commercial office development located within the King's Cross development. The final developed building will provide a ten storey commercial office to the south of the site and an eight storey office to the north of the site.

The development will be served by the King's Cross district heating and cooling network and include a fuel cell for onsite electrical generation. A displacement ventilation system is proposed for the office accommodation that will utilise variable air volumes and free cooling from the ambient air during periods of the year to minimise energy consumption. The benefit of free cooling can be further exploited by the use of indirect evaporative cooling.

The carbon intensity of the heat supplied by the district heating network has been confirmed as 0.0719kgCO2/kWh. The district cooling network has confirmed a carbon intensity for the delivered cooling of 1.039kgCO2/kWh.

The development also makes use of the high thermal mass of its exposed concrete soffit in conjunction with night time cooling to reduce the cooling load during occupied times.

6.3 CRITERION 1 – TARGET EMISSIONS RATE (TER)

A Part L2A (2013) assessment for the proposed King's Cross T2-T3 office development has been undertaken, using approved software IES Virtual Environment 2014, in order to assess the proposed development against Part L of the Building Regulations. IES Virtual Environment 2014 is an approved software according to the DCLG's list of approved National Calculation Methodologies and software programs for buildings other than dwellings.

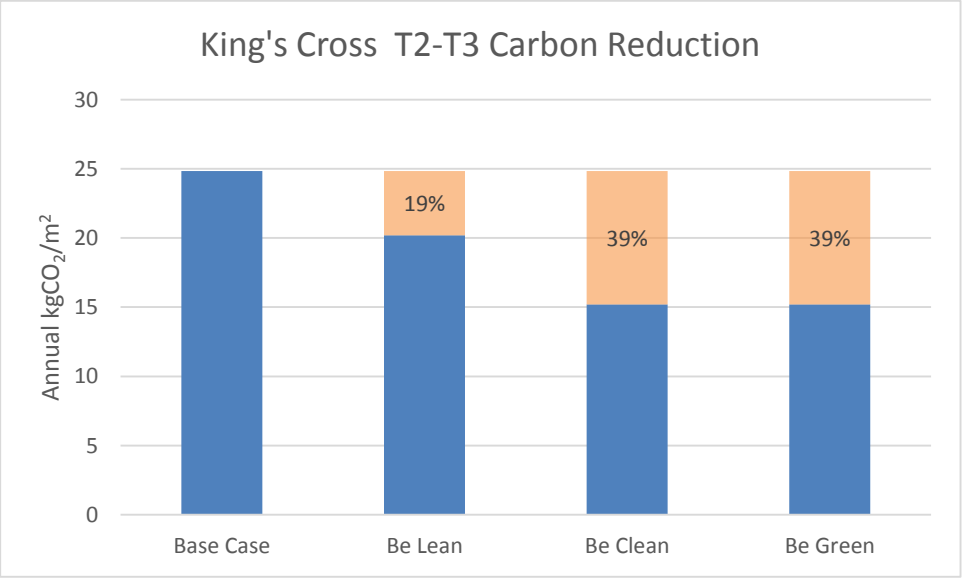
The dynamic weather file used for the analysis was the London TRY weather file in accordance with the National Calculation Methodology (NCM).

In order to meet the requirements of Criterion 1 of the approved document, the Carbon Dioxide (CO_2) emissions rate from the proposed development - the Building Emissions Rate (BER), should be less than the Target Emissions Rate (TER).

6.3.1 Building T2-T3 Compliance with Criterion 1

Using the specified efficiency data and fabric performance standards the BER for Building T2-T3 was calculated to be 15.2kgCO_2/m^2 per annum. The carbon emissions of the notional building were calculated to be 24.8kgCO_2/m^2 per annum. The building therefore performs better than the TER by approximately 38.7% and complies with the Criterion 1 of the Building Regulations Part L2A. Figure below shows the data produced by the IES software.

The Final CO2 Level shown in Figure below accounts for passive design measures, improved plant efficiency, as well as the additional energy-efficiency due to the KXC Energy Centre.



	Absolute (kg)	kgCO_2/m^2	Reduction
Base Case	1217786	24.84	0%
Be Lean	989819	20.19	19%
Be Clean	745183	15.2	39%
Be Green	745183	15.2	39%

6.4 CRITERION 2

In order to comply with the requirements of Criterion 2, the performance of the individual fabric elements and the fixed building services of the building should achieve reasonable overall standards of energy efficiency.

The following design parameters have been used in the energy assessment and comply with Criterion 2 of the Approved Document:

Building Fabric

Detail	Value
External Wall U-value (W/m^2K)	0.26
Ground Floor U-value (W/m^2K)	0.22
Roof U-value (W/m^2K)	0.19
External Window U-value (W/m^2K)	1.60
Visible Light Transmission (%)	56
Glazing G-value	0.28
Rooflight Window U-value (W/m^2K)	1.60
Rooflight Visible Light Transmission (%)	56
Rooflight Glazing G-value	0.28
External Door U-value (W/m^2K)	N/A
Air Permeability ($m^3/hr/m^2$)	3

Lighting Controls

Detail	Value
Minimum Office Lighting Efficacy (Luminaire Lumens/circuit Watt)	90
All other Areas Lighting Efficacy (Luminaire Lumens/circuit Watt)	75
Occupancy Sensing Parasitic Power (W/m^2)	0.1
Photoelectric Cell Parasitic Power (W/m^2)	0.1
Minimum Display Lighting Efficacy (Lumens/circuit Watt)	50
Auto ON/OFF presence detection in toilets, circulation areas and plant spaces	
Auto ON/OFF presence detection in open plan office areas	
Auto ON/OFF presence detection in storage spaces	
Day light dimming controls in Perimeter areas	
Constant Illuminance Controls to all Spaces	
Time Switching of Photoelectric Dimming	
Time Switching of Presence Detection	

Office Displacement System

Detail	Value
AHU SFP (W/l/s)	1.4
AHU Heat Recovery Sensible Efficiency (%)	70
Chiller Cooling SEER	2.89
Heating SCoP	District
Free Cooling Air Supply Rate Perimeter (l/s/m^2)	6.2
Free Cooling Air Supply Rate Core (l/s/m^2)	3.4
Variable Speed, Multiple Pressure Sensors fitted	Yes
Ductwork Leak Detection rated at:	Class A
AHU Leak Detection rated at:	Class L2
Full metering with warnings for out of range values	Yes
NCM System: Displacement	

Changing Facilities and Cycle Store Supply and Extract

Detail	Value
AHU SFP (W/l/s)	1.4
AHU Heat Recovery Sensible Efficiency (%)	70
Chiller Cooling SEER	2.89
Heating SCoP	District
Variable Speed, Multiple Pressure Sensors fitted	Yes
Ductwork Leak Detection rated at:	Class A
AHU Leak Detection rated at:	Class L2
Full metering with warnings for out of range values	Yes
NCM System: Indoor Packaged VAV	

Toilets Extract Only

Detail	Value
Extract Fan SFP (W/l/s)	0.4
Air Extract Flow Rate (ACH)	6
Heat Emitters	Radiators
Boiler Heating Generation Efficiency	District
Boiler Heating Delivery Efficiency	94%
NCM System: Central heating using water: Radiators	

Domestic Hot Water

Detail	Value
Hot Water Generation Efficiency (%)	District Heating
Hot Water Delivery Efficiency (%)	85

Building Details

Detail	Value
Variable Speed, Multiple Pressure Sensors fitted	Yes
Whole building power factor correction	>0.95
Lighting Systems have provision for metering	Yes
Metering with 'out of range' warnings present	Yes

6.5 CRITERION 3

A Criterion 3 check has been carried out on the building design. Part L2A 2013 introduced a new Criterion 3 for limiting solar gain in buildings. It states that any space that is occupied and / or air conditioned must be assessed against the requirement.

The approved document requires that the building has appropriate passive control measures to limit solar gains into the occupied space, with the absolute purpose of limiting solar gains in order to reduce the reliance and capacity of air-conditioning systems.

The design of T2-T3 includes an extensive solar shade along the east and south easterly facing façade that should limit the solar flux striking the fenestration behind whilst not impeding the view out from the occupied office spaces.

The results of the analysis confirms that all of the occupied spaces in the current design are compliant with Criterion 3 based upon the following glazing parameters:

Detail	Value
External Window U-value (W/m^2K)	1.60
Visible Light Transmission (%)	56
Glazing G-value	0.28

Zone	Glazing as % of Floor Area	Glazing category	Orientation	Pass/Fail	Solar gain / limit	Glazing G-Value
Office Perimeter	173	Side Lit	SE	Pass	0.23	0.28
Office Perimeter	173	Side Lit	NE	Pass	0.36	0.28
Office Perimeter	173	Side Lit	NE	Pass	0.38	0.28
Office Perimeter	142	Side Lit	NE	Pass	0.21	0.28
Office Perimeter	126	Side Lit	NE	Pass	0.19	0.28
Office Perimeter	126	Side Lit	NE	Pass	0.2	0.28
Office Perimeter	126	Side Lit	NE	Pass	0.2	0.28
Office Perimeter	126	Side Lit	NE	Pass	0.22	0.28
Office Perimeter	126	Side Lit	E	Pass	0.23	0.28
Office Perimeter	126	Side Lit	E	Pass	0.23	0.28
Office Perimeter	126	Side Lit	E	Pass	0.24	0.28
Office Perimeter	126	Side Lit	E	Pass	0.25	0.28
Office Perimeter	126	Side Lit	E	Pass	0.26	0.28
Office Perimeter	126	Side Lit	NE	Pass	0.26	0.28
Office Perimeter	125	Side Lit	E	Pass	0.19	0.28
Office Perimeter	125	Side Lit	E	Pass	0.19	0.28
Office Perimeter	125	Side Lit	E	Pass	0.19	0.28
Office Perimeter	125	Side Lit	E	Pass	0.2	0.28
Office Perimeter	125	Side Lit	E	Pass	0.23	0.28
Office Perimeter	107	Side Lit	SE	Pass	0.2	0.28
Office Perimeter	107	Side Lit	SE	Pass	0.2	0.28
Office Perimeter	107	Side Lit	SE	Pass	0.21	0.28
Office Perimeter	107	Side Lit	SE	Pass	0.21	0.28
Office Perimeter	107	Side Lit	SE	Pass	0.25	0.28
Office Perimeter	96	Side Lit	SE	Pass	0.49	0.28
Office Perimeter	96	Side Lit	SE	Pass	0.58	0.28
Office Perimeter	87	Side Lit	SE	Pass	0.28	0.28
Office Perimeter	87	Side Lit	SE	Pass	0.31	0.28
Office Perimeter	87	Side Lit	SE	Pass	0.37	0.28
Office Perimeter	87	Side Lit	SE	Pass	0.38	0.28
Office Perimeter	87	Side Lit	SE	Pass	0.39	0.28
Office Perimeter	87	Side Lit	SE	Pass	0.42	0.28
Office Perimeter	87	Side Lit	SE	Pass	0.43	0.28
Office Perimeter	87	Side Lit	SE	Pass	0.51	0.28
Office Perimeter	79	Side Lit	SE	Pass	0.24	0.28
Office Perimeter	78	Side Lit	SE	Pass	0.24	0.28
Office Perimeter	78	Side Lit	SE	Pass	0.25	0.28
Office Perimeter	78	Side Lit	SE	Pass	0.26	0.28
Office Perimeter	78	Side Lit	SE	Pass	0.26	0.28
Office Perimeter	78	Side Lit	SE	Pass	0.28	0.28
Office Perimeter	71	Side Lit	SE	Pass	0.2	0.28
Office Perimeter	71	Side Lit	SE	Pass	0.25	0.28
Office Perimeter	71	Side Lit	SE	Pass	0.27	0.28
Office Perimeter	71	Side Lit	SE	Pass	0.27	0.28
Office Perimeter	69	Side Lit	E	Pass	0.2	0.28
Office Perimeter	69	Side Lit	E	Pass	0.2	0.28
Office Perimeter	69	Side Lit	E	Pass	0.21	0.28
Office Perimeter	69	Side Lit	E	Pass	0.21	0.28
Office Perimeter	69	Side Lit	E	Pass	0.23	0.28
Office Perimeter	67	Side Lit	E	Pass	0.23	0.28

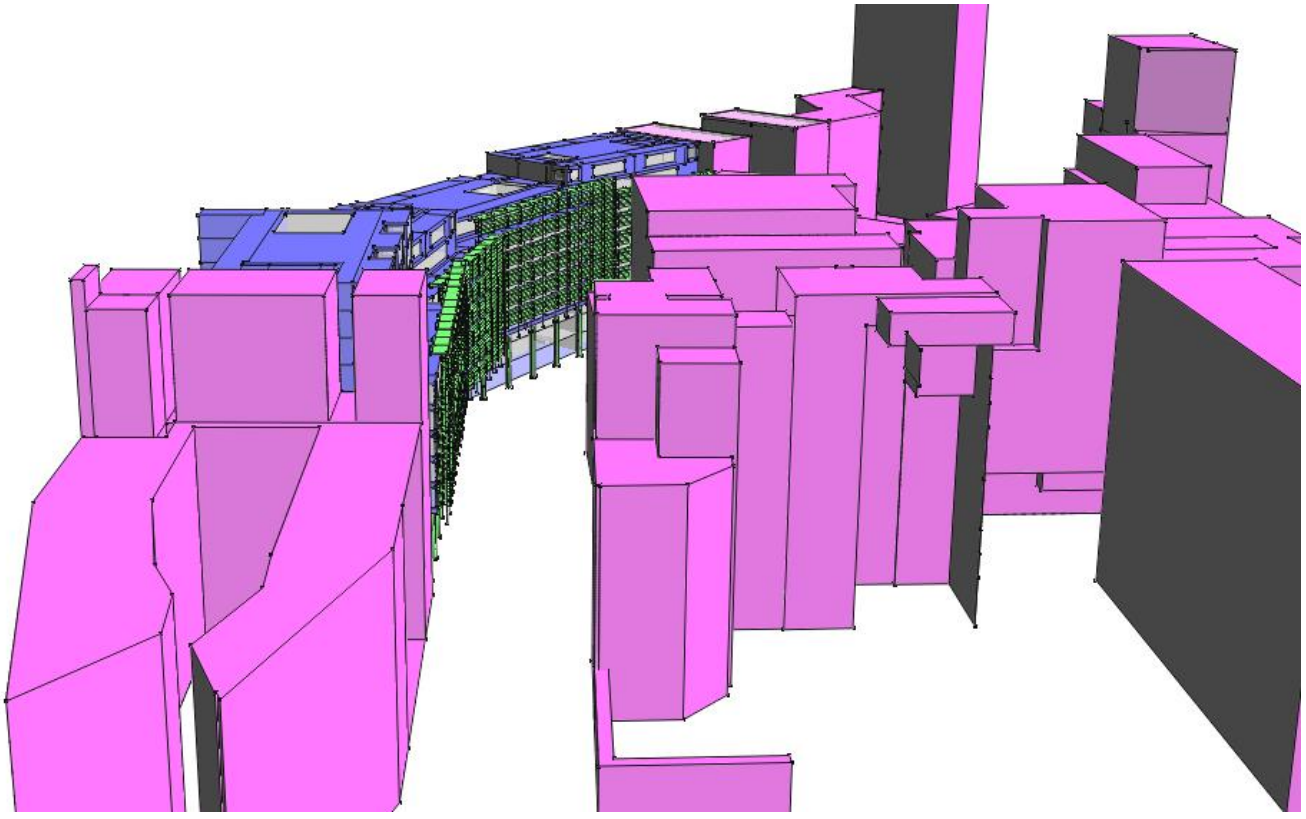
Zone	Glazing as % of Floor Area	Glazing category	Orientation	Pass/Fail	Solar gain / limit	Glazing G-Value
Office Perimeter	67	Side Lit	E	Pass	0.23	0.28
Office Perimeter	67	Side Lit	E	Pass	0.24	0.28
Office Perimeter	67	Side Lit	E	Pass	0.25	0.28
Office Perimeter	67	Side Lit	E	Pass	0.27	0.28
Office Perimeter	66	Side Lit	SE	Pass	0.2	0.28
Office Perimeter	66	Side Lit	SE	Pass	0.2	0.28
Office Perimeter	66	Side Lit	SE	Pass	0.21	0.28
Office Perimeter	66	Side Lit	SE	Pass	0.21	0.28
Office Perimeter	66	Side Lit	SE	Pass	0.21	0.28
Office Perimeter	66	Side Lit	SE	Pass	0.21	0.28
Office Perimeter	66	Side Lit	SE	Pass	0.21	0.28
Office Perimeter	66	Side Lit	SE	Pass	0.22	0.28
Office Perimeter	66	Side Lit	SE	Pass	0.22	0.28
Office Perimeter	66	Side Lit	SE	Pass	0.22	0.28
Office Perimeter	66	Side Lit	SE	Pass	0.22	0.28
Office Perimeter	66	Side Lit	SE	Pass	0.22	0.28
Office Perimeter	66	Side Lit	SE	Pass	0.22	0.28
Office Perimeter	66	Side Lit	SE	Pass	0.23	0.28
Office Perimeter	66	Side Lit	SE	Pass	0.23	0.28
Office Perimeter	66	Side Lit	SE	Pass	0.23	0.28
Office Perimeter	66	Side Lit	SE	Pass	0.23	0.28
Office Perimeter	66	Side Lit	SE	Pass	0.23	0.28
Office Perimeter	66	Side Lit	SE	Pass	0.23	0.28
Office Perimeter	66	Side Lit	SE	Pass	0.24	0.28
Office Perimeter	66	Side Lit	SE	Pass	0.24	0.28
Office Perimeter	66	Side Lit	SE	Pass	0.24	0.28
Office Perimeter	66	Side Lit	SE	Pass	0.25	0.28
Office Perimeter	66	Side Lit	SE	Pass	0.25	0.28
Office Perimeter	66	Side Lit	SE	Pass	0.25	0.28
Office Perimeter	66	Side Lit	SE	Pass	0.26	0.28
Office Perimeter	66	Side Lit	SE	Pass	0.26	0.28
Office Perimeter	66	Side Lit	SE	Pass	0.27	0.28
Office Perimeter	66	Side Lit	SE	Pass	0.28	0.28
Office Perimeter	66	Side Lit	SE	Pass	0.29	0.28
Office Perimeter	63	Side Lit	E	Pass	0.1	0.28
Office Perimeter	63	Side Lit	E	Pass	0.11	0.28
Office Perimeter	63	Side Lit	E	Pass	0.11	0.28
Office Perimeter	63	Side Lit	E	Pass	0.11	0.28
Office Perimeter	63	Side Lit	E	Pass	0.14	0.28
Office Perimeter	63	Side Lit	SE	Pass	0.18	0.28
Office Perimeter	63	Side Lit	SE	Pass	0.19	0.28
Office Perimeter	63	Side Lit	SE	Pass	0.19	0.28
Office Perimeter	63	Side Lit	SE	Pass	0.19	0.28
Office Perimeter	63	Side Lit	SE	Pass	0.23	0.28
Office Perimeter	60	Side Lit	SE	Pass	0.2	0.28
Office Perimeter	60	Side Lit	SE	Pass	0.2	0.28
Office Perimeter	60	Side Lit	SE	Pass	0.2	0.28
Office Perimeter	60	Side Lit	SE	Pass	0.21	0.28
Office Perimeter	60	Side Lit	SE	Pass	0.21	0.28
Office Perimeter	60	Side Lit	SE	Pass	0.21	0.28

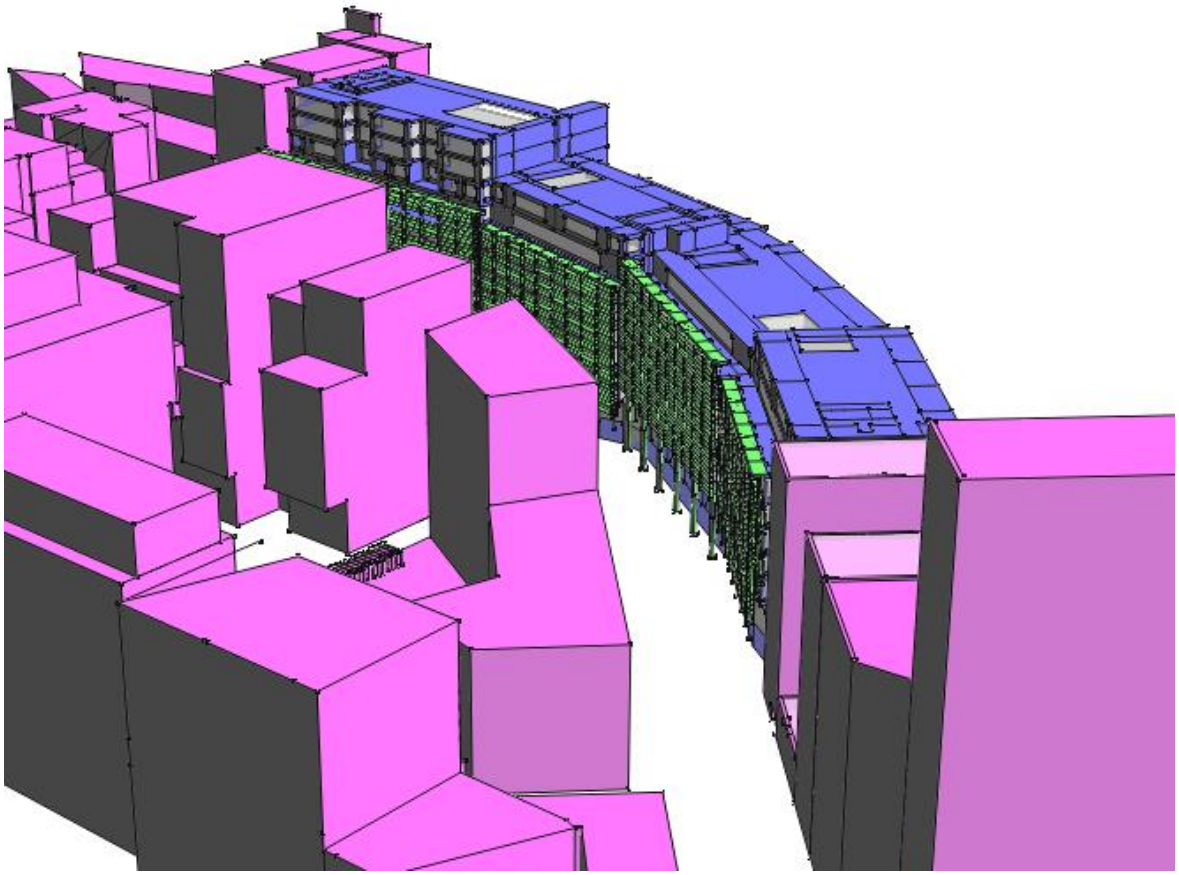
Zone	Glazing as % of Floor Area	Glazing category	Orientation	Pass/Fail	Solar gain / limit	Glazing G-Value
Office Perimeter	60	Side Lit	SE	Pass	0.22	0.28
Office Perimeter	60	Side Lit	SE	Pass	0.22	0.28
Office Perimeter	60	Side Lit	SE	Pass	0.28	0.28
Office Perimeter	60	Side Lit	SE	Pass	0.28	0.28
Office Perimeter	56	Side Lit	SE	Pass	0.21	0.28
Office Perimeter	56	Side Lit	SE	Pass	0.21	0.28
Office Perimeter	56	Side Lit	SE	Pass	0.22	0.28
Office Perimeter	56	Side Lit	SE	Pass	0.24	0.28
Office Perimeter	56	Side Lit	SE	Pass	0.44	0.28
Office Perimeter	53	Side Lit	NW	Pass	0.49	0.28
Office Perimeter	53	Side Lit	NW	Pass	0.49	0.28
Office Perimeter	53	Side Lit	NW	Pass	0.49	0.28
Office Perimeter	53	Side Lit	NW	Pass	0.49	0.28
Office Perimeter	53	Side Lit	NW	Pass	0.49	0.28
Office Perimeter	53	Side Lit	NW	Pass	0.49	0.28
Office Perimeter	53	Side Lit	NW	Pass	0.49	0.28
Office Perimeter	53	Side Lit	NW	Pass	0.49	0.28
Office Perimeter	53	Side Lit	NW	Pass	0.49	0.28
Office Perimeter	53	Side Lit	NW	Pass	0.49	0.28
Office Perimeter	53	Side Lit	NW	Pass	0.52	0.28
Office Perimeter	53	Side Lit	NW	Pass	0.52	0.28
Office Perimeter	53	Side Lit	NW	Pass	0.52	0.28
Office Perimeter	53	Side Lit	NW	Pass	0.52	0.28
Office Perimeter	53	Side Lit	NW	Pass	0.52	0.28
Office Perimeter	53	Side Lit	NW	Pass	0.53	0.28
Office Perimeter	53	Side Lit	NW	Pass	0.53	0.28
Office Perimeter	53	Side Lit	NW	Pass	0.53	0.28
Office Perimeter	53	Side Lit	NW	Pass	0.53	0.28
Office Perimeter	53	Side Lit	NW	Pass	0.53	0.28
Office Perimeter	53	Side Lit	NW	Pass	0.53	0.28
Office Perimeter	53	Side Lit	NW	Pass	0.53	0.28
Office Perimeter	53	Side Lit	NW	Pass	0.53	0.28
Office Perimeter	53	Side Lit	NW	Pass	0.53	0.28
Office Perimeter	53	Side Lit	NW	Pass	0.53	0.28
Office Perimeter	53	Side Lit	NW	Pass	0.53	0.28
Office Perimeter	53	Side Lit	NW	Pass	0.54	0.28
Office Perimeter	53	Side Lit	NW	Pass	0.56	0.28
Office Perimeter	53	Side Lit	NW	Pass	0.56	0.28
Office Perimeter	53	Side Lit	NW	Pass	0.57	0.28
Office Perimeter	52	Side Lit	NW	Pass	0.42	0.28
Office Perimeter	52	Side Lit	NW	Pass	0.42	0.28
Office Perimeter	52	Side Lit	NW	Pass	0.42	0.28
Office Perimeter	52	Side Lit	NW	Pass	0.42	0.28
Office Perimeter	52	Side Lit	NW	Pass	0.43	0.28
Office Perimeter	52	Side Lit	NW	Pass	0.45	0.28
Office Perimeter	52	Side Lit	NW	Pass	0.45	0.28
Office Perimeter	52	Side Lit	NW	Pass	0.45	0.28
Office Perimeter	52	Side Lit	NW	Pass	0.45	0.28
Office Perimeter	52	Side Lit	NW	Pass	0.45	0.28
Office Perimeter	52	Side Lit	NW	Pass	0.46	0.28

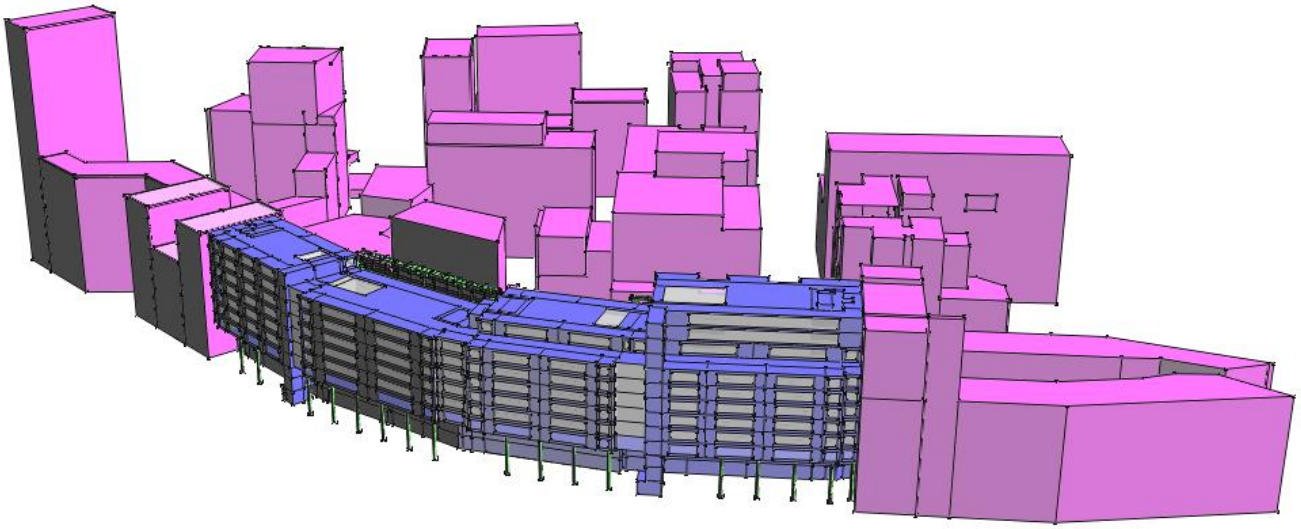
Zone	Glazing as % of Floor Area	Glazing category	Orientation	Pass/Fail	Solar gain / limit	Glazing G-Value
Office Perimeter	52	Side Lit	NW	Pass	0.46	0.28
Office Perimeter	52	Side Lit	NW	Pass	0.5	0.28
Office Perimeter	52	Side Lit	NW	Pass	0.5	0.28
Office Perimeter	52	Side Lit	NW	Pass	0.5	0.28
Office Perimeter	52	Side Lit	NW	Pass	0.5	0.28
Office Perimeter	52	Side Lit	NW	Pass	0.5	0.28
Office Perimeter	52	Side Lit	NW	Pass	0.55	0.28
Office Perimeter	50	Side Lit	NW	Pass	0.2	0.28
Office Perimeter	50	Side Lit	NW	Pass	0.2	0.28
Office Perimeter	50	Side Lit	NW	Pass	0.2	0.28
Office Perimeter	50	Side Lit	NW	Pass	0.2	0.28
Office Perimeter	50	Side Lit	NW	Pass	0.2	0.28
Office Perimeter	50	Side Lit	NW	Pass	0.22	0.28
Office Perimeter	50	Side Lit	NW	Pass	0.31	0.28
Office Perimeter	50	Side Lit	NW	Pass	0.31	0.28
Office Perimeter	50	Side Lit	NW	Pass	0.31	0.28
Office Perimeter	50	Side Lit	NW	Pass	0.31	0.28
Office Perimeter	50	Side Lit	NW	Pass	0.31	0.28
Office Perimeter	50	Side Lit	NW	Pass	0.33	0.28
Office Perimeter	45	Side Lit	NW	Pass	0.38	0.28
Office Perimeter	45	Side Lit	NW	Pass	0.38	0.28
Office Perimeter	45	Side Lit	NW	Pass	0.38	0.28
Office Perimeter	45	Side Lit	NW	Pass	0.38	0.28
Office Perimeter	45	Side Lit	NW	Pass	0.38	0.28
Office Perimeter	45	Side Lit	NW	Pass	0.41	0.28
Office Perimeter	44	Side Lit	NW	Pass	0.29	0.28
Office Perimeter	44	Side Lit	NW	Pass	0.29	0.28
Office Perimeter	44	Side Lit	NW	Pass	0.29	0.28
Office Perimeter	44	Side Lit	NW	Pass	0.29	0.28
Office Perimeter	44	Side Lit	NW	Pass	0.29	0.28
Office Perimeter	44	Side Lit	NW	Pass	0.31	0.28
Office Perimeter	43	Side Lit	W	Pass	0.16	0.28
Office Perimeter	43	Side Lit	W	Pass	0.16	0.28
Office Perimeter	43	Side Lit	W	Pass	0.16	0.28
Office Perimeter	43	Side Lit	W	Pass	0.16	0.28
Office Perimeter	43	Side Lit	W	Pass	0.16	0.28
Office Perimeter	43	Side Lit	W	Pass	0.18	0.28
Office Perimeter	43	Side Lit	W	Pass	0.37	0.28
Office Perimeter	43	Side Lit	W	Pass	0.37	0.28
Office Perimeter	43	Side Lit	W	Pass	0.37	0.28
Office Perimeter	43	Side Lit	W	Pass	0.37	0.28
Office Perimeter	43	Side Lit	W	Pass	0.37	0.28
Office Perimeter	43	Side Lit	W	Pass	0.39	0.28
Office Perimeter	43	Side Lit	NW	Pass	0.48	0.28
Office Perimeter	43	Side Lit	NW	Pass	0.48	0.28
Office Perimeter	43	Side Lit	NW	Pass	0.48	0.28
Office Perimeter	43	Side Lit	NW	Pass	0.48	0.28
Office Perimeter	43	Side Lit	NW	Pass	0.48	0.28
Office Perimeter	43	Side Lit	NW	Pass	0.48	0.28
Office Perimeter	43	Side Lit	NW	Pass	0.48	0.28

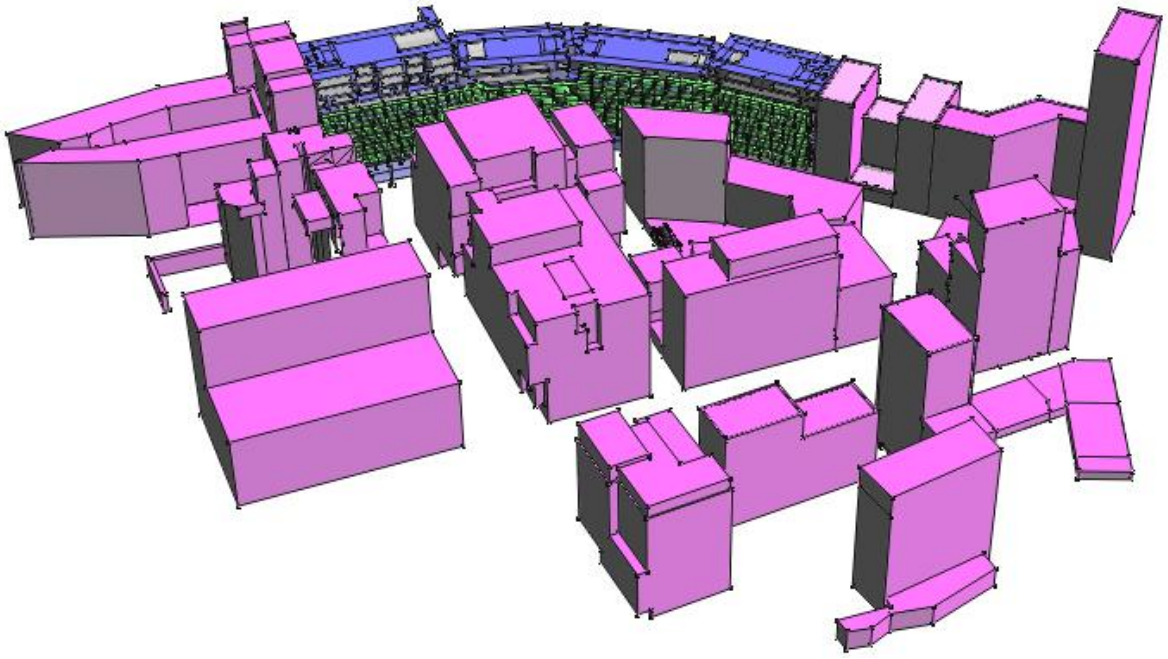
Zone	Glazing as % of Floor Area	Glazing category	Orientation	Pass/Fail	Solar gain / limit	Glazing G-Value
Office Perimeter	43	Side Lit	NW	Pass	0.48	0.28
Office Perimeter	43	Side Lit	NW	Pass	0.48	0.28
Office Perimeter	43	Side Lit	NW	Pass	0.48	0.28
Office Perimeter	43	Side Lit	W	Pass	0.5	0.28
Office Perimeter	43	Side Lit	W	Pass	0.5	0.28
Office Perimeter	43	Side Lit	W	Pass	0.5	0.28
Office Perimeter	43	Side Lit	W	Pass	0.5	0.28
Office Perimeter	43	Side Lit	W	Pass	0.5	0.28
Office Perimeter	43	Side Lit	W	Pass	0.5	0.28
Office Perimeter	43	Side Lit	W	Pass	0.5	0.28
Office Perimeter	43	Side Lit	W	Pass	0.5	0.28
Office Perimeter	43	Side Lit	W	Pass	0.5	0.28
Office Perimeter	43	Side Lit	W	Pass	0.5	0.28
Office Perimeter	43	Side Lit	NW	Pass	0.51	0.28
Office Perimeter	43	Side Lit	NW	Pass	0.52	0.28
Office Perimeter	43	Side Lit	W	Pass	0.53	0.28
Office Perimeter	43	Side Lit	W	Pass	0.53	0.28
Office Perimeter	43	Side Lit	W	Pass	0.54	0.28
Office Perimeter	43	Side Lit	W	Pass	0.54	0.28
Office Perimeter	43	Side Lit	W	Pass	0.54	0.28
Office Perimeter	43	Side Lit	W	Pass	0.54	0.28
Office Perimeter	43	Side Lit	W	Pass	0.54	0.28
Office Perimeter	43	Side Lit	W	Pass	0.57	0.28
Reception	43	Side Lit	SE	Pass	0.58	0.28
Office Core	43	Side Lit	NE	Pass	0.95	0.28
Office Perimeter	42	Side Lit	SE	Pass	0.39	0.28
Office Perimeter	42	Side Lit	SE	Pass	0.48	0.28
Office Core	41	Side Lit	SE	Pass	0.74	0.28
Office Perimeter	39	Side Lit	SE	Pass	0.27	0.28
Office Perimeter	37	Side Lit	E	Pass	0.3	0.28
Reception	36	Side Lit	E	Pass	0.46	0.28
Office Perimeter	35	Side Lit	E	Pass	0.38	0.28
Office Core	35	Side Lit	N	Pass	0.86	0.28
Office Perimeter	34	Side Lit	SE	Pass	0.28	0.28
Office Core	32	Side Lit	E	Pass	0.82	0.28
Office Perimeter	31	Side Lit	E	Pass	0.18	0.28
Office Perimeter	30	Side Lit	E	Pass	0.35	0.28
Reception	30	Side Lit	E	Pass	0.49	0.28
Office Perimeter	29	Side Lit	E	Pass	0.25	0.28
Office Perimeter	29	Side Lit	E	Pass	0.26	0.28
Office Perimeter	24	Side Lit	E	Pass	0.26	0.28
Office Core	21	Side Lit	SE	Pass	0.89	0.28
Office Core	19	Side Lit	SE	Pass	0.73	0.28
Office Core	17	Side Lit	SE	Pass	0.73	0.28
Office Core	14	Side Lit	E	Pass	0.69	0.28
Office Core	1	Side Lit	NE	Pass	0.85	0.28
Office Core	1	Side Lit	NE	Pass	0.73	0.28
Circulation Area	0	Side Lit	N/A	Pass	0.01	0
Circulation Area	0	Side Lit	N/A	Pass	0.01	0
Circulation Area	0	Side Lit	N/A	Pass	0.02	0

Zone	Glazing as % of Floor Area	Glazing category	Orientation	Pass/Fail	Solar gain / limit	Glazing G-Value
Circulation Area	0	Side Lit	N/A	Pass	0.02	0
Circulation Area	0	Side Lit	N/A	Pass	0.03	0
Circulation Area	0	Side Lit	N/A	Pass	0.03	0
Office Core	0	Side Lit	N/A	Pass	0.06	0
Circulation Area	0	Side Lit	N/A	Pass	0.06	0
Office Core	0	Side Lit	N/A	Pass	0.06	0
Office Core	0	Side Lit	N/A	Pass	0.06	0
Office Core	0	Side Lit	N/A	Pass	0.06	0
Office Core	0	Side Lit	N/A	Pass	0.07	0
Office Core	0	Side Lit	N/A	Pass	0.08	0
Office Core	0	Side Lit	N/A	Pass	0.09	0
Office Perimeter	0	Side Lit	N/A	Pass	0.09	0
Office Core	0	Side Lit	N/A	Pass	0.09	0
Office Perimeter	0	Side Lit	N/A	Pass	0.09	0
Office Core	0	Side Lit	N/A	Pass	0.09	0
Office Perimeter	0	Side Lit	N/A	Pass	0.09	0
Office Perimeter	0	Side Lit	N/A	Pass	0.09	0
Office Perimeter	0	Side Lit	N/A	Pass	0.09	0
Office Perimeter	0	Side Lit	N/A	Pass	0.09	0
Office Perimeter	0	Side Lit	N/A	Pass	0.09	0
Office Core	0	Side Lit	N/A	Pass	0.09	0
Office Core	0	Side Lit	N/A	Pass	0.1	0
Office Perimeter	0	Side Lit	N/A	Pass	0.1	0
Office Perimeter	0	Side Lit	N/A	Pass	0.11	0
PHCC	0	Side Lit	NE	Pass	0.11	0.28
Office Perimeter	0	Side Lit	N/A	Pass	0.11	0
Office Perimeter	0	Side Lit	N/A	Pass	0.11	0
Office Perimeter	0	Side Lit	N/A	Pass	0.11	0
Office Perimeter	0	Side Lit	N/A	Pass	0.11	0
Office Perimeter	0	Side Lit	N/A	Pass	0.12	0
Office Perimeter	0	Side Lit	N/A	Pass	0.12	0
Office Perimeter	0	Side Lit	N/A	Pass	0.12	0
Office Perimeter	0	Side Lit	N/A	Pass	0.13	0
Office Perimeter	0	Side Lit	N/A	Pass	0.13	0
Office Perimeter	0	Side Lit	N/A	Pass	0.14	0
Office Perimeter	0	Side Lit	N/A	Pass	0.14	0
Office Core	0	Side Lit	N/A	Pass	0.14	0
Office Core	0	Side Lit	N/A	Pass	0.15	0
Office Core	0	Side Lit	N/A	Pass	0.62	0
Office Core	0	Side Lit	N/A	Pass	0.62	0
Office Core	0	Side Lit	N/A	Pass	0.63	0
Office Core	0	Side Lit	N/A	Pass	0.65	0
Office Core	0	Side Lit	N/A	Pass	0.69	0
Office Core	0	Side Lit	N/A	Pass	0.97	0
Office Core	0	Side Lit	N/A	Pass	0.99	0
Office Core	0	Side Lit	N/A	Pass	0.73	0
Office Core	0	Side Lit	N/A	Pas	0.73	0
Office Core	0	Side Lit	N/A	Pass	0.73	0









7. BUILDING T2-T3 - BREEAM SCORING MATRIX

7.1 SUMMARY

Cundall have prepared this document to highlight those credits which have been sought in order for the Building T2-T3 development to achieve an 'Excellent' rating under the BREEAM New Construction Offices 2014 scheme criteria.

The final BREEAM certification report will be produced in line with the credits highlighted within this schedule and sent to the Building Research Establishment for quality assurance checking and accreditation.

Health & Well-Being

BREEAM Ref	Title	Number Of Credits Available	Number Of Credits Sought
Hea 01	**Visual Comfort**	**3**	**1**
Hea 02	**Indoor air quality**	**4**	**2**
Hea 03	**Thermal comfort**	**2**	**2**
Hea 04	**Water Quality**	**1**	**1**
Hea 05	**Acoustic Performance**	**2**	**2**
Hea 06	**Safety & Security**	**2**	**1**

Energy

BREEAM Ref	Title	Number Of Credits Available	Number Of Credits Sought
Ene 01	**Reduction of CO_2 Emissions**	**15**	**10**
Ene 02	**Energy Monitoring**	**2**	**2**
Ene 03	**External Lighting**	**1**	**0**
Ene 04	**Low & Zero Carbon Technologies**	**5**	**3**
Ene 06	**Energy Efficient Transportation**	**2**	**2**
Ene 08	**Energy Efficient Equipment**	**2**	**0**

Transport

BREEAM Ref	Title	Number Of Credits Available	Number Of Credits Sought
Tra 01	**Public Transport**	**3**	**3**
Tra 02	**Proximity of Amenities**	**1**	**1**
Tra 03	**Cyclist Facilities**	**2**	**2**
Tra 04	**Maximum Car Parking Capacity**	**2**	**2**
Tra 05	**Travel Plan**	**1**	**1**

Water

BREEAM Ref	Title	Number Of Credits Available	Number Of Credits Sought
Wat 01	**Water Consumption**	**5**	**4**
Wat 02	**Water Monitoring**	**1**	**1**
Wat 03	**Water Leak Detection & Prevention**	**2**	**2**
Wat 04	**Water Efficient Equipment**	**1**	**0**

Materials

BREEAM Ref	Title	Number Of Credits Available	Number Of Credits Sought
Mat 01	**Life Cycle Impacts**	**5**	**2**
Mat 02	**Hard Landscaping & Boundary Protection**	**1**	**0**
Mat 03	**Responsible Sourcing of Materials**	**3**	**1**
Mat 04	**Insulation**	**2**	**2**
Mat 05	**Designing For Robustness**	**1**	**1**

Waste

BREEAM Ref	Title	Number Of Credits Available	Number Of Credits Sought
Wst 01	**Construction Waste Management**	**4**	**2**
Wst 02	**Recycled Aggregates**	**1**	**0**
Wst 03	**Operational Waste**	**1**	**1**
Wst 04	**Speculative Floor & Ceiling Finishes**	**1**	**0**

Land Use & Ecology

BREEAM Ref	Title	Number Of Credits Available	Number Of Credits Sought
LE 01	**Site Selection**	**2**	**1**
LE 02	**Ecological Value of Site & Protection of Ecological Features**	**1**	**1**
LE 03	**Mitigating Ecological Impact**	**2**	**2**
LE 04	**Enhancing Site Ecology**	**3**	**2**
LE 05	**Long Term Impact On Biodiversity**	**2**	**2**

Pollution

BREEAM Ref	Title	Number Of Credits Available	Number Of Credits Sought
Pol 01	**Impact of Refrigerants**	**3**	**0**
Pol 02	**NO_x Emissions**	**3**	**3**
Pol 03	**Surface Water Run Off**	**5**	**4**
Pol 04	**Reduction of Night Time Light Pollution**	**1**	**0**
Pol 05	**Noise Attenuation**	**1**	**1**

Innovation

BREEAM Ref	Title	Number Of Credits Available	Number Of Credits Sought
Man 01	**Sustainable Procurement**	**1**	**1**
Man 02	**Responsible Construction**	**1**	**1**

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