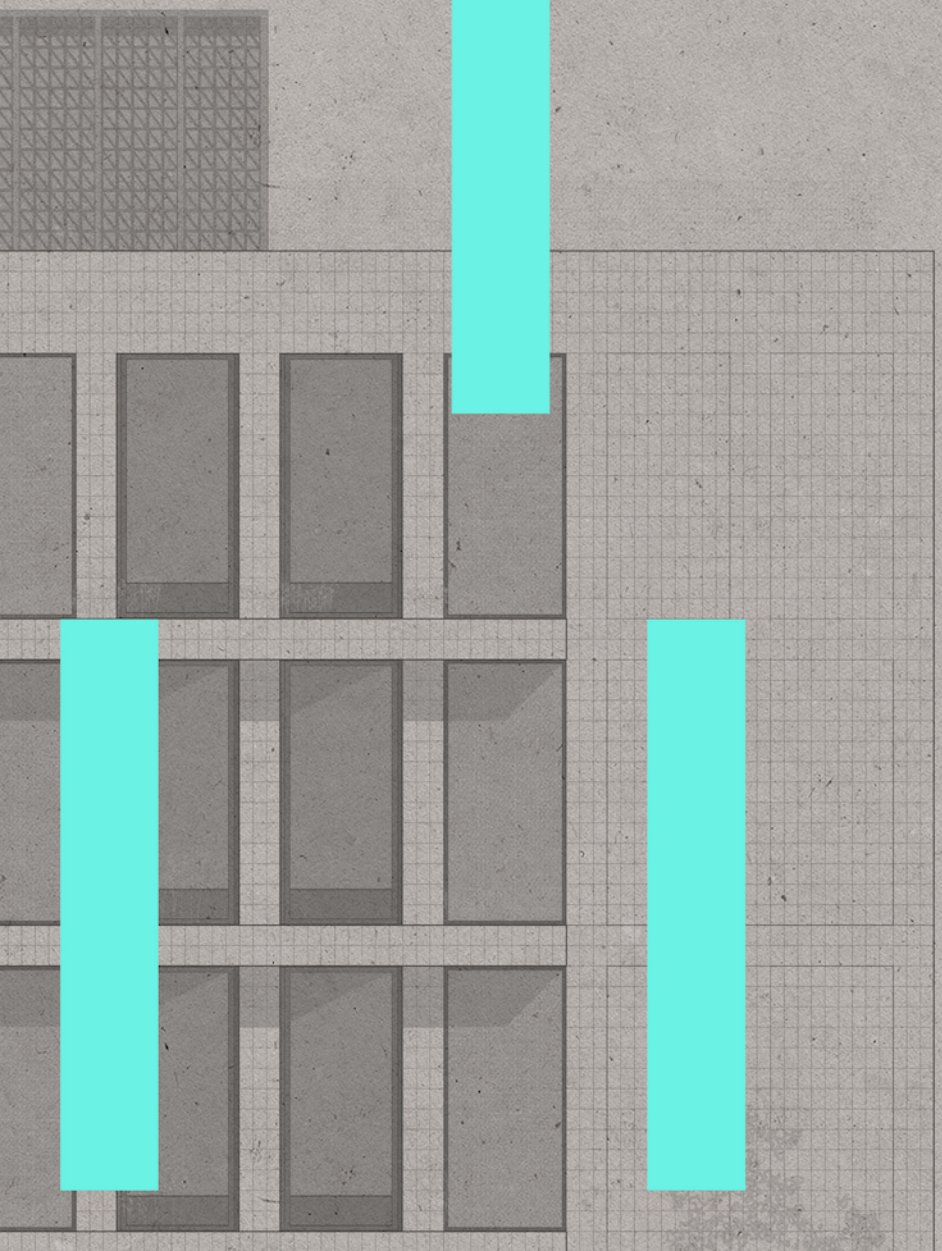
Former Car Repair Centre
70 – 86 Royal College Street
London
NW1 0TH

# SUSTAINABILITY STATEMENT
## (INCLUDING ENERGY STRATEGY REPORT)



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NHS
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BDP.

# 60 – 86 Royal College Street, Camden

## Sustainability Statement

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| Rev | Description | Issued by | Date | Reviewed by | Date |
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| - | For Planning | Kat Radford | 20.01.2020 | Mia Coleman | 20.01.2020 |
| A | Inclusion of Appendix 4 | Kat Radford | 23.01.2020 | Mia Coleman | 23.01.2020 |
| B | Inclusion of updated pre-demolition audit and energy statement | Kat Radford | 04.02.2020 | Mia Coleman | 04.02.2020 |

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# 1. Introduction

This Sustainability Statement has been produced as part of the Planning submission for the new hospital development on Royal College Street, Camden, London.

The existing site, comprising a series of unoccupied garages and offices, is located within St Pancras and Somers Town Ward in the London Borough of Camden, bounded by Royal College Street to the west, Pratt Street to the north, and the Parcelforce site to the east and south. The site will be developed to provide a new healthcare facility (classes D1 / C2) comprising a basement, ground floor, plus four storeys and rooftop gardens, pavilions and plant enclosures.

This statement seeks to address the sustainability requirements of the Camden Local Plan 2017, Camden Development Policies 2010 – 2025, Camden Core Strategy 2010 – 2025, London Plan (2016, adopted) and the Draft London Plan (version July 2019).

This statement should be read in conjunction with the full suite of supporting documents and drawings that form the planning application submission.

# 2. Sustainability Design Response

The following section aims to demonstrate how the development has responded to the sustainability requirements listed in the aforementioned policies.

## 2.1 Sustainable Design and Construction Measures

The following section aims to demonstrate how the development has responded to the sustainability requirements listed in the following policies:

- Camden Core Strategy CS13 Tackling Climate Change Through Promoting Higher Environmental Standards
- Camden Local Plan Policy CC2 Adapting to Climate Change
- Camden Development Policy DP22 Promoting Sustainable Design and Construction

### 2.1.1 All new non-domestic developments >500m$^2$ are expected to achieve BREEAM Excellent:

As required by the Camden Local Plan and Development Plan, the development is expected to achieve a BREEAM Excellent rating.

BDP were appointed as BREEAM Assessors and Advisory Professionals at RIBA Stage 1, during which a pre-assessment exercise was undertaken alongside the design team (the workshop took place on 1st February 2019). Following discussions with the design team and a review of relevant project information, a final target score of 75.75% is anticipated, providing a buffer of 5.75% over the minimum 70% required for BREEAM Excellent. An additional 31.91% worth of credits have been identified, however these either require additional investigation or may incur additional costs.

A copy of the agreed strategy for achieving BREEAM Excellent under the BREEAM New Construction 2018 (Healthcare) criteria can be found in Appendix 1 of this report. A summary of the strategy is demonstrated in Figure 1 and Table 1.

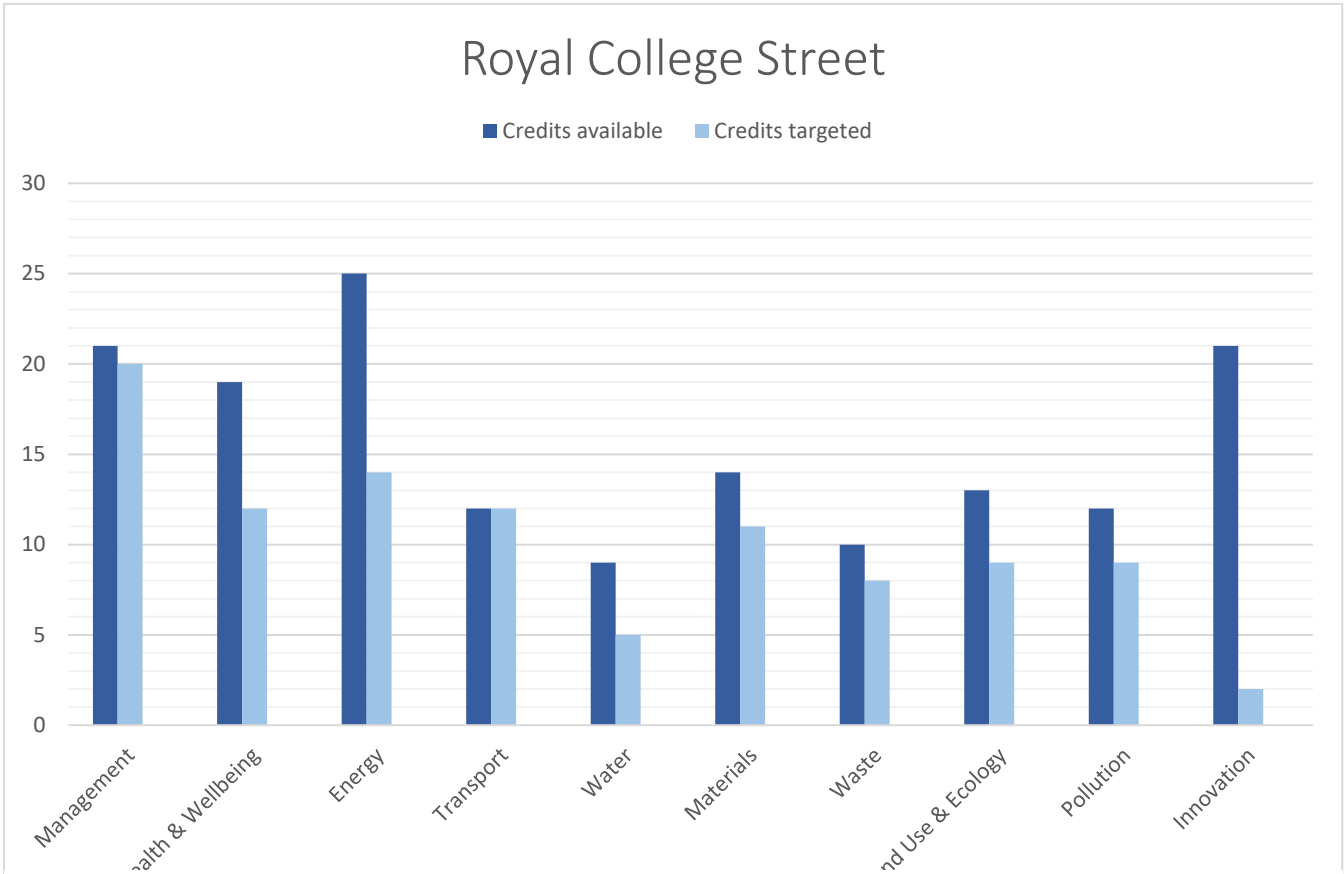


**Figure 1: BREEAM Strategy**

**Table 1: BREEAM Strategy**

| Environmental section | No. credits available | Indicative no. credits targeted | % credits targeted | Section weighting | Indicative section score |
|---|---|---|---|---|---|
| Management | 21 | 20 | 95.24% | 11.00% | 10.48% |
| Health and Wellbeing | 19 | 12 | 63.16% | 14.00% | 8.84% |
| Energy | 25 | 14 | 56.00% | 16.00% | 8.96% |
| Transport | 12 | 12 | 100% | 10.00% | 10.00% |
| Water | 9 | 5 | 55.56% | 7.00% | 3.89% |
| Materials | 14 | 11 | 78.57% | 15.00% | 11.79% |
| Waste | 10 | 8 | 80.00% | 6.00% | 4.80% |
| Land Use and Ecology | 13 | 9 | 69.23% | 13.00% | 9.00% |
| Pollution | 8 | 9 | 75.00% | 8.00% | 6.00% |
| Innovation | 10 | 2 | 20.00% | N/A | 2.00% |
| | | | | **TOTAL:** | **75.75%** |

**2.1.2 Developments should demonstrate that sustainable design standards are integral to the proposal, including their construction and operation, and ensure that they are considered at the beginning of the design process:**

As described in paragraph 2.1.1, the BDP BREEAM Assessor and AP were appointed at RIBA Stage 1, following which a BREEAM workshop was undertaken to inform the strategy for achieving 'Excellent', and to steer the design towards compliance. BREEAM demonstrates best practice with regards to delivering sustainability and to ensure the BREEAM target is met, formal BREEAM reviews will be undertaken throughout the design and construction stages.

**2.1.3 Ensure the development scheme demonstrates how climate change adaptation measures and suitable sustainable development principals have been incorporated into the design and proposed implementation:**

This is demonstrated throughout the following sections.

## 2.2 Energy

The following section aims to demonstrate how the development has responded to the sustainability requirements listed in the following policies:

- London Plan Policies 5.2, 5.3, 5.6, 5.7
- Camden Core Strategy CS13 Tackling Climate Change Through Promoting Higher Environmental Standards
- Camden Local Plan Policy CC1 Climate Change Mitigation
- Camden Local Plan Policy CC2 Adapting to Climate Change
- Camden Development Policy DP22 Promoting Sustainable Design and Construction
- Draft London Plan, July 2019

**2.2.1 Provide an energy statement in line with CPG Energy Efficiency and Adaptation, March 2019:**

A separate energy strategy report (ref: RCS-BDP-ZZ-ZZ-MEP-RP-ZZ_ES-0001) has been provided by BDP, in line with the CPG guidance for the planning submission. Please refer to appendix 2 for more details.

**2.2.2 Achieve zero carbon (with at least 35% reduction achieved through on-site measures), demonstrating that carbon dioxide emissions have been reduced through following the steps in the energy hierarchy (passive measures to be prioritised). The remaining regulated carbon emissions (to 100%) are to be offset through a cash in lieu contribution. Major non-domestic developments will still be expected to achieve a 35% reduction against Part L 2013 Building Regulations:**

As confirmed within the energy strategy report in appendix 2 (ref: RCS-BDP-ZZ-ZZ-MEP-RP-ZZ_ES-0001), a 36% improvement has been achieved through the application of the energy hierarchy, with passive design measures accounting for 1%, and the provision of an ASHP (for 100% of heating and DWH) and a 200m$^2$ PV array for the remaining 35%. It should be noted that the PV array has been designed in line with the landscape strategy.

A summary of the application of the energy hierarchy, as detailed fully within the energy strategy report, is summarised below:

- Be Lean:
    - Building fabric U-values surpass the minimum requirements of Part L2A 2013 Building Regulations:

| Element | Part L2A 2013 Notional Baseline U-value (W/m$^2$.K) | Proposed specification U-value (W/m$^2$.K) |
|---|---|---|
| Ground floor | 0.13 | 0.15 |
| External walls | 0.18 | 0.19 |
| Roof | 0.13 | 0.16 |
| Windows | 1.40 | 1.30 |

    - Spectrally selective solar control glazing has been specified.
    - Fritted glass is provided to 32.5% of the windows in patients' bedrooms to provide solar shading and prevent overheating.
    - Deep horizontal projecting planters and potting sheds create an overhang across the ward bedrooms and dayrooms, providing solar shading.
- Be Clean: As per the details in the energy strategy report, issues such as lighting will be considered at a later stage. CHP and connecting to the district heating networks are not considered feasible, however space has been allowed for in the plant room for future connections.
- Be Green: A 200m$^2$ PV array and air source heat pump are being installed. This will offset 35% of the anticipated emissions.

The remaining emissions will be offset through cash in lieu contributions.

Further carbon reductions through passive design measures will be investigated as the design progresses.

Application of the energy hierarchy is fully in BDP's energy strategy report (ref: RCS-BDP-ZZ-ZZ-MEP-RP-ZZ_ES-0001).

**2.2.3 Achieve a 20% reduction in on-site carbon dioxide emissions through renewable technologies, unless demonstrated that such provision is not feasible:**

As above, 35% is currently anticipated thereby exceeding the 20% requirement.

**2.2.4 Minimise carbon emissions from the redevelopment, construction and occupation of buildings by implementing, in order, all the elements of the energy hierarchy:**

As above, this is demonstrated in the energy strategy report (ref: RCS-BDP-ZZ-ZZ-MEP-RP-ZZ_ES-0001).

**2.2.5 Assess the feasibility of connecting to an existing decentralised energy network, or where this is not possible establishing a new network:**

The BDP energy strategy report confirms that there are no existing networks within a feasible distance from the development.

**2.2.6 Evaluate the feasibility of combined heat and power (CHP) systems, and where a new CHP system is appropriate also examine opportunities to extend the system beyond the site boundary to adjacent sites:**

As per the details in the energy strategy report, CHP has not been considered for this development due to being an unfeasible distance from any existing or proposed heat networks. Space for a future connection has been allowed for within the plant room, however.

**2.2.7 To ensure that the Council can monitor the effectiveness of renewable and low carbon technologies, major developments will be required to install appropriate monitoring equipment:**

Appropriate meters and monitoring equipment will be installed.

**2.2.8 Avoid internal overheating and contribution to the urban heat island effect (thermal comfort model should be provided). Development proposals should minimise adverse impacts on the urban heat island effect through design, layout, orientation, materials and the incorporation of green infrastructure:**

Thermal comfort modelling has been undertaken for the patient bedrooms against both CIBSE TM59 and HTM 03-01 criteria. The results identified a selection of dayrooms that are expected to overheat and, as such, will require cooling. To prevent overheating without mechanical cooling, the glazing would need to be significantly reduced from 41.7m$^2$ to 6m$^2$. This would result in a significant reduction in daylight penetration to these spaces and also inhibit views out, impacting on the mental wellbeing and recovery time of patients, and also increasing lighting loads. Further analysis was undertaken to establish whether relocating the dayrooms from the southwest façade to the northeast would prevent overheating, however it was concluded that these spaces would still fail both CIBSE and HTM criteria.

As such, air conditioning is currently specified to ensure the comfort and safety of patients. Full thermal modelling will be undertaken once the internal layout and client brief is confirmed and finalised. The design team will continue to design out the need for mechanical cooling as far as possible, including the use of overhangs and fritted grills (currently specified) to provide solar shading, and green infrastructure.

With regards to the incorporation of green infrastructure, the BDP Landscape report (appended to the Design and Access Statement) confirms that the following is being provided, providing localised cooling:

i. Two green roof / terrace areas which account for almost the entire roof area.
ii. Winter gardens to the front and rear elevations, comprising planters and climbing plants.
iii. 4nr street trees (within the application boundary).

**2.2.9 Implement measures to reduce the impact of urban and dwelling overheating, including application of the cooling hierarchy. Developments should demonstrate how the design, materials, construction and operation of the development would minimise overheating and also meet its cooling needs. New development should be designed to avoid the need for air conditioning systems:**

As described in paragraph 2.2.8, the requirement for mechanical cooling has been designed out as far as possible, however it will still be required in the day rooms and communications room to ensure that these remain comfortable and safe spaces for patients.

As described in the energy strategy report (ref: RCS-BDP-ZZ-ZZ-MEP-RP-ZZ_ES-0001), the cooling hierarchy has been implemented in order to minimise the risk of overheating and reduce the cooling load. This is summarised as follows:

| Cooling hierarchy | Response |
|---|---|
| 1. Minimise internal heat generation through energy efficient design | Highly insulated hot water pipework has been specified to minimise heat gains through hot water distribution. |
| 2. Reduce the amount of heat entering a building in summer orientation, shading, albedo, fenestration, insulation and green roofs and walls. | Solar control glazing is specified. Work has been done to define the amount of fritted glass needed to prevent overheating and avoid the use of cooling in patients' bedrooms.<br><br>Deep horizontal projecting planters and potting sheds create an overhang across ward bedrooms and dayrooms.<br><br>The metal mesh panels act as solar screens. |
| 3. Manage the heat within the building through exposed internal thermal mass and high ceilings. | Thermal mass will be provided from walls, floors and ceilings.<br><br>A balance between exposed thermal mass and acoustic requirements will be sought. |
| 4. Passive ventilation | Due to noise pollution openable windows cannot be provided. |
| 5. Mechanical ventilation | Mechanical ventilation with heat recovery is provided in most spaces within the building. |
| 6. Active cooling systems (ensuring they are the lowest carbon options) | A high performance ASHP / chiller is provided for the offices, meeting rooms, nurses stations, dayrooms and pavilions in order to meet the cooling loads. |

Furthermore, in line with item 2 in the cooling hierarchy, to reduce the impact of the urban heat island effect, a blue roof and green infrastructure is provided, as described in paragraph 2.2.8.

**2.2.10 Major development proposals should calculate and minimise carbon emissions from other parts of the development, including plant or equipment, that are not covered by Building Regulations, i.e. unregulated emissions:**

Unregulated carbon emissions are being addressed in line with the BREEAM assessment under the targeted Ene 08 (Energy Efficient Equipment) credit. In line with BREEAM and the Draft London Plan requirements, the team will calculate the contribution of the building's unregulated energy consuming loads, identify systems or processes that use a significant proportion of the total annual energy consumption of the building, and then demonstrate a meaningful reduction in the total annual unregulated energy consumption of the building (in line with BREEAM New Construction 2018 guidance).

**2.2.11 Development proposals referable to the Mayor should calculate whole life cycle carbon emissions through a nationally recognised Whole Life Cycle Carbon Assessment and demonstrate actions taken to reduce life cycle carbon emissions:**

BDP were commissioned to undertake a Building Life Cycle Assessment, in line with BREEAM issue Mat 01 (Environmental Impacts from Construction Products – building life cycle assessment), prior to the end of RIBA Stage 2. The LCA exercise was undertaken using IMPACT compliant software to inform the design, with superstructure, substructure, hard landscaping and core services components specified on the basis of having the lowest / lower whole life environmental impacts and embodied carbon.

**2.2.12 Development plans should identify the need and suitability for necessary energy infrastructure requirements (energy centres, storage and upgrades) and identify existing heating and cooling networks, identify proposed locations for future heating and cooling networks and opportunities for expanding existing networks or creating new ones:**

BDP MEP have confirmed that all existing and proposed networks are currently situated too far from the development to allow for a connection.

**2.2.13 Major development proposals within Heat Network Priority Areas should have a communal low-temperature heating system.**

The development is not within a Heat Network Priority Area.

## 2.3 Water and Flooding

The following section aims to demonstrate how the development has responded to the sustainability requirements listed in the following policies:

- London Plan Policy 5.3, 5.12, 5.13
- Camden Core Strategy CS13 Tackling Climate Change Through Promoting Higher Environmental Standards
- Camden Local Plan Policy CC2 Adapting to Climate Change
- Camden Local Plan Policy CC3 Water and Flooding
- Camden Development Policy DP22 Promoting Sustainable Design and Construction
- Camden Development Policy DP23 Water
- Draft London Plan, July 2019

**2.3.1 Major developments (>1000m$^2$) and high or intense water use developments should include grey water recycling unless it can be demonstrated that this is not feasible:**

As per the Department of Health Technical Memorandum 07-04, greywater cannot be considered for healthcare environments due to contamination risk.

**2.3.2 All developments should be designed to incorporate rainwater harvesting:**

The incorporation of rainwater harvesting will be investigated for applications where infection control is not an issue (e.g. staff WCs), providing this can provide a valuable saving in potable water consumption. It is currently thought, however, that due to the small roof area the yield may not be sufficient to provide a valuable reduction. This will be confirmed.

**2.3.3 Non-domestic development will be expected to meet BREEAM water efficiency credits:**

Based on the current BREEAM strategy this will be met. A 12.5% improvement in potable water consumption over the notional baseline is anticipated through the specification of low water consuming sanitaryware and kitchenware.

**2.3.4 Developments must not increase, and where possible reduce, surface water runoff through increasing permeable surfaces and use of SUDS:**

This has been achieved. The existing site comprises hard standing and buildings, with no soft / permeable land cover. The design incorporates a number of areas of soft landscaping, a green roof and blue roof and, as such, impermeable land cover will be reduced from 1190m$^2$ to 760m$^2$, thereby reducing surface water runoff compared to the existing site. As further described in the Heyne Tillett Steel flood risk assessment (FRA) and SuDs strategy report (ref: 2222), submitted as part of the planning application, SuDs interventions (green and blue roofs) will result in a minimum 80% betterment in run-off rates for the

developed site. Calculations regarding the pre and post surface water runoff calculations are provided in the FRA and SuDs strategy report, which is appended to the Structural Method Statement.

**2.3.5 Developments must not increase flood risk and must reduce the risk of flooding where possible. Major developments will need to constrain runoff volumes for a 1 in 100 year, 6 hour rainfall event, where feasible:**

As described in paragraph 2.3.4, net impermeable land cover will decrease as a result of the development. As such the risk of flooding will not be increased. The drainage strategy has been designed to incorporate increases in runoff volume as a result of climate change. At present the intention is to utilise the blue and green roofs to restrict runoff rates to as close to greenfield rates as possible. Further details can be found in the FRA and SuDs strategy report, which is appended to the Structural Method Statement.

**2.3.6 All sites of one hectare or more require a flood risk assessment in line with the NPPF. A drainage report is also required for all major applications, basement development, and vulnerable development in areas at risk of flooding. Developments are required to pass the exemption test set out in the NPPF:**

A separate flood risk assessment, prepared by Heyne Tillet Steel, is provided as part of the Planning submission (report ref: 2222). The report concludes that the site is within Flood Zone 1 and therefore not at risk of flooding.

**2.3.7 Developments will be required to:**

- **Incorporate water efficiency measures;**
- **Avoid harm to the water environment and improve water quality;**
- **Consider the impact of development in areas at risk of flooding (including drainage);**
- **Incorporate flood resilient measures in areas prone to flooding;**
- **Utilise SUDS in line with the drainage hierarchy to achieve a greenfield run-off rate where feasible; and**
- **Not locate vulnerable development in flood prone areas.**

As per paragraph 2.3.3, water efficiency measures in the form of low water consuming sanitaryware and kitchenware will be provided, as well as water leak detection, flow control devices, and water metering and sub metering.

The site is situated in a low flood risk zone (Flood Zone 1). As a result of increased permeable land cover, the development will not increase the risk of flooding.

The current intention is to reuse the existing outfall from the site which discharges directly into a combined sewer and, as such, the impact of the site regarding watercourse pollution is considered negligible. Petrol interceptors will be provided to prevent harm to the water environment, however, and the blue and green roofs will act as filters for rainwater, thereby improving water quality.

**2.3.8 Where an assessment of flood risk is required, developments should consider surface water flooding in detail and groundwater flooding where applicable:**

This information is provided in the FRA and SuDs strategy report, which is appended to the Structural Method Statement.

**2.3.9 Incorporate measures such as smart metering, water saving and recycling measures to help achieve lower water consumption rates and to maximise future-proofing:**

BDP MEP have confirmed that smart metering will be provided, as required.

**2.3.10 Promote the protection and improvement of the water environment in line with the Thames River Basin Management Plan, take account of Catchment Plans, and support wastewater treatment infrastructure investment to accommodate London's growth and climate change impacts. Developments should seek to improve the water environment and ensure adequate wastewater infrastructure is provided and take action to minimise the potential for misconnections between foul and surface water networks:**

This information will be provided in the Heyne Tillet Steel FRA and SuDs Strategy report, appended to the Structural Method Statement.

**2.3.11 Development Plans should use the Mayor's Regional Flood Risk Appraisal and their Strategic Flood Risk Assessment as well as Local Flood Risk Management Strategies, where necessary, to identify areas where particular and cumulative flood risk exists and develop actions and policy approaches aimed at reducing these risks:**

The site is not at risk of flooding and, as such, actions and approaches to reducing cumulative flood risk is not required. Details are provided in the FRA and SuDs strategy report, appended to the Structural Method Statement.

**2.3.12 Proposals should contribute to the delivery of the measures set out in the Thames Estuary 2100 Plan:**

Heyne Tillet Steel have confirmed that as the site is not in a flood risk zone, this does not need to be considered.

**2.3.13 Development proposals for utility services should be designed to remain operational under flood conditions and buildings should be designed for quick recovery following a flood:**

BDP MEP have confirmed that as the site is not in a flood risk zone this will not be an issue.

**2.3.14 Development proposals for impermeable surfacing should be refused unless they can be shown to be unavoidable, including on small surfaces such as front of gardens and driveways:**

The existing site consists entirely of impermeable surfaces. The proposed building will almost entirely fill the site, including the lower ground floor which will extend below ground to the rear. However, net impermeable surface will decrease significantly as a result of the development through the provision of the green roofs.

**2.3.15 Drainage should be designed and implemented in ways that promote multiple benefits including increased water use efficiency, improve water quality, and enhance biodiversity, urban greening, amenity and recreation.**

The green and blue roofs provide a number of ecosystem services including, but not limited to: supporting biodiversity through the creation of new habitats and improving connectivity; surface water attenuation; improving water quality; improving air quality through pollution and carbon sequestration; providing amenity space; and additional cultural services such as recreation, opportunities for social cohesion, and contact with nature (therefore also improving health and mental wellbeing).

## 2.4 Waste Reduction

The following section aims to demonstrate how the development has responded to the sustainability requirements listed in the following policies:

Relevant policies:

- London Plan Policies 5.3, 5.20
- Camden Core Strategy CS13 Tackling Climate Change Through Promoting Higher Environmental Standards
- Camden Local Plan Policy CC1 Climate Change Mitigation
- Camden Local Plan Policy CC2 Adapting to Climate Change
- Camden Local Plan Policy CC5 Waste
- Draft London Plan, July 2019

**2.4.1 All developments to optimise resource efficiency, minimising the generation of waste and maximising reuse or recycling:**

A pre-demolition audit has been carried out by General Demolition (report reference: IMS/HS/063 – Version 1/1) to inform the reuse or recycling of demolition materials (see Appendix 3). It is currently anticipated that 100% of inert demolition waste will be re-used on site and 100% of non-hazardous waste will be recycled off site.

Following this, the design team have confirmed that resources will be optimised through design in line with the BREEAM Mat 06 (Material Efficiency) credit. Examples of this include:

- Increasing the utilisation factor of structural members
- Designing to standard material dimensions to reduce off-cuts and waste on site
- Removing redundant materials from the design
- Using materials that can be recycled or reused at the end of their service life
- Making use of recycled or reclaimed materials
- Designing for deconstruction and material reuse
- Using pre-fabricated elements where appropriate to reduce material waste
- Consider using an 'exposed thermal mass' design strategy to reduce finishes
- Avoiding over-specification of predicted loads
- Using lightweight structural design strategies
- Making use of bespoke structural elements where this will reduce overall material use
- 'Rationalisation' of structural elements
- Optimising the foundation design for embodied environmental impact.

Furthermore, in line with BREEAM Wst 01 (Construction Waste Management) requirements, the principal contractor will be required to limit waste generation to ≤7.5$m^3$ volume / ≤6.5 tonnes of non-hazardous construction waste per 100$m^2$ gross internal floor area. At least 70% of non-demolition waste (by volume) and 80% of demolition waste (by volume) will be diverted from landfill.

**2.4.2 At least 10% of the total value of materials used are to be derived from recycled and reused sources. This should relate to the WRAP Quick Wins or equivalent*:**

This will be investigated as the design progresses. It is currently anticipated that this may be met through the use of PFA (pulverised fuel ash) or GGBS (ground granulated blast-furnace slag) in concrete.

**2.4.3 Major developments are anticipated to achieve 15 – 20% of the total value of materials used to be derived from recycled and reused resources*:**

As above.

*Not identified within the listed policies but stated on the Camden Council webpage for Sustainability Statements (https://www.camden.gov.uk/sustainability-statements)

**2.4.4 Proposals for substantial demolition should be justified in terms of the optimisation of resources and energy use, in comparison with the existing building:**

The existing building is not suitable for reuse in this setting and as such demolition is unavoidable. The team will, however, utilise the information arising from pre-demolition audit to investigate the potential reuse or recycling of demolition materials.

**2.4.5 Where demolition cannot be avoided, developments are expected to divert 85% of waste from landfill:**

This will form part of the contractor's requirements.

**2.4.6 The development must include facilities for the storage and collection of waste and recycling:**

This will be met in line with both local planning and BREEAM requirements.

**2.4.7 Resource conservation, waste reduction, increases in materials re-use and recycling, and reductions in waste going for disposal will be achieved by the Mayor, waste planning authorities and industry working in collaboration to:**

- **Promote a more circular economy that improves resource efficiency and innovation to keep products and materials at their highest use for as long as possible**
- **Encourage waste minimisation and waste prevention through materials reuse.**
- **Achieve >95% of construction and demolition waste to reuse/recycling/recovery and >95% of excavation waste for beneficial use.**
- **Design developments with adequate, flexible and easily accessible storage space and collection systems that support, as a minimum, the separate collection of dry recyclables (at least card, paper, mixed plastics, metals, glass) and food.**

A statement on circular economy has been provided by Norton Mayfield Architects (Appendix 4). The statement summarises how circular economy has been considered within the design. Examples include:

- A pre-demolition audit (see Appendix 3) has been undertaken to determine whether materials reuse is feasible.
- In order to reduce waste and the need for replacement, robust materials have been specified, e.g. the masonry and faiance to the main façade and aluminium framed glazing.
- The design is such so that the building could be easily adapted into offices or residential dwellings following the completion of the 30 year NHS lease.
- Pre-fabricated building elements are being considered. This will reduce waste.
- The interior fit out specification will be standardised to suit the tenants existing supply change. This will provide efficiencies in installation, repairs and maintenance.
- Wherever possible, materials with recycled content will be specified, e.g. concrete will include recycled aggregate such as GGBS.

For further details regarding considerations of the circular economy please refer to the statement in Appendix 4 of this report.

As discussed in the preceding paragraphs, waste will be minimised in line with BREEAM requirements, thereby demonstrating best practice.

**2.4.8 Submit a Circular Economy Statement (in line with the requirements within the Plan document – page 299) to demonstrate how the circular economy is promoted and how net zero-waste is targeted:**

Please refer to paragraph 2.4.7.

## 2.5 Travel

The following section aims to demonstrate how the development has responded to the sustainability requirements listed in the following policies:

- Camden Core Strategy CS13 Tackling Climate Change Through Promoting Higher Environmental Standards
- Draft London Plan, July 2019

### 2.5.1 Demonstrate how the location of the development minimises the need to travel by car:

The PTAL report (Appendix 5) for postcode NW1 0TH confirms that the site has an accessibility index of 43.6 and is in a 6b zone, with 6b having the highest accessibility indices / best access to public transport compared to zones 0 – 6a. With strong transport links, the provision of cycle spaces (in line with the draft London Plan requirements), and limited access to parking, the need to travel by car is minimised.

### 2.5.2 Encourage and facilitate active travel with convenient and inclusive pedestrian and cycle routes, crossing paths, cycle parking, and legible entrances to buildings that are aligned with people's movement patterns and desire lines in the area:

The proposals have been designed to meet the draft London Plan requirements for active travel with clearly defined pedestrian and cycle entrances directly off the main pedestrian and cycle routes, adjacent to the site, with secure internal cycle storage and provision for access from the rear, for future potential pedestrian routes to this side of the building.

## 2.6 Ecology and biodiversity

The following section aims to demonstrate how the development has responded to the sustainability requirements listed in the following policies:

- London Plan Policy 5.3, 5.10, 5.11 7.19
- Camden Core Strategy CS13 Tackling Climate Change Through Promoting Higher Environmental Standards
- Camden Local Plan Policy CC2 Adapting to Climate Change
- Camden Development Policy DP22 Promoting Sustainable Design and Construction
- Draft London Plan, July 2019

### 2.6.1 Protect existing green spaces and promote new appropriate green infrastructure:

As confirmed within the preliminary ecological assessment (prepared by BDP, dated December 2019), the application site comprises buildings and bare ground with small areas of ephemeral and tall ruderal vegetation, and 2 trees. There is no green space present within the existing site. New green infrastructure is promoted as follows:

i. At ground floor level the proposals increase the overall number of trees from 2nr to 4nr.
ii. The building façade will be greened through the use of planters / climbing plants within the upper floors of both the front and rear elevations.
iii. Two accessible roof terraces containing a variety of planting are proposed.

### 2.6.2 Incorporate biodiverse roofs, combination green and blue roofs and green walls where appropriate:

The scheme includes the following:

i. A blue roof to the top level roof terrace.

ii. Both extensive (inaccessible) and intensive (accessible) roof systems are proposed within the top level terrace. An intensive roof space is proposed within the lower terrace.

**2.6.3 No net loss in the quality and quantity of biodiversity:**

As confirmed within the preliminary ecological assessment, prepared by BDP (dated December 2019), the site is of low ecological value in terms of vegetation, with no nationally rare of locally rare plant species identified. The report also confirms that no bats were identified during the presence / absence survey carried out on 18th July 2019, and that none of the existing buildings currently support any bat roosts.

Although the exact change in ecological value has not yet been calculated, no net loss is recorded and an increase in the quantity and quality of biodiversity is anticipated.

**2.6.4 Make a contribution to biodiversity on the site:**

The Phase 1 ecology survey (as reported in the preliminary ecological assessment) identified the presence of Japanese Knotweed on the site. Japanese Knotweed is a highly invasive species which suppresses the growth of other plant species. This will be removed prior to the commencement of site activities. Furthermore, existing vegetation consists of a small area of scrub and 2 semi-mature trees, and as such the site is deemed to be of low ecological value. The current planting scheme will improve the ecological value of the site and support biodiversity.

Furthermore, as a result of the landscape and planting strategy, an increase in biodiversity is anticipated.

**2.6.5 Major developments should contribute to the greening of London by including green infrastructure; develop an Urban Greening Factor to identify the appropriate amount of urban greening required (recommended target score of 0.3 for commercial development) and; existing green cover should be retained:**

The Urban Greening Factor for the proposed site is 0.1879, as calculated by the BDP Ecologist. Although this is below the recommended 0.3, it is a substantial improvement over the Urban Greening Factor for the existing site (0.017). Planting has been maximised throughout the scheme, e.g. the incorporation of the green roof and street planting, and as such the biodiversity and ecological value of the site is likely to have an overall improvement, and will contribute towards the greening of London.

## 2.7 Air Quality

The following section aims to demonstrate how the development has responded to the sustainability requirements listed in the following policies:

- London Plan Policy 5.3, 7.14
- Camden Local Plan Policy CC4 Air Quality
- Camden Development Policy DP22 Promoting Sustainable Design and Construction
- Draft London Plan, July 2019

**2.7.1 The Council will take into account the impact of air quality when assessing development proposals, through the consideration of both the exposure of occupants to air pollution and the effect of the development on air quality. Consideration must be taken to the actions identified in the Councils Air Quality Action Plan:**

- Heating and hot water will be provided by air source heat pumps rather than boilers, thereby reducing pollution.
- The introduction of additional trees and planting will help sequester external pollution.
- Low VOC and formaldehyde paints, varnishes, flooring, ceiling tiles and finishing products will be used, in line with BREEAM requirements.

- Indoor air quality will be improved as a result of a fully mechanically ventilated building with F7 (or similar) filters.
- Due to strong public transport links and the provision of cycle parking, in line with the draft London Plan requirements, the need for car-based transport is minimised, thereby reducing emissions.

**2.7.2 Air Quality Assessments (AQAs) are required where development is likely to expose residents to high levels of air pollution. Where the AQA shows that a development would cause harm to air quality, measures are adopted to mitigate the impact:**

An air quality assessment has been provided separately as part of the Planning submission.

**2.7.3 Development that involves significant demolition, construction or earthworks will also be required to assess the risk of dust and emissions impacts in an AQA and include appropriate mitigation measures to be secured in a Construction Management Plan:**

As per paragraph 2.7.2, an air quality assessment report has been provided as part of the Planning submission. Furthermore, dust and emissions from demolition and construction works will be addressed in line with BREEAM Man 03 (Construction Site Impacts) requirements.

**2.7.4 Design the scheme so that it is 'air quality neutral' and minimises the generation of air pollution:**

This is discussed in the AQA.

**2.7.5 Developers and contractors should follow the guidance set out in the emerging 'minimising dust and emissions from construction and demolition SPG' when constructing their development:**

This will form part of the contractor's requirements.

**2.7.6 Developments should not reduce air quality and should tackle poor air quality. Proposals must be at least air quality neutral. Major developments must submit an AQA:**

Air quality is addressed as per the examples listed in paragraph 2.7.1. Further details can be found in the AQA.

**2.7.7 In order to reduce the impact on air quality during the construction and demolition phase, development proposals must demonstrate how they plan to comply with the Non-Road Mobile Machinery Low Emission Zone and reduce emissions from the demolition and construction of buildings following best practice guidance:**

This will be considered further in the following stages, alongside BREEAM requirements.

## 2.8 Materials

The following section aims to demonstrate how the development has responded to the sustainability requirements listed in the following policies:

- London Plan Policies 5.3, 5.20, 7.6 and 7.14
- Camden Core Strategy CS13 Tackling Climate Change Through Promoting Higher Environmental Standards

### 2.8.1 Securing sustainable procurement of materials, using local supplies where feasible:

The use of sustainable and local materials has been considered in the material selection so far. Further research will be undertaken prior to the final selection of materials.

### 2.8.2 At least 3 main building elements to achieve A+ - D ratings under the Green Guide to Specification:

It is now widely accepted that the Green Guide to Specification is out of date and no longer an accurate representation of low impacting materials. As an alternative, BDP have been appointed to carry out a building life cycle analysis (LCA, using IMPACT complaint software, and in line with BREEAM issue Mat 01 (Environmental Impacts from Construction Products – building life cycle assessment). This has informed the design, with superstructure, substructure, hard landscaping and core services components specified on the basis of having the lowest / lower whole life environmental impacts and embodied carbon.

### 2.8.3 At least 50% of timber and timber products to be FSC or PEFC certified:

As per the BREEAM requirements, to which the team are signed up to, 100% of all timber and timber products used on the site will be PEFC and FSC certified.

# 3. Conclusion

This report summarises the sustainability credentials of the Royal College Street development in relation to the requirements of the Camden Local Plan 2017, Camden Development Policies 2010 – 2025, Camden Core Strategy 2010 – 2025, London Plan (2016, adopted) and the Draft London Plan (version July 2019).

One of the key ambitions for the design team has been to deliver a zero carbon development, with on site and passive measures, including the incorporation of an air source heat pump and 200m$^2$ PV array accounting for a 35% improvement over Part L 2013 Building Regulations, and the remaining carbon reductions being met through offsetting.

In addition to operational carbon, the design team have also considered the impact of embodied carbon, having undertaken a Building Life Cycle Assessment in order to appraise a number of materials options to allow the selection of those with the lowest overall lifecycle impacts.

Issues such as improving biodiversity has also been key, with the incorporation of two green roofs, a blue roof, winter gardens and street trees improving the overall ecological value of the site, as well as contributing to surface water attenuation, and reducing the urban heat island effect.

The many sustainability features related to the development are largely captured and reflected within the BREEAM pre-assessment, for which an “Excellent” rating is targeted.

# Appendix 1: BREEAM Pre-Assessment

# 60-86 Royal College Street

BREEAM New Construction 2018 (Healthcare): PRE-ASSESSMENT (revision 1)

**20-Jan-20**

BDP.

Credit targeted

Credit not targeted / cannot be achieved

| Title | Credit Ref | Credits available | Route to Excellent (min. 70%) 75.75% | Potential (easily achieved) 15.81% | Potential (at cost / investigation required) 16.10% | Compliance Requirements | Responsibility | RIBA Stage | Comments |
|---|---|---|---|---|---|---|---|---|---|
| **MANAGEMENT (1 credit = 0.53%)** | | | | | | | | | |
| **Man 01: Project brief and design** | | | | | | | | | |
| Project Delivery Planning | Man 01-01 | **1** | **1** | | | 1. Prior to completion of the Concept Design, the project delivery stakeholders (see comments) meet to identify and define for each key phase of project delivery:<br>a. Roles<br>b. Responsibilities<br>c. Contributions | | | Project stakeholders: Client, the building occupier, the design team and the principal contractor. Contractors' involvement ensures their input in terms of formulating sustainable design solutions, commenting or inputting on the practicality and buildability of (one or more) design solutions and their impact on programming, cost etc. BREEAM recognises that traditionally for some projects, the contractor for the works is not appointed at the early project stages and therefore compliance with this criterion would not be possible. In these instances, to ensure the aim of the criteria is upheld, the criterion is met if a suitably experienced person with substantial construction or contracting experience in projects similar to the proposed works is involved prior to appointment of the contractor. A suitably experienced person could be a contractor appointed as a consultant for this stage or a construction project manager. |
| | | | | | | 2. Consider each one of the following items when defining roles, responsibilities and contributions for each key phase of the project:<br>a. End user requirements<br>b. Aims of the design and design strategy<br>c. Particular installation and construction requirements/limitations<br>d. Occupiers budget and technical expertise in maintaining any proposed systems<br>e. Maintainability and adaptability of the proposals<br>f. Operational energy (see Ene 01 for further details)<br>g. Requirements for the production of project and end user documentation<br>h. Requirements for commissioning, training and aftercare support. | Architect | 2 | |
| | | | | | | 3. The project team demonstrate how the project delivery stakeholder's contributions and the consultation process outcomes influence the following:<br>a. Initial Project Brief<br>b. Project Execution Plan<br>c. Communication Strategy<br>d. Concept Design. | | | |

| Title | Credit Ref | Credits available | Route to Excellent (min. 70%) 75.75% | Potential (easily achieved) 15.81% | Potential (at cost / investigation required) 16.10% | Compliance Requirements | Responsibility | RIBA Stage | Comments |
|---|---|---|---|---|---|---|---|---|---|
| Stakeholder consultation (interested parties) | Man 01-02 | **1** | **0** | **1** | | 4. Prior to completion of the Concept Design, the independent third party consults with all interested parties (see comments) on matters that cover the minimum consultation content:<br>1. Functionality, build quality and impact (including aesthetics).<br>2. Provision of appropriate internal and external facilities (for future building occupants and visitors or users).<br>3. Management and operational implications.<br>4. Maintenance resources implications.<br>5. Impacts on the local community, e.g. local traffic or transportation impact.<br>6. Opportunities for shared use of facilities and infrastructure with the community or appropriate stakeholders.<br>7. Compliance with statutory (national or local) consultation requirements.<br>8. Energy use and sustainability measures.<br>9. Implementing principles and processes that deliver an inclusive and accessible design.<br>In the case of educational building types, minimum content also includes:<br>10. How the building or grounds could best be designed to facilitate learning and provide a range of social spaces appropriate to the needs of a diverse range of pupils, students and other users, including people of all abilities.<br>In the case of building types containing technical areas or functions, e.g. laboratories, workshops etc., minimum content also includes:<br>11. The end users' broad requirements for such facilities, including appropriate sizing, optimisation and integration of equipment and systems. | Architect | 2 | 01.02.19 (pre-assessment workshop): Third party consultation will be undertaken by an independent third party, however it is not known whether the relevant BREEAM criteria will all be met. This will be investigated.<br><br>*Interested parties include:<br>1. Actual or intended building users (if known) including facilities management staff or those responsible for the day-to-day operation of the building and grounds.<br>2. Representative consultation group from the existing community (if the building is a new development in an existing community) or for a community still under construction.<br>3. Existing partnerships and networks that have knowledge of, and experience of working on, existing buildings of the same type.<br>4. Potential users of any shared facilities, e.g. operators of clubs and community groups.<br>AND the following where relevant:<br>5. In educational building types, representatives of local education authorities, board of governors etc.<br>6. Local or national historic or heritage groups (over and above any requirements relating to statutory consultees).<br>7. Specialist service and maintenance contractors or representatives where the building function has particular technical requirements in complex environments, e.g. buildings containing laboratories.<br><br>**A third party or a person or body internal to a party involved (parties involved are typically a supplier (1st party) or purchaser (2nd party)), who shall not be involved in the issue in question, and shall not have conflicts of interests resulting from their position. To comply with the criterion relating to the use of an independent party, the client or design team needs to demonstrate either:<br>1. They have used a party independent of the design process to conduct the necessary consultation exercise; OR<br>2. If the consultation is to be carried out by an organisation involved with the design of the building, e.g. the project architect, then they must present the assessor with evidence that robustly demonstrates the independence of the consultation process. BREEAM has not attempted to define what form this evidence must take; the onus is on the design team or relevant individual to clearly demonstrate to the BREEAM Assessor a credible level of independence. |
| | | | | | | 5. Demonstrate how the stakeholder contributions and consultation exercise outcomes influence the Initial Project Brief and Concept Design. | | | |
| | | | | | | 6. Prior to completion of the detailed design (RIBA Stage 4, Technical Design or equivalent), all interested parties (see Definitions on page 40 of guidance manual) give and receive consultation feedback. | | 4 | |
| | | | | | | 7. An independent party** carries out the consultation exercise. The Design Quality Indicator and the Achieving Excellence Design Evaluation Toolkit could be used as methods to assess the design quality of buildings. | | | |
| BREEAM AP (Concept Design) | Man 01 pre | - | - | - | - | 8. The project team, including the client, formally agree strategic performance targets early in the design process with the support of the BREEAM AP where appointed). | Client / BREEAM AP | 2 | BDP were appointed at Stage 1 and as such this will be met. |
| | Man 01-03 | **1** | **1** | | | 9. Involve a BREEAM AP in the project at an appropriate time and level to:<br>a. Work with the project team, including the client, to consider the links between BREEAM issues and assist them in maximising the project's overall performance against BREEAM, from their appointment and throughout Concept Design.<br>b. Monitor progress against the performance targets (see Definitions on page 37) agreed under criterion 8 throughout all stages after their appointment where decisions critically impact BREEAM performance.<br>c. Proactively identify risks and opportunities related to the achievement of the targets agreed under criterion 8.<br>d. Provide feedback to the project team as appropriate, to support them in taking corrective actions and achieving their agreed performance targets.<br>e. Monitor and, where relevant, coordinate the generation of appropriate evidence by the project team. | | | |

| Title | Credit Ref | Credits available | Route to Excellent (min. 70%) 75.75% | Potential (easily achieved) 15.81% | Potential (at cost / investigation required) 16.10% | Compliance Requirements | Responsibility | RIBA Stage | Comments |
|---|---|---|---|---|---|---|---|---|---|
| BREEAM AP (Developed Design) | Man 01-04 | **1** | **1** | | | 10. Criteria 8 and 9 are achieved.<br>11. Involve the BREEAM AP in the project at an appropriate time and level to:<br>a. Work with the project team, including the client, to consider links between BREEAM issues and to assist them in maximising the project's overall performance against BREEAM throughout developed design.<br>b. Monitor progress against the performance targets agreed under criterion 8, throughout all stages where decisions critically impact the specification and tendering process and the BREEAM performance.<br>c. Proactively identify risks and opportunities related to the achievement of the targets agreed under criterion 8.<br>d. Provide feedback to the project team as appropriate, to support them in taking corrective actions and achieving their agreed performance targets.<br>e. Monitor and, where relevant, coordinate the generation of appropriate evidence by the project team. | BREEAM Assessor | 4 | |
| **Man 02: Life Cycle Cost and Service Life Planning** | | | | | | | | | |
| Elemental life cycle cost (LCC) | Man 02-01 | **2** | **2** | | | 1. A competent person carries out an outline, entire asset LCC plan at Process Stage 2 (equivalent to Concept Design - RIBA Stage 2) together with any design options appraisals in line with 'Standardised method of life cycle costing for construction procurement' PD 156865:2008. | Cost Consultant | 2 | |
| | | | | | | 2. The elemental LCC plan:<br>a. Provides an indication of future replacement costs over a period of analysis as required by the client (e.g. 20,30,50 or 60 years);<br>b. Includes service life, maintenance and operation cost estimates.<br>The study period should ideally be agreed by the client, in line with the design life expectancy of the building. However, where the life expectancy of the building is not yet formally agreed (due to being at very early design stages), the default design life of 60 years should be used for modelling purposes (in line with the UK default). | Cost Consultant | | |
| | | | | | | 3. Demonstrate, using appropriate examples provided by the design team, how the elemental LCC plan has been used to influence building and systems design/specification to minimise life cycle costs and maximise critical value. | Architect / MEP | | |
| Component level LCC Option Appraisal | Man 02-02 | **1** | **1** | | | 4. A competent person develops a component level LCC options appraisal by the end of Process Stage 4 (equivalent to Technical Design – RIBA Stage 4) in line with PD 156865:2008. The component level LCC includes (where present):<br>a. Envelope, e.g. cladding, windows, and/or roofing<br>b. Services, e.g. heat source cooling source, and/or controls<br>c. Finishes, e.g. walls, floors and/or ceilings<br>d. External spaces, e.g. alternative hard landscaping, boundary protection<br>The component level LCC option appraisal should review all of the above component types (where present). However, you do not need to consider every single example cited under each component; only a selection of those most likely to draw valued comparisons. This is to ensure that a wide range of options are considered and help focus the analysis on components which would benefit the most from the appraisal. | Cost Consultant | 4 | |
| | | | | | | 5. Demonstrate, using appropriate examples provided by the design team, how the component level LCC options appraisal has been used to influence building and systems design/specification to minimise life cycle costs and maximise critical value. | Architect / MEP | | |
| Capital cost reporting | Man 02-03 | **1** | **1** | | | 6. Report the capital cost for the building in pounds per square metre of gross internal floor area (£k/m2), as part of the submission to BRE. The capital cost for the building includes the expenses related to the initial construction of the building:<br>– Construction, including preparatory works, materials, equipment and labour<br>– Site management<br>– Construction financing<br>– Insurance and taxes during construction<br>– Inspection and testing<br><br>Costs related to land procurement, clearance, design, statutory approvals and post occupancy aftercare are not included. | Contractor | | This is considered an 'easy win'. |
| **Man 03: Responsible Construction Practices** | | | | | | | | | |
| Pre-requisite | Man 03-pre | - | - | - | - | 1. All timber and timber based products used during the construction process of the project are 'Legally harvested and traded timber'. | Contractor | | |
| | | | | | | 2 NHS buildings only: To award any of the available credits for this issue, any party who at any stage manages the construction site (e.g. the principal contractor, the demolition contractor) operates an Environmental Management System (EMS) (see requirements of criterion 3 below). | Client / Contractor | | |

| Title | Credit Ref | Credits available | Route to Excellent (min. 70%) 75.75% | Potential (easily achieved) 15.81% | Potential (at cost / investigation required) 16.10% | Compliance Requirements | Responsibility | RIBA Stage | Comments |
|---|---|---|---|---|---|---|---|---|---|
| Environmental management | Man 03-01 | **1** | **1** | | | 3. All parties who at any stage manage the construction site (e.g. the principal contractor, the demolition contractor) operate an EMS covering their main operations.<br>The EMS must:<br>a. Be third party certified, to ISO 14001:2015/EMAS or equivalent standard; or<br>b. In compliance with BS 8555:2016 have:<br>i. Appropriate structure<br>ii. Reached implementation stage phase four 'implementation and operation of the environmental management system'<br>iii. Completed defined phase audits one to four. | Contractor | | The principal contractor should be ISO 14001 accredited. |
| | | | | | | 4. All parties who at any point manage the construction site (e.g. the principal contractor, the demolition contractor) implement best practice pollution prevention policies and procedures on site in accordance with Working at construction and demolition sites: PPG6, Pollution Prevention Guidelines. | | | |
| BREEAM AP (Site) | Man 03-02 pre | - | - | - | - | 5. The client and the contractor formally agree performance targets. | Project Manager | | Requires someone in the contractor team to be a BREEAM AP. Alternatively, the contractor can appoint a third party. |
| | Man 03-02 | **1** | **1** | | | 6. Involve a BREEAM AP in the project at an appropriate time and level to:<br>a. Work with the project team, including the client, to consider the links between BREEAM issues and assist them in achieving and if possible going beyond the design intent, to maximise the project's performance against the agreed performance targets throughout the Construction, Handover and Close Out stages.<br>b. Monitor construction progress against the performance targets agreed under criterion 5 above throughout all stages where decisions critically impact BREEAM performance.<br>c. Proactively identify risks and opportunities related to the procurement and construction process and the achievement of the targets agreed under criterion 5.<br>d. Provide feedback to the constructors and the project team as appropriate, to support them in taking corrective actions and achieving their agreed performance targets.<br>e. Monitor and, where relevant, coordinate the generation of appropriate evidence by the project team and the provision to the assessor. | Contractor | | |
| Responsible Construction Management | Man 03-03 | **2** | **2** | | | 7. Achieve items listed as required for one credit in table 4.1 of the guidance manual.<br>Two credits:<br>8. Achieve criterion 7<br>9. Achieve six additional items in table 4.1 of the guidance manual. | Contractor | | **1 credit is required for Excellent** |

| Title | Credit Ref | Credits available | Route to Excellent (min. 70%) 75.75% | Potential (easily achieved) 15.81% | Potential (at cost / investigation required) 16.10% | Compliance Requirements | Responsibility | RIBA Stage | Comments |
|---|---|---|---|---|---|---|---|---|---|
| Monitoring of construction-site impacts | Man 03-04 | **2** | **2** | | | 10. Responsibility has been assigned to an individual(s) for monitoring, recording and reporting energy use, water consumption and transport data (where measured) resulting from all on-site construction processes (and dedicated off-site manufacturing) throughout the build programme. To ensure the robust collection of information, this individual(s) must have the appropriate authority and responsibility to request and access the data required. Where appointed, the BREEAM AP could perform this role. | Contractor | | |
| | | | | | | **First Monitoring Credit - Utility consumption**<br><br>**Energy consumption**<br>11. Achieve criterion 10.<br>12. Set targets for the site energy consumption in kWh (and where relevant, litres of fuel used) as a result of the use of construction plant, equipment (mobile and fixed) and site accommodation.<br>13. Monitor and record date for the energy consumption described in criterion 12.<br>14. Report the total carbon dioxide emissions (total kgCO2/project value) from the construction process via the BREEAM Projects (for the purposes of potential future BREEAM performance benchmarking).<br><br>**Water consumption**<br>15. Achieve criterion 10.<br>16. Set targets for the potable water consumption ($m^3$) arising from the use of construction plant, equipment (mobile and fixed) and site accommodation.<br>17. Monitor and record data for the potable water consumption described in criterion<br>18. Use the collated data to report the total net water consumption ($m^3$), i.e. consumption minus any recycled water use from the construction process via BREEAM Projects (for the purposes of potential future BREEAM performance benchmarking). | Contractor | | |
| | | | | | | **Second Credit - Transport of construction materials and waste**<br>19. Achieve Criterion 10.<br>20. Set targets for transportation movements and impacts resulting from delivery of the majority of construction materials to site and construction waste from site. As a minimum cover:<br>20.a. Transport of materials from the point of supply to the building site, including any transport, intermediate storage and point of supply. Monitor as a minimum:<br>20.a.i. Materials used in major building elements (e.g. those defined in BREEAM issue Mat01 Environmental impacts from construction products - Building life cycle assessment (LCA).<br>20.a.ii. Ground works and landscaping materials.<br>20.b. Transportation of construction waste from the construction gate to waste disposal processing or recovery centre gate. This monitoring must cover the construction waste groups outlined in the project's resource management plan.<br>21. Monitor and record data for the transportation movement as described in criterion 20.<br>22. Using the collated data, report separately for materials and waste, the total transport-related carbon dioxide emissions ($kgCO_2$-eq) plus total distance travelled (km) via BREEAM Projects (for the purposes of potential future BREEAM performance benchmarking). | Contractor | | |
| Exemplary level criteria | Man 03-Ex | **1** | **1** | | | 23. Achieve all items in Table 4.1 of the guidance manual. | Contractor | | |

| Title | Credit Ref | Credits available | Route to Excellent (min. 70%) 75.75% | Potential (easily achieved) 15.81% | Potential (at cost / investigation required) 16.10% | Compliance Requirements | Responsibility | RIBA Stage | Comments |
|---|---|---|---|---|---|---|---|---|---|
| **Man 04: Commissioning and handover** | | | | | | | | | |
| Commissioning and testing schedule and responsibilities | Man 04-01 | **1** | **1** | | | 1. Prepare a schedule of commissioning and testing. The schedule identifies a suitable timescale for commissioning and re-commissioning of all complex and non-complex building services and control systems and for testing and inspecting building fabric.<br>2. The schedule identifies the appropriate standards for all commissioning activities to be conducted, where applicable, in accordance with:<br>a. Current Building Regulations<br>b. BSRIA guidelines<br>c. CIBSE guidelines<br>d. Other appropriate standards (see Methodology)<br>Exclude from the assessment any process or manufacture-related equipment specified as part of the project. However, include such equipment in cases where they form an integral part of the building HVAC services, such as some heat recovery systems.<br>3. Where a building management system (BMS) is specified:<br>a. Carry out the commissioning of air and water systems when all control devices are installed, wired and functional<br>b. Include physical measurements of room temperatures, off-coil temperatures and other key parameters, as appropriate, in Commissioning results.<br>c. The BMS or controls installation should be running in auto with satisfactory internal conditions prior to handover<br>d. All BMS schematics and graphics (if BMS is present) are fully installed and functional to user interface prior to handover<br>e. Fully train the occupier or facilities team in the operation of the system.<br>4. Appoint an appropriate project team member to monitor and programme pre-commissioning, commissioning and testing. Where necessary include, re-commissioning activities on behalf of the client.<br>5. The principal contractor accounts for the commissioning and testing programme, responsibilities and criteria within their budget and the main programme of works. Allow the required time to complete all commissioning and testing activities prior to handover, | Contractor | | **Mandatory for BREEAM Excellent** |
| Commissioning - design and preparation | Man 04-02 | **1** | **1** | | | 6. Achieve criteria 1-5.<br>7. During the design stage, the client or the principal contractor appoints an appropriate project team member provided they are not involved in the general installation works for the building services systems: with responsibility for:<br>a. Undertaking design reviews and giving advice on suitability for ease of commissioning.<br>b. Providing commissioning management input to construction programming and during installation stages.<br>c. Management of commissioning, performance testing and handover or post-handover stages. For buildings with complex building services and systems, this role needs to be carried out by a specialist commissioning manager. | Contractor | | Requires the appointment of a specialist commissioning manager. |
| Testing and inspecting building fabric | Man 04-03 | **1** | **1** | | | 8. Achieve criteria 1-5.<br>9. Complete post-construction testing and inspection to quality-assure the integrity of the building fabric, including continuity of insulation, avoidance of thermal bridging and air leakage paths (this is through airtightness testing and a thermographic survey). A suitably qualified professional undertakes the survey and testing in accordance with the appropriate standard.<br>10. Rectify any defects identified during post-construction testing and inspection prior to building handover and close out. Any remedial work must meet the required performance characteristics for the building or element as defined at the design stage. | Contractor | | |
| Handover | Man 04-04 | **1** | **1** | | | 11. Prior to handover, develop two building user guides for the following users:<br>a. A non-technical user guide for distribution to the building occupiers<br>b. A technical user guide for the premises facilities managers<br>c. A draft copy is developed and discussed with users first (where the building occupants are known) to ensure the guide is most appropriate and useful to potential users.<br>12. Prepare two training schedules timed appropriately around handover and proposed occupation plans for the following users:<br>a. A non-technical training schedule for the building occupiers<br>b. A technical training schedule for the premises facilities managers. | Contractor | | **Provision of a compliant BUG is mandatory for Excellent** |

| Title | Credit Ref | Credits available | Route to Excellent (min. 70%) 75.75% | Potential (easily achieved) 15.81% | Potential (at cost / investigation required) 16.10% | Compliance Requirements | Responsibility | RIBA Stage | Comments |
|---|---|---|---|---|---|---|---|---|---|
| **Man 05: Aftercare** | | | | | | | | | |
| Aftercare support | Man 05-01 | **1** | **1** | | | 1. Provide aftercare support to the building occupiers through having in place operational infrastructure and resources. This includes as a minimum:<br>a. A meeting between the aftercare support team or individual, and the building occupier or management team (prior to initial occupation, or as soon as possible thereafter) to:<br>i. Introduce the aftercare support available, including the content of the building user guide (where it exists) and training schedule.<br>ii. Present key information on the building including the design intent and how to use the building to ensure it operates as efficiently and effectively as possible.<br>b. On-site facilities management training including:<br>i. a walkabout of the building<br>AND<br>ii. introduction and familiarisation with the building systems, their controls and how to operate them in accordance with the design intent and operational demands.<br>c. Provide initial aftercare support for at least the first month of building occupation, e.g. weekly attendance on-site, to support building users and management (the level of frequency will depend on the complexity of the building and building operations).<br>d. Provide longer term aftercare support for occupiers for at least the first 12 months from occupation, e.g. a helpline, nominated individual or other appropriate system to support building users/management.<br><br>2. Establish operational infrastructure and resources to coordinate the collection and monitoring of energy and water consumption data for a minimum of 12 months, once the building is substantially occupied. This facilities analysis of discrepancies between actual and predicted performance, with a view to adjusting systems and/or user behaviours accordingly. | Contractor | | |
| Commissioning - implementation | Man 05-02 | **1** | **1** | | | 3. Complete the following commissioning activities over a minimum 12-month period, once the building becomes substantially occupied:<br><br>a. Complex systems - Specialist Commissioning Manager will:<br>i. Identify changes made by the owner or operator that might have caused impaired or improved performance.<br>ii. Test all building services under full load conditions, i.e. heating equipment in mid-winter, cooling and ventilation equipment in mid-summer and under part load conditions (spring and autumn).<br>iii. Where applicable, carry out testing during periods of extreme (high or low) occupancy.<br>iv. Interview building occupants (where they are affected by the complex services) to identify problems or concerns regarding the effectiveness of the systems.<br>v. Produce monthly reports comparing sub-metered energy performance to the predicted one (see Ene01 Reduction of energy use and carbon emissions).<br>vi. Identify inefficiencies and areas in need of improvement.<br>vii. Re-commission systems (following any work needed to serve revised loads), and incorporate any revisions in operating procedures into the operations and maintenance (O&M) manuals.<br><br>b. Simple systems (naturally ventilated) - external consultant/aftercare team/facilities manager will:<br>i. Review thermal comfort, ventilation, and lighting, at three, six and nine month intervals after initial occupation, either by measurement or occupant feedback.<br>ii. Identify deficiencies and areas in need of improvement.<br>iii. Re-commission systems and incorporate any relevant revisions in operating procedures into the O&M manuals. | Contractor | | **Mandatory for Excellent**<br><br>Requires a specialist commissioning manager. |

| Title | Credit Ref | Credits available | Route to Excellent (min. 70%) 75.75% | Potential (easily achieved) 15.81% | Potential (at cost / investigation required) 16.10% | Compliance Requirements | Responsibility | RIBA Stage | Comments |
|---|---|---|---|---|---|---|---|---|---|
| Post occupancy evaluation | Man 05-03 | **1** | **1** | | | 4. The client or building occupier makes a commitment to carry out a post-occupancy evaluation (POE) exercise one year after building is substantially occupied. This gains comprehensive in-use performance feedback and identifies gaps between design intent and in-use performance. The aim is to highlight any improvements or interventions that need to be made and inform operational processes.<br><br>5. An independent party carries out the POE covering:<br>a. A review of the design intent and construction process (review of design, procurement, construction and handover processes)<br>b. Feedback from a wide range of building users including facilities management on the design and environmental conditions of the building covering:<br>i. Internal environmental conditions (light, noise, temperature, air quality)<br>ii. Control, operation and maintenance<br>iii. Facilities and amenities<br>iv. Access and layout<br>v. Energy and water consumption<br>vi. Other relevant issues<br><br>6. The independent party provides a report with lessons learned to the client and building occupiers.<br><br>7. The client or building occupier commits funds to pay for the POE in advance. This requires an independent party to be appointed to carry out the POE. Evidence of the appointment of the independent party and schedule of responsibilities which fulfils the BREEAM criteria are acceptable to demonstrate compliance. | Client | | Requires fund to be committed / proof of appointment. |
| **HEALTH AND WELLBEING (1 credit = 0.74%)** | | | | | | | | | |
| **Hea 01: Visual Comfort** | | | | | | | | | |
| Control of Glare from Sunlight | Hea 01-01 | **1** | **1** | | | 1. Identify areas at risk of glare using a glare control assessment, The glare control assessment also justifies any areas deemed not at risk of glare.<br><br>2. Where risk has been identified within a relevant building area, a glare control strategy is used to design out the potential for glare.<br><br>3. The glare control strategy does not increase energy and consumption used for lighting. This is achieved by:<br>a. Maximising daylight levels in all weather, cloudy or sunny AND<br>b. Ensuring the use or location of shading does not conflict with the operation of lighting control systems. | Architect | | Compliant shading measures for meeting glare control criteria can include:<br>– building-integrated measures (e.g. overhangs or fins)<br>– occupant-controlled devices such as opaque Venetian or close weave fabric blinds, (where the openness factor of blinds is 1% or less, and where the fabric light transmittance value is < 0.1 (10%))<br>– external shading or brise soleil. |
| Daylighting | Hea 01-02 | **2** | **0** | | **2** | 4. Daylighting criteria have been met using either of the following options:<br>a. The relevant building areas meet good practice daylight factor(s) and other criterion as outlined in Table -5.1 and Table - 5.2:<br><br>1 credit: minimum 2% daylight factor in at least 60% (m2) of staff and public areas, consulting rooms and occupied patient areas such as dayrooms and wards (and either compliance with the uniformity ration requirements OR view of sky and room depth criteria in Table 5.2.)<br>2 credits: minimum 2% daylight factor in at least 80% (m2) of relevant staff and public areas (and either compliance with the uniformity ration requirements OR view of sky and room depth criteria in Table 5.2.) AND minimum 3% daylight factor in at least 80% (m2) of consulting rooms and occupied patient areas such as dayrooms and wards (and either compliance with the uniformity ration requirements OR view of sky and room depth criteria in Table 5.2.)<br><br>OR<br><br>b. The relevant building areas meet good practice average and minimum point daylight illuminance criteria as outlined in Table - 5.4. | MEP | | Daylight calculations should be undertaken at an early stage to allow this to inform the design. Clinical areas with controlled environmental conditions, e.g. operating theatres, delivery rooms or pathology are excluded from these requirements. However, BREEAM strongly advises that the benefits from daylighting and view out are seriously considered when designing areas of critical and intensive care in healthcare buildings. |

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|---|---|---|---|---|---|---|---|---|---|
| View Out | Hea 01-03 | **2** | **0** | | **2** | 5. 95% of the floor area in relevant building areas is within 8m of an external wall. The external wall has a window or permanent opening that provides an adequate view out.<br><br>6.The window/opening must be ≥ 20% of the surrounding wall area (refer to Relevant definitions in the Additional information section). Where the room depth is greater than 8m, compliance is only possible where the percentage of window/opening is the same as, or greater than, the values in Table 1.0 of BS 8206:part 2.<br><br>**Patient-occupied spaces, e.g. wards and dayrooms:**<br>As criteria 5 and 6 for the relevant building areas PLUS the distance between the wall with the window or opening and nearest external solid object (e.g. buildings, screens, walls or fences) is ≥ 10m. | Architect | | This credit can be difficult to achieve in larger buildings. Compliance must be demonstrated for the percentage of the floor area in each relevant building area, rather than the percentage of the total relevant building area in the building. To be investigated by the design team.<br><br>"Relevant building areas" are those requiring a view out including areas of the building where:<br>1. There are or will be workstations or benches or desks for building users.<br>2. Close work will be undertaken or visual aids will be used.<br>Excluded areas for each of these might include:<br>1. Nurse bases where they are located centrally in a ward or patient area in order to enable patient observation.<br>2. Courts and interview rooms where compliance is not possible due to security or privacy criteria.<br>3. Any clinical areas where the control of environmental or operational conditions prevents such spaces from providing a view out.<br>5. Conference rooms, lecture theatres, sports halls, acute SEN and also any spaces where the exclusion or limitation of natural light is a functional requirement.<br>6. Isolated work station for intermittent, short term work, e.g. work station within a server room. |
| Internal and external lighting levels, zoning and control | Hea 01-03 | **1** | **1** | | | **Internal Lighting**<br><br>8. Internal lighting in all relevant areas of the building is designed to provide illuminance (lux) levels and colouring rendering index in accordance with the SLL code for lighting 2012. and any other relevant industry standard. Internal lighting should be appropriate to the tasks undertaken, accounting for building user concentration and comfort levels.<br><br>9. For areas where computer screens are regularly used, the lighting design complies with CIBSE Lighting Guide 7 sections 2.4, 2.13, 2.15, 2.20, and 6.10 to 6.20. This gives recommendations highlighting:<br>a. Limits to the luminance of the luminaires to avoid screen reflections. (Manufacturers' data for the luminaires should be sought to confirm this.)<br>b. Any area where surface is used to reflect light in to a space such as uplighting, the recommendations refer to the luminance of the lit ceiling rather than the luminaire; a design team calculation is usually required to demonstrate this.<br>c. Recommendations for direct lighting, ceiling illuminance, and average wall illuminance.<br><br>**External Lighting**<br>10. All external lighting located within the construction zone is specified in accordance with BS5489-1:2013 Code for the practice for the design of road lighting. Lighting of roads and public amenity areas and BS EN 12464-2:2014 Light and lighting - lighting of work places - Part 2: Outdoor workplaces. External lighting should provide illuminance levels that enable users to perform outdoor visual tasks efficiently and accurately, especially during the night.<br><br>11. Where no external light fittings are specified (either separate from or mounted on the external building façade of roof), the criteria relating to external lighting do not apply and the credit can be awarded on the basis of compliance with criteria 8-9.<br><br>**Zoning and occupant control**<br>12. Internal lighting is zoned to allow for occupant control. Zoning is in accordance with the criteria below for relevant areas present within the building:<br>a. In office areas, zones of no more than four workplaces<br>b. Workstations adjacent to windows/atria and other building areas separately zoned and controlled<br>c. Seminar and lecture rooms: zoned for presentation and audience areas<br>d. Library spaces: separate zoning of stacks, reading and counter areas<br>e. Teaching space or demonstration area<br>f. Whiteboard or display screen<br>g. Auditoria: zoning of seating areas, circulation space and lectern area<br>h. Dining, restaurant, café areas: separate zoning of servery and seating/dining areas<br>i. Retail: separate zoning of display and counter areas<br>j. Bar areas: separate zoning of bar and seating areas<br>k. Wards or bedded areas: zoned lighting control for individual bed spaces and control for staff over groups of bed spaces<br>l. Treatment areas, dayrooms, waiting areas: zoning of seating and activity areas and circulation space with controls accessible to staff. | MEP | | |

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|---|---|---|---|---|---|---|---|---|---|
| Exemplary level criteria | Hea 01-03 EX | **1** | **0** | | | 15. To achieve an exemplary performance credit for daylighting:<br>Daylighting criteria have been met using either of the following options:<br>a. Relevant building areas meet exemplary daylight factors and the relevant criteria in Table 5.8 of the guidance manual.<br>b. Relevant building areas meet exemplary average and minimum point daylight illuminance criteria in Table 5.9 of the guidance manual. | MEP | | |
| | Hea 01-03 EX | **1** | **0** | **1** | | 16. To achieve an exemplary performance credit for Internal and external lighting levels, zoning and control:<br>Lighting in each zone can be manually dimmed by occupants down to 20% of the maximum light output using dimmer switches positioned in accessible locations. Dimming and control gear should avoid flicker and noise. | MEP | | 01.02.19 (pre-assessment workshop): It was confirmed that this would be easy to achieve technically, however, as dimmable bulbs are more expensive this will have maintenance issues. |
| **Hea 02: Indoor Air Quality** | | | | | | | | | |
| Pre-Requisite | Hea 02-Pre | - | - | - | - | 1. A site-specific indoor air quality plan has been produced and implemented in accordance with the guidance in Guidance Note GN06. The objective of the plan is to facilitate a process that leads to design, specification and installation decisions and actions that minimise indoor air pollution during occupation of the building. The indoor air quality plan must consider the following:<br>a. Removal of contaminant sources<br>b. Dilution and control of contaminant sources (where present, consideration is given to the air quality requirements of specialist areas such as laboratories)<br>c. Procedures for pre-occupancy flush out.<br>d. Third party testing an analysis.<br>e. Maintaining good indoor air quality in-use. | MEP/ Architect | | |
| Ventilation | Hea 02-01 | **1** | **1** | | | 2. The building has been designed to minimise the indoor concentration and recirculation of pollutants in the building as follows:<br>a. Provide fresh air into the building in accordance with the criteria of the relevant standard for ventilation<br>b. Ventilation pathways are designed to minimise the ingress and build-up of air pollutants inside the building<br>c. Where present, HVAC systems must incorporate suitable filtration to minimise external air pollution, as defined in BS EN 13779:2007 Annex A3. The specified filters should achieve a minimum Indoor Air Quality of IDA2.<br>d. Areas of the building subject to large and unpredictable or variable occupancy patterns have carbon dioxide ($CO_2$) or air quality sensors specified and :<br>i. In mechanically ventilated buildings or spaces: sensors are linked to the mechanical ventilation system and provide demand-controlled ventilation to the space.<br>ii. In naturally ventilated buildings or spaces: sensors either have the ability to alert the building owner or manager when $CO_2$ levels exceed the recommended set point, or are linked to controls with the ability to adjust the quantity of fresh air, i.e. automatic opening windows or roof vents.<br>e. For naturally ventilated or mixed mode buildings, the design demonstrates that the ventilation strategy provides adequate cross flow of air to maintain the required thermal comfort conditions and ventilation rates in accordance with CIBSE AM10. | MEP | | |
| Emissions from construction products | Hea 02-02 | **2** | **1** | **1** | | **One credit:**<br><br>3. Three out of the five product types meet the emission limits, testing requirements and any additional requirements listed in Table 5.11 of the guidance manual. Where wood-based products are not one of the three selected product types, all wood-based products used for internal fixtures fittings must be tested and classified as formaldehyde E1 class as a minimum.<br><br>**Two credits:**<br><br>4. All of the product types listed meet the emission limits, testing requirements and any additional requirements listed in Table 5.11 of the guidance manual. | Architect | | |

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|---|---|---|---|---|---|---|---|---|---|
| Post construction indoor air quality measurement | Hea 02-03 | **1** | **1** | | | 5. The formaldehyde concentration indoor air is measured post construction (but pre-occupancy) and does not exceed 100µg/ m³ averaged over 30 minutes. (World Health Organisation guidelines for indoor air quality: Selected pollutants, 2010).<br>6. The formaldehyde sampling and analysis is performed in accordance with ISO 16000-2 and ISO 16000-3.<br>7. The total volatile organic compound (TVOC) concentration in indoor air is measured post construction (but pre-occupancy) and does not exceed 500µg/ m³ over 8 hours.<br>8. The TVOC sampling and analysis is performed in accordance with ISO 16000-5 and ISO 16000-6 or ISO 16017-1.<br>9. Where levels are found to exceed these limits, the project team confirms the measures that have, or will be, undertaken in accordance with the IAQ plan, to reduce TVOC and formaldehyde levels to within the above limits.<br>10. The measured concentration levels of formaldehyde (µg/ m³) are reported via the BREEAM Scoring and Reporting Tool. | Contractor | | |
| Exemplary level criteria | Hea 02-Ex | **1** | **0** | | 1 | 11. Three of the product types listed meet the emission limits, testing requirements and any additional requirements listed in Table 5.12 of the guidance manual. Where wood-based products are not one of the three selected product types, all wood-based products used for internal fixtures and fittings must be tested and classified as formaldehyde E1 class as a minimum, | Architect | | |
| **Hea 04: Thermal Comfort** | | | | | | | | | |
| Thermal Modelling | Hea 04-01 | **1** | **1** | | | 1. Thermal modelling has been carried out using software in accordance with CIBSE AM11 Building Energy and Performance Modelling.<br>2. The software used to carry out the simulation at the detailed design stage provides full dynamic thermal analysis. For smaller and more basic building designs with less complex heating or cooling systems, an alternative less complex means of analysis may be appropriate (such methodologies must still be in accordance with CIBSE AM11).<br>3. The modelling demonstrates that:<br><br>a. For air conditioned buildings, summer and winter operative temperature ranges in occupied spaces are in accordance with the criteria set out in CIBSE Guide A Environmental design, Table 1.5; or other appropriate industry standard (where this sets a higher or more appropriate requirement/level for the building type).<br>b. For naturally ventilated buildings:<br>i. Winter operative temperature ranges in occupied spaces are in accordance with the criteria set out in CIBSE Guide A Environmental design, Table 1.5; or other appropriate industry standard (where this sets a higher or more appropriate requirement/level for the building type).<br>ii. The building is designed to limit the risk of overheating, in accordance with the adaptive comfort methodology outlined in CIBSE TM52: The limits of thermal comfort: avoiding overheating in European buildings or CIBSE TM59: Design methodology for the assessment of overheating risk in homes. One credit:<br><br>Alternatively, for Education buildings design teams can refer to Building Bulletin 101, Ventilation of school buildings. For schools with a straightforward servicing strategy, ClassCool is considered a suitable alternative to AM11 full dynamic model.<br>4. For air conditioned buildings, the PMV (predicted mean vote) and PPD (predicted percentage of dissatisfied) indices based on the above modelling are reported via the BREEAM assessment scoring and reporting tool. | MEP | | |
| Design for Future Thermal Comfort | Hea 04-02 | **1** | **1** | | | 5. Criteria 1 to 4 are achieved.<br>6. The thermal modelling demonstrates that the relevant requirements set out in criteria 3 are achieved for a projected climate change environment.<br>7. Where criterion 6 is not met, the project team demonstrated how the building has been adapted or designed to be easily adapted in future using passive design solutions in order to subsequently meet the requirements under criterion 6.<br>8. For air conditioned buildings, the PMV and PPD indices based on the above modelling are reported via the BREEAM assessment scoring and reporting tool. | MEP | | |

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|---|---|---|---|---|---|---|---|---|---|
| Thermal zoning and controls | Hea 04-03 | **1** | **1** | | | 9. Criteria 1 to 4 are achieved<br>10. The thermal modelling analysis (criteria 1 to 4) has informed the temperature control strategy for the building and its users.<br>11. The strategy for proposed heating/cooling system(s) demonstrates that it has addressed the following:<br><br>a. Zones within the building and how the building services could efficiently and appropriately heat or cool these areas. For example consider the different requirements for the central core of a building compared with the external perimeter adjacent to the windows.<br>b. The degree of occupant control required for these zones, based on discussions with the end user (or alternatively building type or use specific design guidance, case studies, feedback) considers:<br>b.i. User knowledge of building services<br>b.ii. Occupancy type, patterns and room functions (and therefore appropriate level of control required)<br>b.iii. How the user is likely to operate or interact with the system(s), e.g. are they likely to open windows, access thermostatic radiator valves (TRV) on radiators, change air-conditioning settings etc.<br>b.iv. The user expectations (this may differ in the summer and winter) and degree of individual control (i.e. obtaining the balance between occupant preferences, for example some occupants like fresh air and others dislike draughts).<br>c. How the proposed systems will interact with each other (where there is more than one system) and how this may affect the thermal comfort of the building occupants.<br>d. The need or otherwise for an accessible building user actuated manual override for any automatic systems. | MEP | | Requires consultation with the building operator. |
| **Hea 05: Acoustic Performance** | | | | | | | | | |
| Acoustic Performance | Hea 05-01 | **3** | **2** | **1** | | 1. The building meets the appropriate acoustic performance standards and testing requirements defined in Table 5.14 of the guidance manual which defines criteria for the acoustic principles of:<br>a. Sound insulation<br>b. Indoor ambient noise level<br>c. Room acoustics.<br>OR<br>2. A suitably qualified acoustician (SQA) is appointed to define a bespoke set of performance requirements for all function areas in the building. The bespoke performance requirements use the three acoustic principles defined in criterion Hea05 Acoustic Performance - Criterion 1, setting out the performance requirements for each and the testing regime required. | Acoustician / Contractor | | It is assumed that at least 2 of the 3 available credits will be sought. |
| **Hea 06: Security** | | | | | | | | | |
| Security of Site and Building | Hea 06-01 | **1** | **1** | | | 1. A suitably qualified security specialist (SQSS) conducts an evidence-based Security Needs Assessment (SNA) during or prior to Concept Design (RIBA Stage 2 or equivalent). The purpose of the SNA will be to identify attributes of the proposal, site and surroundings which may influence the approach to security for the development.<br>2. The SQSS develops a set of security controls and recommendations for incorporation into the proposals. These controls and recommendations shall directly relate to the threats and assets identified in the preceding SNA.<br>3. The controls and recommendations shall be incorporated into proposals and implemented in the as-built development. Any deviation from those controls and recommendations shall be justified and agreed with the SQSS. | Architect / Security Consultant<br>MEP/ Architect | 2 | If the SNA is carried out after Stage 2, this will still be acceptable providing the SQSS provides a statement to confirm that no security measures have been discounted due to late consideration. |
| Exemplary Level Criteria | Hea 06-Ex | **1** | **0** | | **1** | 4. To achieve an exemplary level performance credit:<br>A compliant based risk security rating scheme has been used. The performance against the scheme has been confirmed by independent assessment and verification. | Architect | | SABRE is currently recognised as a compliant scheme. |

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| **Hea 07: Safe and Healthy Surroundings** | | | | | | | | | |
| Safe Access | Hea 07-01 | **1** | **1** | | | 1. Where external site areas form part of the assessed development the following apply:<br>Dedicated and safe cycle paths are provided from the site entrance to any cycle storage, and connect to off-site cycle paths where applicable.<br>2. Dedicated and safe footpaths are provided on and around the site providing suitable links for the following:<br>a. The site entrance to the building entrance<br>b. Car parks (where present) to the building entrance<br>c. The building to outdoor space<br>d. Connecting to off-site paths where applicable.<br>3. Pedestrian drop-off areas are designed off, or adjoining to, the access road and should provide direct access to other footpaths.<br>4. Where vehicle delivery access to drop-off areas form part of the assessed development, the following apply:<br>a. pedestrian and cyclist paths<br>b. outside amenity areas accessible to building users and general public<br>5. There is a dedicated parking or waiting area for goods vehicles with appropriate separation from the manoeuvring area and staff and visitor car parking.<br>6. Parking and turning areas are designed for simple manoeuvring according to the type of delivery vehicle likely to access the site, thus avoiding the need for repeated shunting. | Architect / Landscape Architects | | This credit only applies to developments that have areas external to the assessed building and within the boundary of the assessed development This includes external parking areas. Where the assessed building has no external areas but does have a covered parking facility, and cyclists, pedestrians or delivery vehicles access the building via this area, then the relevant safe access criteria apply and this area must be assessed against those criteria.<br><br>Where it is not practical to provide dedicated footpaths from each parking space within a car park, it is expected that design teams take every practical measure to ensure the safety of pedestrians.<br><br>Further exclusions apply for smaller sites / sites with limited external space. |
| Outside Space | Hea 07-02 | **1** | **0** | | | 7. There is an outside space providing building users with an external amenity area. | Architect / Landscape Architects | | Due to limited external space it is thought that this credit will not be achievable. |
| **ENERGY (1 credit = 0.64%)** | | | | | | | | | |
| **Ene 01: Reduction of energy use and carbon emissions** | | | | | | | | | |
| Energy Performance | Ene 01-01 | **9** | **4** | | **5** | 1. Calculate an Energy Performance Ratio for New Constructions (EPRNC). Compare the EPRNC achieved with the benchmarks in Table 6.1 in the guidance manual and award the corresponding number of BREEAM credits. | MEP | | **4 credits (energy performance) mandatory for Excellent.** |
| Prediction of Operational Energy Consumption | Ene 01-02 | **4** | **0** | **4** | | 2. Involve relevant members of the design team in an energy design workshop focusing on operational energy performance. | MEP/ Design Team | | Due to cost it is thought that TM54 modelling will not be pursued, however the design team should consider this. |
| | | | | | | 3. Undertake additional energy modelling during the design and post-construction stage to generate predicted operational energy consumption figures. (see Prediction of operational energy consumption on page 125 of the guidance manual - assessor to provide.)<br>4. Report predicted energy consumption targets by end use, design assumptions and input data (with justifications).<br>5. Carry out a risk assessment to highlight any significant design, technical and process risks that should be monitored and managed throughout the construction and commissioning process. | MEP | | |
| Exemplary level criteria | Ene 01-Ex | **2** | **0** | | | 6. The building achieves an EPR NC ≥ 0.9 and zero net regulated $CO_2$ emissions.<br>7. Energy generation from on-site and near-site LZC sources is sufficient to offset carbon emissions from regulated energy use plus a percentage of emissions from unregulated energy use.<br>8. Award the exemplary credits based on the percentage of additional emissions from unregulated energy that are offset by LZC sources. (Table 6.2 guidance manual). | MEP | | These credits should be investigated. |
| | Ene 01-Ex | **3** | **0** | | | 9. The building is deemed carbon negative where >100% (see Table 6.2 guidance manual) of carbon emissions from unregulated (and regulated) energy use are offset by energy generated from on-site and near-site LZC sources. | MEP | | |
| | Ene 01-Ex | **2** | **0** | **2** | | 10. Achieve maximum available credits in Ene 02 Energy monitoring.<br>11. The client or building occupier commits funds to pay for the post occupancy stage. This requires an assessor to be appointed and to report on the actual energy consumption compared with the targets set in criterion 4.<br>12. The energy model (criterion 3) is:<br>a. Submitted to BRE and<br>b. Retained by the building owner. | MEP | | |

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|---|---|---|---|---|---|---|---|---|---|
| **Ene 02: Energy Monitoring** | | | | | | | | | |
| Sub-metering of end-use categories | Ene 02-01 | **1** | **1** | | | 1. Install energy metering systems so at least 90% of the estimated annual energy consumption of each fuel is assigned to the end-use categories.<br>2. Meter the energy consumption in buildings according to the total useful floor area:<br>a. If the area is greater than 1,000m², by end-use category with an appropriate energy monitoring and management system.<br>b. If the area is less than 1,000m², use either:<br>i. an energy monitoring and management system or<br>ii. separate accessible energy sub-meters with pulsed or other open protocol community outputs, for future connection to an energy monitoring and management system<br>3. Building users can identify the energy consuming end users, for example through labelling or data outputs. | MEP | | **Mandatory for Excellent** |
| Sub-metering of high energy load and tenancy areas | Ene 02-02 | **1** | **1** | | | 4. Monitor a significant majority of the energy supply with:<br>a. An accessible energy monitoring and management system for:<br>i. tenanted areas or<br>ii. Relevant function areas or departments in single occupancy buildings<br>OR<br>b. Separate accessible energy sub-meters with pulsed or other open protocol community outputs for future connection to an energy monitoring and management system for:<br>i tenanted areas<br>ii. relevant function areas or departments in single occupancy buildings.<br>5. Sub-meter per floor plate in large single occupancy or single-tenancy buildings with one homogenous function, for example hotel bedrooms, offices. | MEP | | Function areas for healthcare buildings are typically:<br>1. Operating departments<br>2. Imaging departments<br>3. Radiotherapy departments<br>4. Pathology departments<br>5. Dialysis departments<br>6. Medical physics facilities<br>7. Mortuary and post mortem departments<br>8. Rehabilitation when including hydrotherapy pools<br>9. Central sterile supplies departments (or equivalent)<br>10. Process areas (e.g. commercial-scale kitchens and laundries)<br>11. IT rooms<br>12. Pharmacy departments<br>13. Laboratories<br>14. Tenancy areas (e.g. catering, retail, laundry)<br>In small healthcare buildings (< 999m²) with no high energy load areas (as defined above), a single meter per floor plate is sufficient to achieve this credit. Individual areas within each floor plate do not need to be sub-metered. |
| **Ene 03: External Lighting** | | | | | | | | | |
| External Lighting | Ene 03-01 | **1** | **1** | | | 1. No external lighting (which includes lighting on the building, at entrances and signs).<br>OR<br>2. External light fittings within the construction zone with:<br>a. Average initial efficacy of not less than 70 luminaire lumens per circuit Watt.<br>b. Automatic control to prevent operation during daylight hours.<br>c. Presence detection in areas of intermittent pedestrian traffic. | MEP | | |
| **Ene 04: Low carbon design** | | | | | | | | | |
| Passive design analysis | Ene 04-01 | **1** | **1** | | | 1. Achieve the first credit Hea 04 Thermal comfort: One credit - Thermal modelling to demonstrate that the building design delivers appropriate thermal comfort levels in occupied spaces.<br>2. The project design team analyses the proposed building design and development during concept design to identify opportunities for the implementation of passive design measures.<br>3. Implement passive design measures to reduce the total heating, cooling, mechanical ventilation, lighting loads and energy consumption in line with the passive design analysis findings.<br>4. Quantify the reduced total energy demand and carbon dioxide ($CO_2$) emissions resulting from the passive design measures. | MEP | 2 | |
| Free Cooling | Ene 04-02 | **1** | **0** | | 1 | 5. Achieve the passive design analysis credit.<br>6. Include free cooling analysis in the passive design analysis carried out under criterion 2.<br>7. Identify opportunities for the implementation of free cooling solutions.<br>8. The building is naturally ventilated or uses any combination of the free cooling strategies listed in free cooling analysis. | MEP | | |

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|---|---|---|---|---|---|---|---|---|---|
| Low and zero carbon feasibility study | Ene 04-03 | **1** | **1** | | | 9. An energy specialist completes a feasibility study by the end of the concept design.<br>10. Establish the most appropriate recognised local (on-site or near-site) low or zero carbon (LZC) energy sources for the building or development based on the feasibility study.<br>11. Specify local LZC technologies for the building or development in line with the feasibility study recommendations.<br>12. Quantify the reduced regulated carbon dioxide ($CO_2$) emissions resulting from the feasibility study. | MEP | 2 | |
| **Ene 05: Energy Efficient Cold Storage** | | | | | | | | | |
| Refrigeration Energy Consumption | Ene 05-01 | **1** | **1** | | | 1. Design, install and commission the refrigeration system:<br>a. In accordance with the Code of Conduct for carbon reduction in the refrigeration retail sector and BS EN 378-2:2016.<br>busing robust and tested refrigeration systems or components included on the Enhanced Capital Allowance Energy Technology Product List or and equivalent list.<br>2. Commission the refrigeration plant in compliance with the commissioning criteria in BREEAM issue Man 04 Commissioning and handover. | MEP / Contractor | | If no commercial or industrial scale cold storage is provided then this credit is not assessed. |
| Indirect Greenhouse Gas Emissions | Ene 05-02 | **1** | **0** | | 1 | 3. Achieve criteria 1 and 2.<br>4. Demonstrate a saving in indirect greenhouse gas emissions ($CO_2$-eq) from the installed refrigeration system over the course of its operational life. | MEP / Contractor | | |
| **Ene 06: Energy Efficient Transportation Systems** | | | | | | | | | |
| Energy Consumption | Ene 06-01 | **1** | **1** | | | 1. For specified lifts, escalators and moving walks (transportation types) :<br>1.a. Analyse the transportation demand and usage patterns for the building to determine the optimum number and size of lifts, escalators and/or moving walks.<br>b. Calculate the energy consumption in accordance with BS EN ISO 25745 Energy performance of lifts, escalators and moving walks, Part 2 : Energy calculation and classification for lifts (elevators) and/or Part 3 - Energy calculation and classification for escalators and moving walks, for one of the following:<br>i. At least two options for each transportation type (e.g. for lifts, hydraulic, traction or machine roomless (MRL)) OR<br>ii. At least two options considering different system arrangements and control strategies.<br>c. Consider the use of regenerative drives, subject to the requirements in the guidance manual.<br>d. Specify the transportation system with the lowest energy consumption. | MEP | | Goods lifts / platforms or any lift with a rated speed of less than 0.15m/s do not require assessment. Analysis is only required for new lifts. |
| Energy efficient features | Ene 06-02 | **1** | **1** | | | 2. Criterion 1 is achieved.<br>3. Specify the following three energy efficient features for each lift:<br>a. A standby condition for off-peak periods.<br>b. The lift car lighting and display lighting provides an average luminous efficacy, (across all fittings in the car) of > 70 luminaire lumens/circuit Watt.<br>c. The lift uses a drive controller capable of variable speed, variable-voltage, and variable-frequency (VVVF) control of the drive motor.<br>4. Specify regenerative drives where their use is demonstrated to save energy.<br>5. Specify at least one of the following for each escalator or moving walk:<br>a. A load-sensing device that synchronises motor output to passenger demand through a variable speed drive OR<br>b. A passenger-sensing device for automated operation (auto walk), so the escalator operates in auto start mode when there is no passenger demand. | MEP | | |

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|---|---|---|---|---|---|---|---|---|---|
| **Ene 08: Energy Efficient Equipment** | | | | | | | | | |
| Energy Efficient Equipment | Ene 08-01 | **2** | **2** | | | 1. Identify the building's unregulated energy consuming loads and estimate their contribution to the total annual unregulated energy consumption of the building, assuming a typical/standard specification.<br>2. Identify the systems and/or processes that use a significant proportion of the total annual unregulated energy consumption of the building.<br>3. Demonstrate a meaningful reduction in the total annual unregulated energy demand of the building. Table 6.5 in the guidance manual lists examples of significant contributors to unregulated energy consumption and the associated criteria. If additional significant contributors, not listed in the table, will be specified, the design team should justify how a meaningful reduction will be achieved for these contributors. | Client / MEP | | 01.02.19 (pre-assessment workshop): It was confirmed that there will be no large scale healthcare equipment and that domestic scale appliances will have the greatest contribution to unregulated energy consumption. To comply: any white goods, available to purchase from the developer, must achieve the following ratings (or better) under the EU Energy Efficiency Labelling Scheme:<br>1. Fridges, fridge-freezers: A+ rating<br>2. Washing machines: A++ rating<br>3. Dishwashers: A+ rating<br>4. Washer-dryers: A rating<br>5. Tumble dryers: A rating<br><br>Medical equipment is exempt from these criteria.<br><br>Sources of unregulated energy (for BREEAM Ene 08 purposes) include:<br>- Swimming pools<br>- Laundry facilities with commercial sized appliances<br>- Data centres<br>- Healthcare equipment*<br>- IT-intensive operating areas<br>- Domestic - scale appliances (white goods)<br>- Kitchen and catering facilities |
| **TRANSPORT (1 credit = 0.84%)** | | | | | | | | | |
| **Tra 01: Transport Assessment and Travel Plan** | | | | | | | | | |
| Travel Plan | Tra 01-01 | **2** | **2** | | | 1. No later than Concept Design stage, undertake a site-specific transport assessment (or develop a travel statement) and draft travel plan, which can demonstrably be used to influence the site layout and built form.<br>2 The site-specific travel assessment (or statement) shall cover as a minimum:<br>a. If relevant, travel patterns and attitudes of existing building or site users towards cycling, walking and public transport, to identify relevant constraints and opportunities.<br>b. Predicted travel patterns and transport impact of future building or site users.<br>c. Current local environment for pedestrians and cyclists, accounting for any age-related requirements of occupants and visitors.<br>d. Reporting of the number and type of existing accessible amenities, see Table 7.1 below, within 500m of the site.<br>e. Disabled access accounting for varying levels and types of disability, including visual impairment.<br>f. Calculation of the existing public transport Accessibility Index (AI), see Methodology on the facing page.<br>g. Current facilities for cyclists.<br>3. Following a transport assessment (in accordance with the requirements set out in criteria 2), develop a site specific travel plan that provides a long term management strategy which encourages more sustainable travel. The travel plan includes measures to increase or improve more sustainable modes of transport and movement of people and goods during the building's operation (further details on the methodology to be provided by the assessor).<br>4. If the occupier is known, involve them in the development of the travel plan.<br>5. Demonstrate that the travel plan will be implemented and supported by the building's management in operation. | Transport Consultant | 2 | 01.02.19 (pre-assessment workshop): It was confirmed that this is already underway. |

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| **Tra 02: Sustainable Transport Measures** | | | | | | | | | |
| Sustainable Transport Measures | Tra 02-Pre | - | - | - | - | 1. Achieve the Tra 01 Transport assessment and travel plan credits. | Architect / MEP | | An AI of >40 is achieved (43.6). As such, at least 6 Tra 02 points are required to get 10 credits; 5 for 9 credits; 4 for 8 credits; 3 for 6 credits; 2 for 4 credits; and 1 for 2 credits.<br><br>Cycle spaces: 1 per 10 staff plus 1 per 2 consulting rooms OR 10 beds required (largest must be used). Special healthcare building types, e.g. chemotherapy outpatient centre or maternity ward—for such building types, given the nature of the building function, the cycle storage spaces for '2 consulting rooms OR 10 beds' (i.e. those intended for patients and visitors), might be excluded, as it is unlikely that patients and accompanying visitors would be cycling to and from the centre. |
| | | | | | | 2. Identify the sustainable transport measures in table 7.4 of the guidance manual | | | |
| | Tra 02-01 | **10** | **10** | | | 3. Award credits according to the Accessible Index of the project and the total number of points achieved for the options implemented. (See table 7.3 of the guidance manual.)*<br>It is assumed the 6 points will be achieved as follows:<br>- Existing AI of >8 (1 point)<br>- Provide a public transport information system in a publically accessible area (1 point)<br>- Install compliant cycle storage (spaces can be reduced by 50% or the sliding scale of compliance applied) (1 point)<br>- Where compliant cycle storage is provided, provide at least 2 compliant cyclist facilities (1 point)<br>- At least 3 existing accessible amenities are present (1 point)<br>- Provide electric recharging stations of a minimum of 3kW for at least 10% of the total car parking capacity for the development (1 point) | | |
| **WATER (1 credit = 0.78%)** | | | | | | | | | |
| **Wat 01: Water Consumption** | | | | | | | | | |
| Water Consumption | Wat 01-01 | **5** | **1** | **4** | | 1. Use the BREEAM Wat 01 calculator to assess the efficiency of the domestic water-consuming components. | Architect / MEP | | **1 credit is required for Excellent**<br><br>Components in clinical areas may be omitted. Clinical areas refer to all areas with a scrub-up trough, clinical sink or clinical basin. This is not an exhaustive list and guidance should always be sought from the appropriate professional, to ascertain areas of exemption specific to infection control and other considerations. Appropriate professionals could include a health authorities<br>infection control officer or a client infection control representative or equivalent.<br>Although exempt, HTM 07-04(155) contains guidance on water savings from medical-related activities. Furthermore, in some cases, the use of water efficient fittings and appliances may not be appropriate to the needs of the patient, and inappropriate specification may adversely affect the incidence and propagation of infections. In such instances, the assessor will need to confirm with BRE Global whether components from the relevant building areas are exempt. The design team should also consult NHS guidelines concerning appropriate selection of sanitary fittings and fixtures<br>and the control of legionella, including HTM 04-01(156). |
| | | | | | | 2. Use the standard Wat01 method to compare the water consumption (litres/person/day) for the assessed building against a baseline performance. Award BREEAM credits based upon the following:<br>1 credit: 12.5%<br>2 credits: 25%<br>3 credits: 40%<br>4 credits: 50%<br>5 credits: 55%<br>Where it is not possible to use the standard method, and for some building types, complete the assessment using the alternative Wat 01 method. | | | |
| | | | | | | 3. If a greywater or rainwater system is specified, use its yield in L/person/day to offset potable water demand from components. | | | |
| | | | | | | 4. If a greywater or rainwater system is specified and installed:<br>a. Greywater systems in compliance with BS 8525-1:2010 Greywater systems - Part 1 Code of Practice.<br>b. Rainwater systems in compliance with BS EN 16941-1:2018 | | | |
| | | | | | | **For healthcare buildings only**<br>5. If applicable, the flushing control for each WC or urinal must be suitable for operation by patients with frail or infirm hands or activated by electronic sensors | | | |
| Exemplary level criteria | Wat 01-Ex | **1** | **0** | | | To achieve an exemplary performance credit:<br>7. Achieve criteria 1 to 4. | | | |
| | | | | | | 8. The water consumption (litres/person/day) for the assessed building achieves the 65% improvement described as exemplary performance in Table 8.1 of the guidance manual. | | | |

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| **Wat 02: Water Monitoring** | | | | | | | | | |
| Water Monitoring | Wat 02-01 | **1** | **1** | | | 1. The specification of a water meter on the mains water supply to each building; this includes instances where water is supplied via a borehole or other private source.<br>2. Water-consuming plant or building areas, consuming 10% or more of the building's total water demand:<br>a. Fit easily accessible sub-meters OR<br>b. Install water monitoring equipment integral to the plant or area.<br>3.For each meter (main and sub):<br>a. Install a pulsed or other open protocol communication output AND<br>b. Connect it to an appropriate utility monitoring and management system e.g. a building management system (BMS), for the monitoring of water consumption. If there is no BMS system in operation at Post-Construction stage, award credits provided that the system used enables connection when the BMS becomes operational.<br>4. In buildings with swimming pools, or large water tanks and aquariums, fit separate sub-meters on the water supply of the above and any associated changing facilities (toilets, showers etc.) irrespective of their water consumption levels.<br>5. In buildings containing laboratories, fit a separate water meter on the water supply to any process cooling loop for 'plumbed in' laboratory process equipment, irrespective of their water consumption levels.<br>6. *Additionally for those pursuing a post occupancy stage certification:*<br>The water monitoring strategy used enables the identification of all water consumption for sanitary uses as assessed under Wat 01 (litres/person/day) if a post occupancy stage certification is sought. | MEP | | **Criterion 1 is mandatory**<br><br>For healthcare buildings and sites with multiple departments, e.g. large health centres or acute hospitals, fit separate sub-meters on the supply to the following areas where present:<br>– Staff and public areas<br>– Clinical areas and wards<br>– Letting areas: on the water supply to each tenant unit<br>– Laundries<br>– Main production kitchen<br>– Hydrotherapy pools<br>– Laboratories<br>– Central sterile supply department (CSSD), hospital sterilisation and disinfection unit (HSDU), pathology, pharmacy, mortuary and any other major process water use<br>– Supplementary supply of water from a cold water tank. |
| **Wat 03: Water Leak Detection and Prevention** | | | | | | | | | |
| Leak detection system | Wat 03-01 | **1** | **1** | | | 1. Install a leak detection system capable of detecting a major water leak:<br>a. On the utilities water supply within the buildings, to detect any major leaks within the buildings<br>AND<br>b. Between the buildings and the utilities water supply, to detect any major leak between the utilities supply and the buildings under assessment.<br>2. The leak detection system is:<br>a. A permanent automated water leak detection system that alerts the building occupants to the leak OR an inbuilt automated diagnostic procedure for detecting leaks.<br>b. Activated when the flow of water passing through the water meter or data logger is at a flow rate above a pre-set maximum for a pre-set period of time. This usually involves installing a system which detects higher than normal flow rates at meters or sub-meters. It does not necessarily require a system that directly detects water leakage along part or the whole length of the water supply system.<br>c. Able to identify different flow and therefore leakage rates e.g. continuous, high or low level, over set time periods. Although high and low level leakage rates are not specified, the leak detection equipment installed must have the flexibility to distinguish between different flow rates to enable it to be programmed to suit the building type and owners or occupiers usage patterns.<br>d. Programmable to suit the owner's or occupiers water consumption criteria.<br>e. Where applicable, designed to avoid false alarms caused by normal operation of large water-consuming plant such as chillers. Where there is physically no space for a leak detection system between the utilities water meter and the building, alternative solutions can be used, provided that a major leak can still be detected. | MEP | | |
| Flow control devices | Wat 03-02 | **1** | **1** | | | 2. Install flow control devices that regulate the supply of water to each WC area/sanitary facility according to demand, in order to minimise undetected wastage and leaks from sanitary fittings and supply pipework. | MEP | | This issue does not apply to toilet facilities in clinical areas |

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|---|---|---|---|---|---|---|---|---|---|
| **Wat 04: Water Efficient Equipment** | | | | | | | | | |
| Water efficient equipment | Wat 04-01 | **1** | **1** | | | 1. Identify all water demands from users other than those considered under Wat 01 that could be realistically mitigated or reduced. Where there is no water demand from uses other than domestic -style, sanitary use components in the building, this issue is not applicable.<br>2. Identify systems or processes to reduce the relevant water demand (criterion 1) and establish, through either good practice design or specification, a demonstrable reduction in the total water demand of the building. | MEP | | For the purposes of this BREEAM Issue, non-domestic scale, non- sanitary water uses refer to any building integrated water uses not assessed under Wat 01. This includes, but is not limited to the following:<br>– Swimming pools<br>– Recreational hot tubs and hydrotherapy pools<br>– Equipment used for irrigation<br>– Vehicle wash equipment<br>– Project-specific industrial processes<br>– Water filtration and treatment processes<br>– Building services (e.g. cooling towers and humidification systems) |
| **MATERIALS (1 credit = 1.07%)** | | | | | | | | | |
| **Mat 01: Life Cycle Impacts** | | | | | | | | | |
| Superstructure | Mat 01-01 | **6** | **4** | **2** | | **Option appraisal during Concept Design (all building types).**<br>4. During Concept Design, identify opportunities for reducing environmental impacts as follows:<br>a. Carry out building LCA options appraisal of 2 to 4 significantly different superstructure design options (applicable to the Concept Design stage)<br>b. Use a building LCA tool that is recognised by BREEAM (as suitable for assessing superstructure during Concept Design) according to the methodology.<br>c. For each design option, fulfil the same functional requirements specified by the client and all statutory requirements (to ensure functional equivalency).<br>d. Integrate the LCA options appraisal activity within the wider design decision-making process. Record this in an options appraisal summary document.<br>e. Record the following in the Mat 01/02 Results Submission Tool: The differences between the design options; the design option selected by the client to be progressed beyond Concept Design; the reasons for selecting it and the reasons for not selecting the other design options.<br>f. Submit the Mat 01/02 Results Submission Tool to BRE at the end of Concept Design, and before planning permission is applied for (that includes external material or product specifications).<br>If the building LCA tool recognised by BREEAM and used for criteria 3 to 5 (and 6 to 9, if pursued) is not an IMPACT Compliant LCA tool and criteria 1 to 2 are applicable, then BREEAM Simplified Building LCA tool (or an IMPACT Compliant LCA tool) shall be used for criteria 1 to 2. | Architect / BREEAM Assessor | 2 | This information must be submitted to the BRE at Stage 2. Up to 2 credits are available for using the BRE's free software. The remaining credits require bespoke software which may incur additional costs. It is suggested this is undertaken to improve the score (up to 10 credits are available using bespoke software). |
| | | | | | | **Options appraisal during Technical Design (all building types)**<br>5. During Technical Design identify opportunities for reducing environmental impacts as follows:<br>a. Carry out building LCA options appraisal of 2 to 3 significantly different superstructure design options (based on the selected Concept Design option and as applicable to the Technical Design stage).<br>b. Use a building LCA tool that is recognised by BREEAM (as suitable for assessing superstructure during Technical Design) according to the methodology.<br>c. As criteria 4.c. to 4.e. above. Where an options appraisal summary document was produced during Concept Design, update it to include the Technical Design options.<br>d. Submit the Mat 01/02 Results Submission Tool to BRE at the end of Technical Design.<br>Where a project has not achieved criteria 3 and 4, criterion 5 may still be achieved. | Architect / BREEAM Assessor | 4 | |
| Substructure and Hard Landscaping options appraisal During Concept Design | Mat 01-02 | **1** | **1** | | | 6. Criteria 3 and 4 are achieved.<br>7. During Concept Design identify opportunities for reducing environmental impacts as follows:<br>a. Carry out building LCA options appraisal of a combined total of at least six significantly different substructure or hard landscaping design options (at least two shall be substructure and at least two shall be hard landscaping).<br>b. Using a building LCA tool that is recognised by BREEAM (as suitable for assessing substructure and hard landscaping during Concept Design) according to the methodology.<br>c As criteria 4.c. to 4.f. | C&S Engineer / Landscape Architect / TBC | 2 | |
| Exemplary Performance Criteria | Mat 01-Ex1 | **1** | **1** | | | 8. Criteria 3-4 are achieved.<br>9.During Concept Design, identify opportunities for reducing environmental impacts as follows:<br>a. Carry out building LCA options appraisal of at least 3 significantly different core building services design options.<br>b. Use a building LCA tool that is recognised by BREEAM (as suitable for assessing core building services during Concept Design) according to the methodology.<br>c. As criteria 4.c.to 4.f. | MEP / TBC | 2 | |

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| Exemplary Performance Criteria | Mat 01-Ex2 | 1 | 0 | 1 | | 10. Achieve criteria 3 to 5.<br>11. Achieve the Elemental LCC plan and Component Level LCC options appraisal credits (Man 02 Life cycle cost and service life planning).<br>12. Include design options appraised for criteria 3 to 4 (and 6 to 7 and 8 to 9, if pursued) during Concept Design in Assessment scope- The elemental LCC plan.<br>13. Include the design options appraised for criterion 5 during Concept Design in the 'Component Level LCC option appraisal' (in Man 02 Life cycle cost and service life planning)<br>14. Integrate the aligned LCA and LCC options appraisal activity within the wider design decision-making process. Record this in an options appraisal summary document including the relevant cost information from the 'elemental LCC plan' and 'Component Level LCC option appraisal'. | Cost Consultant / Architect / MEP/ BREEAM Assessor | | Potentially achievable |
| | Mat 01-Ex3 | 1 | 0 | 1 | | 15.Criteria 1 to 7 ( As applicable to the building type) are achieved.<br>16. A suitably qualified third party carries out the building LCAs or produces a report verifying the building LCAs accurately represent the designs under consideration during Concept Design and Technical Design with reference to the requirements of criteria 1 to 7 (and 8 to 14 if pursued).<br>17. For each LCA option, itemise the findings of the verification checks made by the suitably qualified third party in the report including, as a minimum, the quality requirements shown in Table 9.4 of the guidance manual.<br>18. Include details of the suitable qualified third party's relevant skills and experience and a declaration of their third party independence from the project client and design team in the report. | TBC | | Potentially achievable |
| **Mat 02: Environmental Impacts from Construction Products - Environmental Product Declarations (EPD)** | | | | | | | | | |
| Specification of products with a recognised EPD | Mat 02-01 | 1 | 1 | | | 1. Specify construction products with EPD that achieve a total EPD points score of at least 20, according to methodology.<br>2. Enter the details of each EPD into the Mat 01/02 Results Submission Tool, including the material category classification. The mat 01/02 results submission tool will verify the EPD points score and credit award. | Architect / Contractor<br>BREEAM assessor | | Requires the use of products with EPDs. This could be difficult to achieve but is possible. Assessor to provide further details. |
| **Mat 03: Responsible Sourcing of Construction Products** | | | | | | | | | |
| Ensuring Sustainable Procurement | Mat 03-Pre | - | - | - | - | 1. All timber and timber based products used on the project is ' Legally harvested and traded timber' as per the UK government's Timber Procurement Policy (TPP) | Contractor | | **Criterion 1 is mandatory** |
| | Mat 03-01 | 1 | 1 | | | 2. A sustainable procurement plan must be used by the design team to guide specification towards sustainable construction products. The plan must:<br>a. Be in place before Concept Design<br>b. Include sustainability aims, objectives for the credit to be awarded but justification must be provided for targets that are not achieved.<br>c. Include a requirement for assessing the potential to procure construction products locally. There must be a policy to procure construction products locally where possible.<br>d. Include details of procedures in place to check and verify the effective implementation of the sustainable procurement plan.<br><br>In addition if the plan is applied to several sites or adopted at an organisational level it must:<br>e. Identify the risks and opportunities of procurement against a broad range of social, environmental and economic issues following the process set out in BS ISO 20400:2017. | Architect | 1 | |
| Measuring responsible sourcing | Mat 03-02 | 3 | 2 | | 1 | 3. Use the Mat 03 calculator tool and methodology to determine the number of credits achieved for the construction products specified or procured. Credits are awarded in proportion to the scope of the assessment and the number of points achieved. (Use table 9.10 in the guidance manual). | Contractor | | |

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| **Mat 05: Designing for durability and resilience** | | | | | | | | | |
| Designing for durability and resilience | Mat 05-01 | **1** | **1** | | | **Protecting vulnerable parts of the building from damage**<br>1. Protection measures are incorporated into the building's design and construction to reduce damage to the building's fabric or materials in case of accidental or malicious damage occurring. These measures must provide protection against:<br>a. Negative impacts of high user numbers in relevant areas of the building (e.g. corridors, lifts, stairs, doors etc.)<br>b. Damage from any vehicle or trolley movements within 1m of the internal building fabric in storage, delivery, corridor and kitchen areas.<br>c. External building fabric damage by vehicle. Protection where parking or manoeuvring areas are within 1 metre of the building facade and where delivery areas or routes are within 2 metres of the facade i.e. specifying bollards or protection rails.<br>d. Potential malicious damage to building materials and finishes in public and common areas where appropriate. | Architect / Landscape Architects | | Key exposed building elements in the context of this issue are those adding up to at least 80% by area of each of the following categories:<br>1. External walls and cladding<br>2. Roof or balconies<br>3. Glazing: windows, skylights<br>4. Hard landscaping |
| | | | | | | **Protecting exposed parts of the building from material degradation**<br>2. Key exposed building elements have been designed and specified to limit long and short term degradation due to environmental factors. This can be demonstrated through one of the following:<br>a. The element or product achieving an appropriate quality or durability standard or design guide, see Table 9.14 of the guidance manual. If none are available use BS 7543:2015 as the default appropriate standard.<br>OR<br>b. A detailed assessment of the element's resilience when exposed to the applicable material degradation and environmental factors. | | | |
| | | | | | | 3. Include convenient access to the roof and façade for cost-effective cleaning, replacement and repair in the building's design. | | | |
| | | | | | | 4. Design the roof and façade to prevent water damage, ingress and detrimental ponding. See Table 9.14 in the guidance manual for an example list of relevant industry durability and quality standards. | | | |
| **Mat 06: Material efficiency** | | | | | | | | | |
| Material efficiencies | Mat 06-01 | **1** | **1** | | | 1. At the Preparation and Brief and Concept Design stages, set targets and report on opportunities and methods to optimise the use of materials. These must be done for each of the following stages:<br>a. Preparation and Brief<br>b Concept Design<br>c. Developed Design<br>d Technical design<br>e. Construction | Architect | 1 to 5 | Examples of suitable material efficiency design measures can include:<br>1. Increasing the utilisation factor of structural members<br>2. Designing to standard material dimensions to reduce off-cuts and waste on site<br>3. Removing redundant materials from the design<br>4. Using materials that can be recycled or reused at the end of their service life<br>5. Making use of recycled or reclaimed materials<br>6. Designing for deconstruction and material reuse<br>7. Using pre-fabricated elements where appropriate to reduce material waste<br>8. Consider using an 'exposed thermal mass' design strategy to reduce finishes<br>9. Avoiding over-specification of predicted loads<br>10. Using lightweight structural design strategies<br>11. Making use of bespoke structural elements where this will reduce overall material use<br>12. 'Rationalisation' of structural elements<br>13. Optimising the foundation design for embodied environmental impact. |
| | | | | | | 2. Develop and record the implementation of material efficiency during:<br>a. Developed Design<br>b. Technical Design<br>c. Construction | | | |
| | | | | | | 3. Report the targets and actual material efficiencies achieved. | | | |

| Title | Credit Ref | Credits available | Route to Excellent (min. 70%) 75.75% | Potential (easily achieved) 15.81% | Potential (at cost / investigation required) 16.10% | Compliance Requirements | Responsibility | RIBA Stage | Comments |
|---|---|---|---|---|---|---|---|---|---|
| **WASTE (1 credit = 0.60%)** | | | | | | | | | |
| **Wst 01: Construction Waste Management** | | | | | | | | | |
| Pre-Demolition Audit | Wst 01-01 | **1** | **1** | | | 1. Complete a pre-demolition audit of any existing buildings, structures or hard surfaces being considered for demolition. This must be used to determine whether refurbishment or reuse is feasible and, in the case of demolition, to maximise the recovery of material for subsequent high grade or value applications. The audit must cover the content of pre-demolition audit scope and:<br>a. Be carried out at Concept Design stage (RIBA Stage 2) by a competent person prior to strip-out or demolition works.<br>b. Guide the design, consider materials for reuse and set targets for waste management.<br>c. Engage all contractors in the process of maximising high grade reuse and recycling opportunities.<br>d. Compare actual waste arisings and waste management routes used with those forecast and investigate significant deviations from planned targets. | Demolition Contractor | 2 | Pre-demolition audit competent person:<br>An individual who has appropriate knowledge of buildings, waste and options for reuse and recycling of different waste streams. Ideally this would be a demolition contractor, but could also be the main contractor. |
| | | | | | | 2. Make reference to the audit in the resource management plan (RMP). | Demolition Contractor | | |
| | | | | | | 3. Compare actual waste arisings and waste management routes used with those forecast and investigate significant deviations from planned targets. | | | |
| Construction resource efficiency | Wst 01-02 | **3** | **2** | | **1** | 3. Prepare a compliant Resource Management Plan (RMP) covering:<br>a. Non-hazardous waste materials (from on-site construction and dedicated off-site manufacturer or fabrication) including demolition and excavation waste.<br>b. Accurate data records on waste arising's and waste management routes. | Contractor | | |
| | | | | | | 4. Meet or improve upon the benchmarks below for non-hazardous construction waste, excluding demolition and excavation waste:<br>Amount of waste generated per 100m2 GIFA:<br>1 credit: ≤ 13.3m3 actual volume (not bulk) / ≤ 11.1 tonnes<br>2 credits: ≤ 7.5m3 actual volume (not bulk) / ≤ 6.5 tonnes<br>3 credits: ≤ 3.4m3 actual volume (not bulk) / ≤ 3.2 tonnes<br>Exemplary level: ≤ 1.6m3 actual volume (not bulk) / ≤ 1.9 tonnes | | | |
| Diversion of resources from landfill | Wst 01-03 | **1** | **1** | | | 5. Meet, where applicable, the diversion from landfill benchmarks below for non-hazardous construction waste and demolition and excavation waste generated:<br>Non-demolition: 70% volume / 80% tonnage<br>Demolition: 80% volume / 90% tonnage<br>Excavation: n/a | | | |
| | | | | | | 6. Sort waste materials into separate key waste groups as per Table 10.3 of the guidance manual, either on-site or through a licensed contractor for recovery. | | | |
| Exemplary Performance Criteria | Wst 01-Ex | **1** | **0** | | **1** | 7. Non-hazardous construction waste generated, excluding demolition and excavation waste is less than or equal to the exemplary level resource efficiency benchmarks:<br>Exemplary level: ≤ 1.6m2 actual volume (not bulk) / ≤ 1.9 tonnes | Contractor | | |
| | | | | | | 8. The percentage of non-hazardous construction (on-site and dedicated off-site manufacture/fabrication), demolition and excavation waste (if relevant) diverted from landfill meets or exceeds the exemplary level percentage benchmarks outlined below:<br>Non-demolition: 85% volume / 90% tonnage<br>Demolition: 85% volume / 95% tonnage<br>Excavation: 95% volume / 95% tonnage | | | |
| | | | | | | 9. All key waste groups in Table 10.3 of the guidance manual, for diversion from landfill are covered in the RMP. | | | |
| | | | | | | 10. Waste data obtained from licenced external waste contractors is reliable and verifiable, by using data from EA/SEPA/EA Wales/NIEA Waste Return Forms or from PAS 402:2013 compliant company. | | | |

| Title | Credit Ref | Credits available | Route to Excellent (min. 70%) 75.75% | Potential (easily achieved) 15.81% | Potential (at cost / investigation required) 16.10% | Compliance Requirements | Responsibility | RIBA Stage | Comments |
|---|---|---|---|---|---|---|---|---|---|
| **Wst 02: Recycled Aggregates** | | | | | | | | | |
| Pre-Requisite | Wst 02-Pre | - | - | - | - | 1. If demolition occurs on site, to encourage the reuse of site-won material on site, complete a pre-demolition audit of any existing buildings, structures or hard surfaces in accordance with Assessment scope- Criterion 1 and Assessment Scope - Criterion 2 | Pre-demolition contractor | | This is typically very difficult to achieve. |
| Sustainable Aggregate Points | Wst 02-01 | 1 | 0 | | | 2. Identify all aggregate uses and types on the project Table 10.5, and Table 10.6 in the guidance manual.<br>3. Determine the quantity in tonnes for each identified use and aggregate type.<br>4. Identify the region in which the aggregate source is located.<br>5. Calculate the distance in kilometres travelled by all aggregates by transport type.<br>6. Enter the information into the BREEAM Wst 02 calculator to calculate the Project Sustainable Aggregate points. The corresponding number of BREEAM credits will be awarded (refer to Table 10.4 in the guidance manual). | C&S Engineer | | |
| Exemplary Performance Criteria | Wst 02-Ex | 1 | 0 | | | To achieve an exemplary performance credit:<br>7. The Project Sustainable Aggregate Points score meets or exceeds the exemplary level performance benchmark in Table 10.4 of the guidance manual. | C&S Engineer | | |
| **Wst 03: Operational Waste** | | | | | | | | | |
| Operational Waste | Wst 03-01 | 1 | 1 | | | 1. Provide a dedicated space for the segregation and storage of operational recyclable waste generated. The space is:<br>a. Clearly labelled, to assist with segregation, storage and collection of the recyclable waste streams<br>b. Accessible to building occupants or facilities operators for the deposit of materials and collections by waste management contractors<br>c. Of a capacity appropriate to the building type, size, number of units (if relevant) and predicted volumes of waste that will arise from daily/weekly operational activities and occupancy rates. | Architect | | **Mandatory for Excellent**<br><br>The design team demonstrates that the provision of waste management facilities for the assessed building is adequate given the building type, occupier (if known), operational function and likely waste streams and volumes to be generated.<br>Where it is not possible to determine what provision should be made, use the following guide for minimum storage space provision:<br>1. At least 2m² per 1000m² of net floor area for buildings < 5000m²<br>2. A minimum of 10m² for buildings ≥ 5000m²<br>3. An additional 2m² per 1000m² of net floor area where catering is provided (with an additional minimum of 10m² for buildings ≥ 5000m²).<br>The net floor area should be rounded up to the nearest 1000m2. |
| | | | | | | 2. For consistent and large amounts of operational waste generated, provide:<br>a. Static waste compactors or balers; situated in a service area or dedicated waste management space<br>b. Vessels for composting suitable organic waste OR adequate spaces for storing segregated food waste and compostable organic material for collection and delivery to an alternative composting facility<br>c. A water outlet provided adjacent to or within the facility for cleaning and hygiene purposes where organic waste is to be stored or composted on site. | | | |
| | | | | | | 3. In addition to the standard criteria, the waste facilities are compliant with the relevant NHS guidelines HTM 07-01 (England version) | | | |
| **Wst 05: Adaptation to climate change** | | | | | | | | | |
| Resilience of structure, fabric, building services and renewables installation | Wst 05-01 | 1 | 1 | | | 1. Conduct a climate change adaptation strategy appraisal using:<br>a. A systematic risk assessment to identify the impact of expected extreme weather conditions arising from climate change on the building over its projected life cycle. The assessment covers the installation of building services and renewable systems, as well as structural and fabric resilience aspects and includes:<br>i. Hazard identification<br>ii. Hazard assessment<br>iii. Risk estimation<br>iv. Risk evaluation<br>v. Risk management. | Architect / MEP/ C&S Engineer | 2 | |
| | | | | | | 2. Develop recommendations or solutions based on the climate change adaptation strategy appraisal, before or during concept design, that aim to mitigate the identified impact. | | | |
| | | | | | | 3. Provide an update during Technical Design demonstrating how the recommendations or solutions proposed at Concept Design have been implemented where practical and cost effective. Omissions have been justified in writing by the assessor. | Architect / MEP/ C&S Engineer | 4 | |

| Title | Credit Ref | Credits available | Route to Excellent (min. 70%) 75.75% | Potential (easily achieved) 15.81% | Potential (at cost / investigation required) 16.10% | Compliance Requirements | Responsibility | RIBA Stage | Comments |
|---|---|---|---|---|---|---|---|---|---|
| Exemplary Criteria | Wst 05-Ex | **1** | **0** | | 1 | Achievement of the following criteria demonstrates a holistic approach to the design and construction of the building's life cycle to mitigate against the impacts of climate change.<br>To achieve an exemplary level performance credit:<br>4. Meet criteria 1-3. | BREEAM assessor | | |
| | | | | | | 5. Meet the criteria or achieve credits of the assessment issues given below:<br>- Hea 04: Criterion 6<br>- Ene 01: Minimum 6 credits<br>- Ene 04: Passive design credit<br>- Wat 01: Minimum 3 credits<br>- Mat 05: Criteria 2 - 4<br>- Pol 03: Minimum 1 credit for flood resilience and 2 credits under Surface Water Runoff | | | |
| **Wst 06: Design for Disassembly and Adaptability** | | | | | | | | | |
| Recommendations | Wst 06-01 | **1** | **1** | | | 1. Conduct a study to explore the ease of disassembly and the functional adaptation potential of different design scenarios by the end of Concept Design. | Architect | 2 | |
| | | | | | | 2. Develop recommendations or solutions based on the study during or prior to Concept Design, that aim to enable and facilitate disassembly and functional adaptation. | | | |
| Implementation | Wst 06-02 | **1** | **1** | | | 3. Achieve criteria 1 and 2. | Architect | 4 | |
| | | | | | | 4. Provide an update, during Technical Design, on:<br>a. How the recommendations or solutions proposed by Concept Design have been implemented where practical and cost effective. Omissions have been justified in writing to the assessor.<br>b. Changes to the recommendations and solutions during the development of the Technical Design, | | | |
| | | | | | | 5. Produce a building adaptability and disassembly guide to communicate the characteristics allowing functional adaptability and disassembly to prospective tenants. | | | |
| **LAND USE AND ECOLOGY (1 credit = 1.00%)** | | | | | | | | | |
| **LE 01: Site Selection** | | | | | | | | | |
| Previously Occupied Land | LE 01-01 | **1** | **1** | | | 1. At least 75% of the proposed development's footprint is on an area of land which has previously been occupied. | Architect | | This should easily be achieved. |
| Contaminated Land | LE 01-02 | **1** | **0** | 1 | | 2. A contaminated land professional's site investigation, risk assessment and appraisal has deemed land within the site to be affected by contamination. The site investigation, risk assessment and appraisal have identified:<br>a. The degree of contamination<br>b. The contaminant sources/types<br>c. The options for remediating sources of contamination which present an unacceptable risk. | C&S Engineer | | 01.02.19 (pre-assessment workshop): It is thought that this will be achieved, however the full investigation is yet to take place. |
| | | | | | | 3. The client or principal contractor confirms that remediation of the site will be carried out in accordance with the remediation strategy and its implementation plan as recommended by the contaminated land professional. | | | |

| Title | Credit Ref | Credits available | Route to Excellent (min. 70%) 75.75% | Potential (easily achieved) 15.81% | Potential (at cost / investigation required) 16.10% | Compliance Requirements | Responsibility | RIBA Stage | Comments |
|---|---|---|---|---|---|---|---|---|---|
| **LE 02: Identifying and understanding the risks and opportunities for the project** | | | | | | | | | |
| Pre-Requisite | LE 02-Pre | - | - | - | - | **Assessment route selection**<br>1. An assessment route for the project has been determined using BREEAM Guidance Note GN34 BREEAM Ecological Risk Evaluation Checklist.<br>2. The client or contractor confirms compliance is monitored against all relevant UK and EU or international legislation relating to the ecology of the site. | Ecologist / Client / Contractor | 2 | Even though there is little / no potential to influence site ecology, it is assumed that route 2 will be followed to maximise the number of credits available.<br><br>Only 1 credit is available using route 1. |
| Survey and Evaluation and Determining Ecological Outcomes | LE 02-01 | **2** | **2** | | | **Route 1**<br>3. Completion of the BREEAM Ecological Risk Evaluation Checklist indicates Assessment route 1 can be used as the assessment. | Design Team | 1 | |
| | | | | | | **Route 2**<br>4. An appropriate individual is appointed at a project stage that ensures early involvement in site configuration and, where necessary, can influence strategic planning decisions. | Project Manager / Architect | | |
| | | | | | | 5. Prior to the completion of the preparation and brief, an appropriate level of survey and evaluation (see assessment route 2, for sites where complex ecological systems are likely to be present) has been carried out to determine the ecological baseline of the site, taking account of the zone of influence to establish:<br>a. Current and potential ecological value and condition of the site, and related areas within the zone of influence.<br>b. Direct and indirect risks to current ecological value.<br>c. Capacity and feasibility for enhancement of the ecological value of the site and, where relevant, areas within the zone of influence. | Ecologist | | |
| | | | | | | 6. Data is collected and shared with project team to inform the site preparation, design or construction works. | | | |
| | | | | | | 7. Survey evaluation criteria (criteria 3-6) relevant to the chosen route have been achieved. | | | |
| | | | | | | 8. During Concept Design, the project team liaise and collaborate with representative stakeholders to identify and consider ecological outcomes for the sites (appropriate to the scale and type of development) for the project. | Ecologist / Architect / Client | 2 | |
| | | | | | | 9. When determining the ecological outcome for the site, this must involve the identification, appraisal and selection of specific solutions and measures sufficiently early to influence key project planning decisions. This must be done in accordance with the following hierarchy of action:<br>a. Avoidance<br>b. Protection<br>c. Reduction or limitation of negative impacts<br>d. Onsite compensation and,<br>e. Enhancement, considering the capacity and feasibility within the site, or where viable, off-site. | | | |
| | | | | | | 10. Following this, the optimal ecological outcome for the site is selected after liaising with the representative stakeholders and the project team. | | | |
| Exemplary level criteria | LE 02-Ex | **1** | **0** | | | To achieve one exemplary performance credit:<br>**Determine the ecological outcomes for the site (sustainability-related activities)**<br>11. Achieve criteria 8 to 10. | Ecologist / Architect / Landscape Architect | | |
| | | | | | | 12. When determining the optimal ecological outcome for the site, consider, in addition to those outlined in criteria 8-10, the wider site sustainability related activities and the potential for ecosystem service related benefits. | | | |
| | | | | | | 13. Achieve the credits of the assessment issues outlined below:<br>13. Both Hea 07 credits<br>13. Pol 03 credits for 'surface water run-off' and 'minimising watercourse pollution'.<br>13. Pol 05 | | | |

| Title | Credit Ref | Credits available | Route to Excellent (min. 70%) 75.75% | Potential (easily achieved) 15.81% | Potential (at cost / investigation required) 16.10% | Compliance Requirements | Responsibility | RIBA Stage | Comments |
|---|---|---|---|---|---|---|---|---|---|
| **LE 03: Managing Negative Impacts on Ecology** | | | | | | | | | |
| Pre-Requisite | LE 03-Pre | - | - | - | - | 1. LE02 has been achieved.<br>2. The client or contractor has confirmed that compliance is monitored against all relevant UK, and EU or International legislation relating to the ecology of the site. | Contractor | | Only 2 credits are available using Route 1. |
| Planning, Liaison, Implementation and Data | LE 03-01 | **1** | **1** | | | 3. Roles and responsibilities have been clearly defined, allocated and implemented to support successful delivery of project outcomes at an early enough stage to influence the concept design or design brief.<br>4. Site preparation and construction works have been planned for and are implemented at an early project stage to optimise benefits and outputs.<br>5. The project team liaising and collaborating with representative stakeholders, taking into consideration data collated and shared, have implemented solutions, and measures have been selected during site preparation and construction works. | Design Team<br>Contractor<br>Design Team | | |
| Managing Negative Impacts of the Project | LE 03-02 | **2** | **1** | | 1 | **Route 1 (one credit)**<br>6. Negative impacts from site preparation and construction works have been managed according to the hierarchy and no net impact has resulted.<br>**Route 2 (up to two credits)**<br>7. Negative impacts from site preparation and construction works have been managed according to the hierarchy (see Assessment route 2: For sites where complex ecological systems are likely to be present) and either:<br>a. No overall loss of ecological value has occurred (2 credits)<br>b. The loss of ecological value has been limited as far as possible (1 credit) | Ecologist / Landscape Architect / Contractor | | |
| **LE 04: Change and Enhancement of Site Ecology** | | | | | | | | | |
| Pre - Requisite | LE 04-Pre | - | - | - | - | 1. Criteria 2-3 in LE 03 have been achieved.<br>2. The client or contractor has confirmed that compliance is monitored against all relevant UK, and EU or International legislation relating to the ecology of the site. | Design Team<br>Contractor | | Using Route 1, no credits are available under LE 04-02 and only 1 under LE 04-03. |
| Liaison, Implementation and Data Collection | LE 04-02 | **1** | **1** | | | **Route 2**<br>5. The project team liaising and collaborating with representative stakeholder, taking into consideration data collated and shared, have implemented the solutions and measures selected in a way that enhances ecological value in the following order:<br>a. On site, and where this is not feasible<br>b. Off site within the zone of influence | Ecologist / Landscape Architect / Contractor | | |
| Enhancement of Ecology | LE 04-03 | **3** | **1** | | | **Route 2**<br>b. Up to three credits are awarded based on the calculation of the change in ecological value occurring as a result of the project. This must be calculated in accordance with the process set out in GN36 - BREEAM, CEEQUAL and HQM Ecology Calculation Methodology – Route 2. Credits are awarded as follows:<br>a. Minimising loss of ecological value (one credit - percentage score of 75-94)<br>b. No net loss of ecological value (two credits - percentage score of 95-104)<br>c. Net gain of ecological value (three credits - percentage score of 105-109) | Ecologist / Landscape Architect | | |
| Exemplary level criteria | LE 04-EX | **1** | **0** | | | 7 The change in ecological value occurring is calculated in accordance with the process set out in GN36 - BREEAM, CEEQUAL and HQM Ecology Calculation Methodology – Route 2. The credit is awarded as follows:<br>a. Significant net gain of ecological value (percentage score of 110 or above) | Ecologist / Landscape Architect | | Very unlikely due to the lack of external space. |

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|---|---|---|---|---|---|---|---|---|---|
| **LE 05: Long Term Ecology Management and Maintenance** | | | | | | | | | |
| Pre-Requisite | LE 05-Pre | - | - | - | - | 1 The client or contractor has confirmed that compliance is being monitored against all relevant UK, EU and international standards relating to the ecology of the site. | Contractor | | Only 1 credit is available using Route 1. |
| | | | | | | 2 The following must be achieved, according to the route being assessed:<br>a Route 1 - Criteria 2-3 in LE 03 have been achieved.<br>b Route 2 - Criteria 2-3 in LE 03 have been achieved, and at least one credit under LE 04 for 'Change and Enhancement of Ecology' has been awarded. | | | |
| Planning, liaison, data, monitoring and review management and maintenance | LE 05-01 | **1** | **1** | | | 3. The project team liaise and collaborate with representative stakeholders, taking into consideration data collated and shared, on solutions and measures implemented to:<br>a Monitor and review the effectiveness with which the plans for LE 03 & LE 04 are implemented<br>b. Develop and review management and maintenance solutions, actions or measures. | Landscape Architect / Client | | |
| | | | | | | 4. In support of the above and to help ensure their continued relevance over the period of the project the following should be considered:<br>a. Monitoring and reporting of the ecological outcomes for site implemented at the design and construction stage<br>b. Monitoring and reporting of outcomes and successes from the project<br>c. Arrangements for the ongoing management of landscape and habitat connected to the project (on and, where relevant, off site)<br>d. Maintaining the ecological value of the site and its relationship or connection to its zone of influence<br>e. Maintaining the site in line with the any sustainability linked activities, e.g. ecosystems benefits (LE 02).<br>f. Remedial or other management actions are carried out which relate to those identified in LE 02, LE 03 and LE 04. | Design Team | | |
| | | | | | | 5. As part of the tenant or building owner information supplied, include a section on Ecology and Biodiversity to inform the owner or occupant of local ecological features, value and biodiversity on or near the site. | Design Team | | |
| Landscape and Ecology Management Plan (or similar) development | LE 05-02 | **1** | **1** | | | 6. Landscape and ecology management plan, or equivalent, is developed in accordance with BS 42020:2013 Section 11.1(210) covering as a minimum the first five years after project completion and includes:<br>a. Actions and responsibilities, prior to handover, to give to relevant individuals<br>b. The ecological value and condition of the site over the development life.<br>c. Identification of opportunities for ongoing alignment with activities external to the development project and which supports the aims of BREEAM's Strategic Ecology Framework<br>d. Identification and guidance to trigger appropriate remedial actions to address previously unforeseen impacts<br>e. Clearly defined and allocated roles and responsibilities. | Landscape Architect | | |
| | | | | | | 7. The landscape and management plan or similar is updated as appropriate to support maintenance of the ecological value of the site. | | | |

| Title | Credit Ref | Credits available | Route to Excellent (min. 70%) 75.75% | Potential (easily achieved) 15.81% | Potential (at cost / investigation required) 16.10% | Compliance Requirements | Responsibility | RIBA Stage | Comments |
|---|---|---|---|---|---|---|---|---|---|
| **POLLUTION (1 credit = 0.67%)** | | | | | | | | | |
| **Pol 01: Impact of Refrigerants** | | | | | | | | | |
| Impact of refrigerant | Pol 01-01 | **2** | **1** | | 1 | **Three credits - No refrigerant use**<br>1. Where the building does not require the use of refrigerants within its installed plant/systems.<br>OR alternatively, where the building does require the use of refrigerants, the three credits can be awarded as follows:<br>**Pre-requisite**<br>2. All systems (with electric compressors) must comply with the requirements of BS EN 378:2016 (parts 2 and 3) and where refrigeration systems containing ammonia comply with the Institute of Refrigeration Ammonia Refrigeration Systems Code of Practice<br>**Two credits - Impact of refrigerant**<br>3. Where the systems using refrigerants have Direct Effect Life Cycle CO2 equivalent emissions (DELC CO2e) of ≤ 100 kgCO2e/kW cooling/heating capacity. For systems which provide cooling and heating, the worst performing output based on the lower of kW cooling output and kW heating output is used to complete the calculation. To calculate the DELC CO2e please refer to the Relevant definitions in the Additional information section and the Methodology section.<br>OR<br>4. Where air-conditioning or refrigeration systems are installed the refrigerants used have a Global Warming Potential (GWP) ≤10.<br>OR<br>**One credit - Impact of refrigerant**<br>5. Where the systems using refrigerants have Direct Effect Life Cycle CO2equivalent emissions (DELC CO2e) of ≤ 1000 kgCO 2e/kW cooling/heating capacity. | MEP | | At least 1 credit is typically achieved. |
| Leak detection | Pol 01-02 | **1** | **1** | | | 6. All systems are hermetically sealed or only use environmentally benign refrigerants.<br>OR<br>7. Where the systems are not hermetically sealed:<br>a. Systems have:<br>i. A permanent automated refrigerant leak detection system, that is robust and tested, and capable of continuously monitoring for leaks.<br>OR<br>ii. An inbuilt automated diagnostic procedure for detecting leakage is enabled.<br>b. In the event of a leak, the system must be capable of automatically responding and managing the remaining refrigerant charge to limit loss of refrigerant (see automatic isolation and containment of refrigerant). | MEP | | |
| **Pol 02: Local Air Quality** | | | | | | | | | |
| Local Air Quality | Pol 02-01 | **2** | **1** | | 1 | 1. All heating and hot water is supplied by non-combustion systems. For example, only powered by electricity<br>OR alternatively;<br>2. Emissions from all installed combustion plant that provide space hearing and domestic hot water do not exceed the levels set in Table 12.4 and Table 12.5 in the guidance manual (assessor to provide). The measurements must be provided by manufacturers, following the labelling requirements of the European Directive 2009/125/EC. No credits can be awarded for Pol02 if any of the combustion appliances are not covered in Table 12.4 and Table 12.5 in the guidance manual.<br>3. Emissions from all installed combustion plant that provide space heating and domestic hot water do not exceed the levels set in table 12.4 and 12.15 of the guidance manual. | MEP | | Although these credits can be difficult to achieve it is assumed they will be sought.<br><br>The project will not be connected to the district heating system. |

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|---|---|---|---|---|---|---|---|---|---|
| **Pol 03: Flood and Surface Water Management** | | | | | | | | | |
| Flood resilience | Pol 03-01 | **2** | **2** | | | 1. An appropriate consultant is appointed to carry out and demonstrate the development's compliance with all criteria.<br>Two credits - Low flood risk<br><br>2. A site-specific flood risk assessment (FRA) confirms that the development is in a flood zone that is defined as having low annual probability of flooding. The FRA takes all current and future sources of flooding into consideration.<br>One credit - Medium/high flood risk<br><br>3. A site-specific FRA confirms the development is in a flood zone that is defined as having a medium or high annual probability of flooding and is not in a functional floodplain. The FRA must take all current and future sources of flooding into consideration. For smaller sites, refer to Level of detail required in the FRA for smaller sites which overrides criterion 2.<br>4. To increase the resilience of the development to flooding, one of the following must be achieved:<br>a. The ground level of the building and access to both the building and the site, are designed (or zoned) so they are at least 600mm above the design flood level of the site's flood zone.<br>b. The final design of the building and wider site reflects the recommendations made by an appropriate consultant with the hierarchy approach outlined in section 5 of BS 8533:2017. | C&S Engineer | | It is thought that the development is a low flood risk zone. |
| Surface Water Run-off | Pol 03-Pre | - | - | - | - | 5. Surface water run-off design solutions must be bespoke, i.e. they must take account of the specific site requirements and natural or man-made environment of and the surrounding site. The priority levels detailed in the Methodology must be followed, with justification given by the appropriate consultant where water is allowed to leave the site. | C&S Engineer | | 01.02.2019 (pre-assessment workshop): Attenuation is being provided and, as such, it is thought that both credits will be achieved. |
| | Pol 03-02 | **1** | **1** | | | **One credit - Surface water run-off - Rate**<br>6. Drainage measures are specified so that the peak rate of run-off from the site to the watercourses (natural or municipal) shows a 30% improvement for the developed site compared with the pre-developed site. This should comply at the 1-year and 100-year return period events.<br>7. Relevant maintenance agreements for the ownership, long term operation and maintenance of all specified Sustainable Drainage Systems (SuDs) are in place.<br>8. Calculations include an allowance for climate change. This should be made in accordance with the current best practice planning guidance. | C&S Engineer | | |
| | Pol 03-03 | **1** | **1** | | | **One credit - Surface Run-off - Volume**<br>9. Flooding of property will not occur and in the event of local drainage system failure (caused by either extreme rainfall or a lack of maintenance); AND<br>EITHER<br>10. Drainage design measures are specified so that the post-development run-off volume, over the development lifetime, is no greater than it would have been prior to the assessed site's development. This must be for the 100-year-6-hour event, including an allowance for climate change.<br>11. Any additional predicted volume run-off for this event is prevented from leaving the site by using infiltration or other SuDS techniques.<br>OR (only where criteria 10 and 11 for this credit cannot be achieved):<br>12. Justification from the appropriate consultant indicating why the above criteria cannot be achieved, i.e. where infiltration or other SuDS techniques are not technically viable options.<br>13. Drainage design measures are specified so that that post-development peak run-off is reduced to the limiting discharge. The limiting discharge is defined as the highest flow rate from the following options:<br>a. the pre-development one-year peak flow rate<br>b. The mean annual flow rate (Qbar)<br>c 2L/s/ha.<br>For the one-year peak flow rate, the one-year return period event criterion applies.<br>14. Relevant maintenance agreements for the ownership, long term operation and maintenance of all specified SuDS are in place.<br>15. For either option, above calculations must include an allowance for climate change; this should be made in accordance with current best practice planning guidance. | C&S Engineer | | |

| Title | Credit Ref | Credits available | Route to Excellent (min. 70%) 75.75% | Potential (easily achieved) 15.81% | Potential (at cost / investigation required) 16.10% | Compliance Requirements | Responsibility | RIBA Stage | Comments |
|---|---|---|---|---|---|---|---|---|---|
| Minimising Water Course Pollution | Pol 03-04 | 1 | 0 | | 1 | 16. There is no discharge from the developed site for rainfall up to 5mm (confirmed by the Appropriate Consultant).<br>17. Areas with a low risk source of watercourse pollution, an appropriate level of pollution prevention treatment is provided, using appropriate SuDS techniques.<br>18. Areas with a high risk of contamination of spillage of substances, such as petrol and oil have separators (or an equivalent system) are installed in surface water drainage systems.<br>19. Chemical or liquid gas storage areas have a means of containment fitted to the site drainage system (i.e. shut-off valves). This is to prevent the escape of chemicals to natural watercourses in the event of spillage or bunding failure.<br>20. All water pollution prevention systems have been designed and installed in accordance with the recommendations of documents such as the SuDS manual and other relevant industry best practice. They must be bespoke solutions taking account of the specific site requirements and natural or man-made environment of and surrounding the site.<br>21. A comprehensive and up to date drainage plan of the site will be made available for the building or site occupiers.<br>22. Relevant maintenance agreements for the ownership, long term operation and maintenance of all specified SuDS must be in place.<br>23. All external storage and delivery areas are designed and detailed in accordance with the current best practice planning guidance. | C&S Engineer | | It is assumed criterion 16 cannot be met. |
| **Pol 04: Reduction of Night Time Light Pollution** | | | | | | | | | |
| Reduction of Night Time Light Pollution | Pol 04-01 | 1 | 1 | | | 1. External lighting pollution has been eliminated through effective design that removes the need for external lighting. This does not adversely affect the safety and security of the site and its users.<br>OR alternatively, where the building does have external lighting one credit can be awarded as follows:<br>2. The external lighting strategy has been designed in compliance with Table 2 (and its accompanying notes) of the Institution of Lighting Professionals (LP) Guidance notes for the reduction of obtrusive light, 2011.<br>3. All external lighting (except for safety and security lighting) can be automatically switched off between 23:00 and 07:00<br>4. If safety or security lighting is provided and will be used between 23:00 and 07:00, this part of the lighting system complies with the lower levels of lighting recommended during these hours in Table 2 of the ILP guidance notes.<br>5. Illuminated advertisements are designed in compliance with IPL PLG05 The Brightness of Illuminated Advertisement. | MEP | | |
| **Pol 05: Reduction of noise pollution** | | | | | | | | | |
| Reduction of Noise Pollution | Pol 05-01 | 1 | 1 | | | 1. There are no noise-sensitive areas within the assessed building or within 800m radius of the assessed site.<br>OR<br>2. Where there are noise-sensitive areas within the assessed building or noise-sensitive areas within 800m radius of the assessed site, a noise impact assessment compliant with BS4142:2014 is commissioned. Noise levels must be measured or determined for:<br>a. Existing background noise levels:<br>i. at the nearest or most exposed noise-sensitive development to the proposed assessed site.<br>ii. Including existing plant on a building, where the assessed development is an extension to the building.<br>b. Noise rating level from the assessed building<br>3. The noise impact assessment must be carried out by a suitably qualified acoustic consultant.<br>4. The noise level from the assessed building, as measured in the locality of the nearest or most exposed noise-sensitive development, must be at least 5dB lower than the background noise throughout the day and night. | Acoustician | | |
| | | | | | | 5. If the noise sources from the assessed building are greater than the levels described in criterion 4, measures have been installed to attenuate the noise at its source to a level where it will comply with the criterion. | Contractor | | |

# Appendix 2: Energy report

# 70-86 Royal College Street

## Energy Strategy Report

Doc No: RCS-BDP-ZZ-ZZ-MEP-RP-ZZ_ES-0001 Combined Energy Strategy Report
Issue: Planning issue
Rev: P01
Date: January 20

BDP.

| Revision | Date | Description | By | Approved |
|---|---|---|---|---|
| P01 | 17 January 2020 | Planning issue | KD | CY |
| | | | | |
| | | | | |

# Contents

# Part A - Energy Assessment

## Executive summary

BDP has been appointed to complete the energy modelling assessment (Part L2A 2013) of the 70-86 Royal College Street development, located in London. The results indicate that the London Plan and Camden targets shall be achieved after the following key measures have been implemented:

- Building fabric improved beyond the minimum required by the Building Regulations
- Glazing thermal and solar properties improved to reduce heat loss and risk of overheating
- Deep horizontal projecting planters and potting sheds to create an overhang across ward bedrooms and dayrooms
- Metal mesh panel acting as a solar screen
- Air permeability improved to reduce the loss caused by air infiltration
- Thermal mass has been incorporated to reduce peak temperatures during the entire day
- Using air source heat pump systems for space heating and domestic hot water
- A 200 $m^2$ photovoltaic solar array has been included on the roofs to generate renewable energy and reduce further the carbon emissions

Furthermore, according to Greater London Authority guidance (Energy Assessment Guidance October 2018), the updated SAP 2010 carbon emission factors are regarded in this report. This approach is regarded in order to reflect the decarbonisation of the electricity grid, which is not currently considered by Part L of Building Regulations.

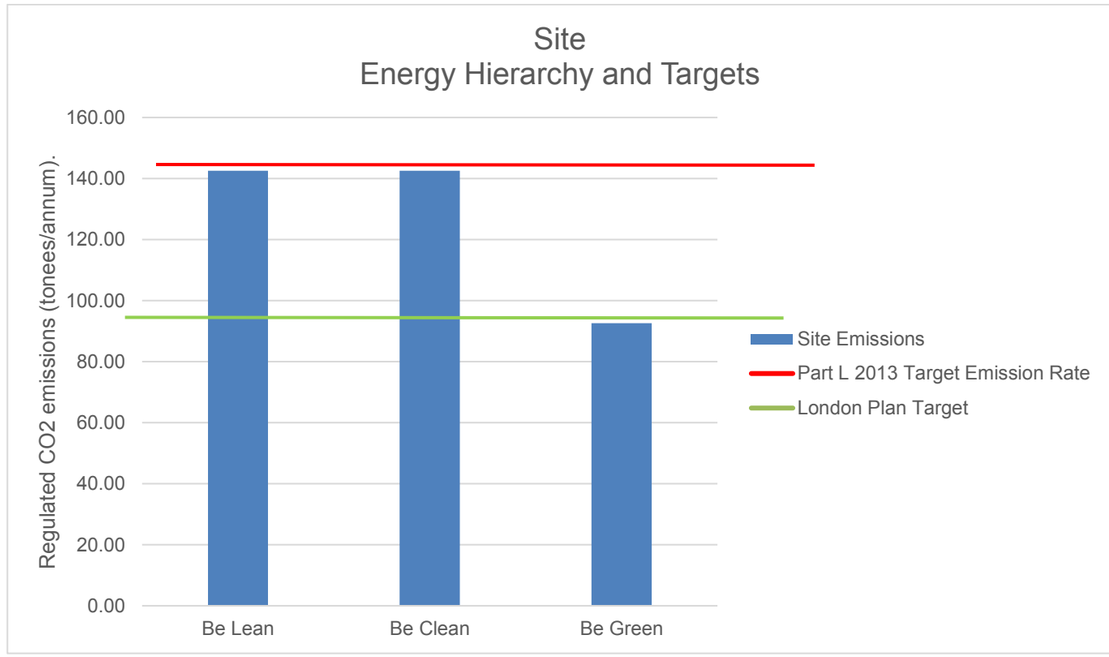



*Figure 1: Site - energy hierarchy and targets*

*Table 1: Comparison between carbon emission factor between SAP 2012 and SAP 10*

| **Fuel type** | **Fuel Carbon Factor ($kgCO_2/kWh$)** | |
|---|---|---|
| | **SAP 2012** | **SAP 10** |
| Natural Gas | 0.216 | 0.210 |
| Grid Electricity | 0.519 | 0.233 |

**"Be Lean" Notes**

- The hospital building presents only a marginal improvement in terms of "Be Lean" measures.
- Hospitals are typically characterised by extensive mechanical ventilation systems (such as so called "all air systems"). Such systems are heavily penalised in Part L, because the notional building is always modelled with low fan power.
- A study by IES and Mabbett Associates on hospitals in Scotland observed that a Part L energy prediction was six times lower than a corrected case based on real-world observations[1].

*Table 2: – $CO_2$ emissions breakdown*

| | Carbon dioxide emissions (Tonnes $CO_2$ per annum) | |
|---|---|---|
| | Regulated | Unregulated |
| Baseline $CO_2$ emissions (Part L 2013 of the Building Regulations Compliant Development) | 144.4 | 135.2 |
| $CO_2$ emissions after energy demand reduction (be lean) | 142.6 | 135.2 |
| $CO_2$ emissions after heat network (be clean) | 142.6 | 135.2 |
| $CO_2$ emissions after renewable energy (be green) | 92.6 | 135.2 |

[1] IES+Mabbett: http://www.hfs.scot.nhs.uk/

*Table 3: $CO_2$ savings breakdown*

| | Regulated Carbon dioxide savings | |
|---|---|---|
| | (Tonnes $CO_2$ per annum) | (%) |
| Be lean: Savings from energy demand reduction | 1.8 | 1% |
| Be clean: Savings from heat network | 0 | 0 |
| Be green: Savings from renewable energy | 50 | 35% |
| Total Cumulative Savings | 51.8 | 36% |
| Minimum Target Savings on Site for London Plan and Camden | 50.5 | 35% |
| Minimum Target Savings from onsite renewables for Camden and London Plan | 28.9 | 20% |
| Annual surplus against minimum target saving on site | 1.24 | |
| Savings from off-set payments | 92.6 | |

**Site-wide Results**

*Table 4: Site-wide $CO_2$ emissions and savings breakdown*

| | Total regulated emissions | Carbon dioxide savings | Percentage savings |
|---|---|---|---|
| | (Tonnes $CO_2$ per annum) | (Tonnes $CO_2$ per annum) | (%) |
| Part L 2013 Baseline | 144.4 | | |
| Lean | 142.6 | 1.8 | 1% |
| Clean | 142.6 | 1.8 | 1% |
| Green | 92.6 | 51.8 | 36% |

With the Emerging Policy 9.2.6 it is expected that non-domestic developments will be required to reduce emissions by 15% through energy efficiency measures ("lean"). Although the 15% is not met in the current design, this is thought to be due to current Part L methodologies which heavily penalise developments such as hospitals which require extensive mechanical ventilation. As discussed previously, this is an unfair reflection on the true “Be Lean” improvements, as demonstrated through the IES and Mabbett Associates study.

**Cash-in-lieu**

Assuming the zero carbon target under the future London Plan, the remaining 2.778 tonnes of carbon to achieve zero carbon over 30 years are to be off-set to a cash-in-lieu contribution to the borough at the price per tonne established by the local authority. In this case this has been considered £60 pounds per tonne of carbon resulting in £166,680.

## Introduction

- This Energy Statement outlines the environmental strategy that has been included for 70-86 Royal College Street development.
- The purpose of the report is to establish a strategy to adhere to Part L, GLA and Camden Council policies, according to the updated SAP 10 carbon emissions factors.

## Tools and Methods

The assessment demonstrates carbon reductions in accordance with the London Plan 2018 (Energy Assessment Guidance) energy hierarchy:

- Lean (Demand reductions)
- Clean (Energy efficiency)
- Green (Renewable energy)

Software used:

- IES Virtual Environment 2018

The analysis was supervised by a CIBSE accredited Low Carbon Energy Assessor (LCEA) and undertaken by an experienced building physicist.

## Weather data

The Test Reference Years are synthetically generated from average months selected from a historical baseline of 1984 to 2004.

- Location: London
- CIBSE 2005 Test Reference Year

## Policy Summary

### London Plan (Current)

At a regional level, the climate change policies as set out in the London Plan require developments to make the fullest contribution to the mitigation and adaptation to climate change and to minimise carbon dioxide emissions.

### Policy 5.2 Minimising Carbon Dioxide Emissions

All new homes should be **zero carbon** by 2016 and new non-domestic buildings should achieve **35%** carbon emissions reductions below Part L 2013.

All developments should demonstrate a reduction in carbon emissions in accordance with the following energy hierarchy:

- Use Less Energy (Be Lean)
- Supply Energy Efficiently (Be Clean)
- Use Renewable Energy (Be Green)

### Policy 5.3 Sustainable Design and Construction

Policy 5.3 states that all Major Developments must meet the standards outlined in the Mayor's Supplementary Planning Guidance. This includes consideration of the following issues relevant for this report:

- Minimising carbon dioxide emissions across the site, including the building and services (such as heating and cooling systems)
- Avoiding internal overheating and contributing to the urban heat island effect

### Policy 5.6 Decentralised Energy in Development Proposals

Development proposals should evaluate the feasibility of connection to a Decentralised Energy Heating System and Combined Heat and Power (CHP) systems. In cases where a new CHP system is appropriate, development proposals should also examine opportunities to extend the system beyond the site boundary to adjacent sites.

Major development proposals should select energy systems in accordance with the following hierarchy:

- Connection to existing heating or cooling networks,
- Site wide CHP network, and
- Communal heating and cooling.

### Policy 5.7 Renewable Energy

The Mayor seeks to increase the proportion of energy generated from renewable sources, and expects that the projections for installed renewable energy capacity outlined in the Climate Change Mitigation and Energy Strategy and in supplementary planning guidance, will be achieved in London. Within the framework of the energy hierarchy (see Policy 5.2), there is a presumption that all major development proposals will seek to reduce carbon dioxide emissions by at least 20% through the use of on-site renewable energy generation wherever feasible.

Development proposals should seek to utilise renewable energy technologies such as: biomass heating; cooling and electricity; renewable energy from waste; photovoltaics; solar water heating; wind and heat pumps. All renewable energy systems should be located and designed to minimise any potential adverse impacts on biodiversity, the natural environment and historical assets, and to avoid any adverse impacts on air quality.

**Policy 5.9 Overheating and Cooling**

Major development proposals should reduce potential overheating and reliance on air conditioning systems through consideration of principles of the following cooling hierarchy:

- Minimise internal heat generation through energy efficient design,
- Reduce the amount of heat entering a building during summer months through orientation, shading, albedo, fenestration, insulation and green roofs and walls,
- Manage the heat within the building through exposed internal thermal mass and high ceilings.
- Use passive ventilation,
- Use mechanical ventilation, and
- Use active cooling systems (ensuring they are the lowest carbon options).

Major development proposals should demonstrate how the design, materials, construction and operation of the development would minimise overheating and also meet its cooling needs. New development in London should also be designed to avoid the need for energy intensive air.

**New London Plan (July 2019 Draft)**

Policy 9.2.5 All new major developments should be zero carbon where at least 35% carbon emissions reductions are met on site with the remaining reductions made through a cash-in-lieu contribution.

Policy 9.2.6 It is expected that both residential and non-domestic developments to reduce carbon emissions by 10% and 15% respectively from energy efficiency measures (Lean).

**Camden Council Policies**

*Camden Local Plan - Policy CC1 Climate change mitigation*

*Camden Local Plan - Policy CC2 Adapting to climate change*

*Camden Planning Guidance – Energy efficiency and adaptation, March 2019*

*Camden Core Strategy CS13 Tackling Climate Change Through Promoting Higher Environmental Standards*

*Camden Development Policy DP22 Promoting Sustainable Design and Construction*

- All developments in Camden is expected to reduce carbon dioxide emissions by following the energy hierarchy
- All major development to demonstrate how London Plan targets for carbon dioxide emissions have been met
- Natural ‘passive’ measures should be prioritised over active measures to reduce energy
- All major developments to assess the feasibility of connecting to an existing decentralised energy network, or where this is not possible establishing a new network
- Developments of five or more dwellings and/or more than 500 sqm of any gross internal floor space to achieve a 20% reduction in carbon dioxide emissions from on-site renewable energy generation
- Developments are expected to reduce overheating risk through following the steps in the cooling hierarchy. All new developments should submit a statement demonstrating how the cooling hierarchy has been followed
- Active cooling (air conditioning) will only be permitted where its need is demonstrated and the steps in the cooling hierarchy are followed
- Development schemes demonstrate how adaptation measures and sustainable development principles have been incorporated into the design and proposed implementation
- Expecting non-domestic developments of 500 sqm of floorspace or above to achieve “excellent” in BREEAM assessments and encouraging zero carbon in new development from 2019.

.

**Summary**

The development should be assessed under the described policies and achieve at least 35% reduction through on-site measures and at least 20% reduction in on-site carbon dioxide emissions through renewable technologies.

Furthermore, according to Greater London Authority guidance (2018), the updated SAP 2010 carbon emission factors are regarded in this report. This approach is regarded in order to reflect the decarbonisation of the electricity grid, which is not currently taken into account by Part L of Building Regulations.

*Table 5: Comparison between carbon emission factor between SAP 2012 and SAP 10*

| **Fuel type** | **Fuel Carbon Factor ($kgCO_2/kWh$)** | |
|---|---|---|
| | **SAP 2012** | **SAP 10** |
| Natural Gas | 0.216 | 0.210 |
| Grid Electricity | 0.519 | 0.233 |

## Baseline Scenario

- The baseline scenario is based on the Notional building specification, described in Building Regulation 2013 Part L2A and on the National Calculation Methodology.
- Heating and cooling notional efficiency is selected depending on the servicing strategy of the proposed building. For the purpose of this energy strategy, the notional building HVAC generated for the 'Be Lean' measures was used.

### Layout and Orientation

- The geometry was based on the architectural information (drawings received end of November) from Ian Chalk Architects
- The development comprises of 7 floors of total floor area of 6756.5m$^2$, primarily consisting of patient bedrooms, dayrooms, consult/exam rooms and nursing stations. Some office spaces are located in the basement and ground floor whereas the two pavilions in the roof act as a rest and eat/drink spaces for the staff and the patients.

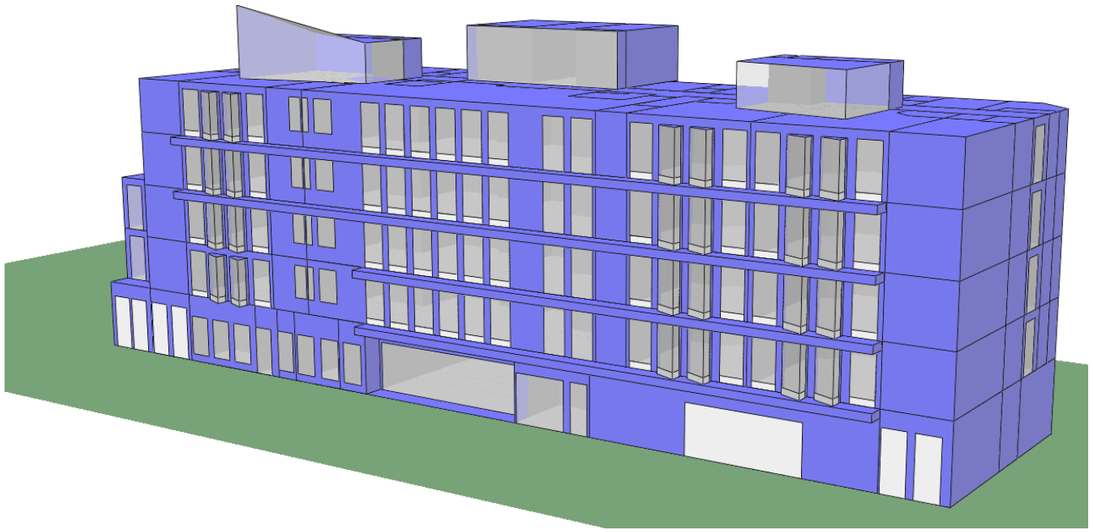


*Figure 2: Model view from South*

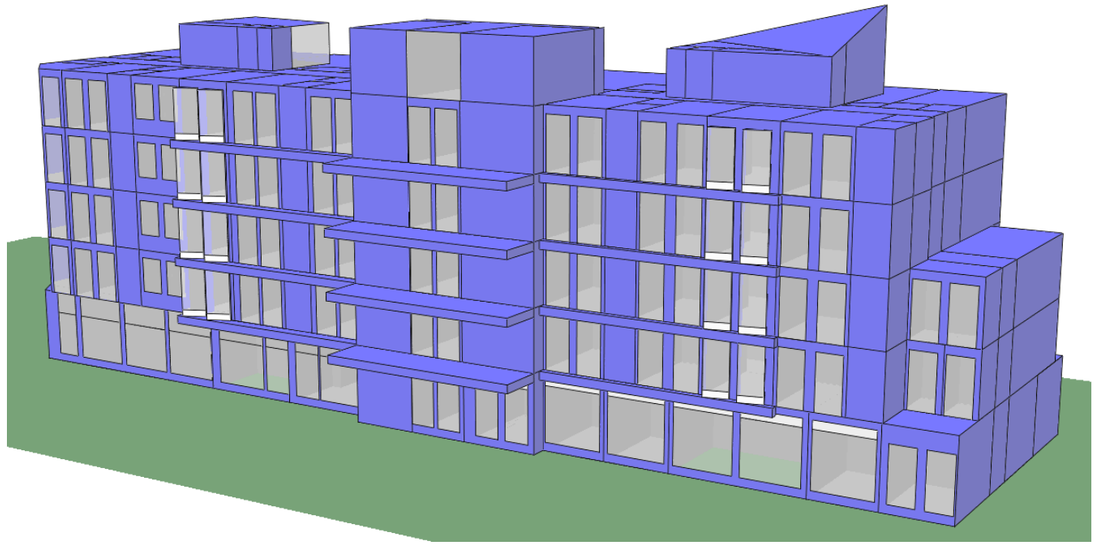


*Figure 3: Model view from North*

*Table 6: Notional building properties*

| Element | 2013 Notional Building (Baseline) |
|---|---|
| **Roof u-value** | 0.18 W/m$^2$.K |
| **Wall u-value** | 0.26 W/m$^2$.K |
| **Floor u-value** | 0.22 W/m$^2$.K |
| **Windows** | 1.6 W/m$^2$.K |
| **Rooflights** | 1.8 W/m$^2$.K |
| **Air permeability** | 5m$^3$/h/m$^2$ |
| **Lighting** | Luminaire output 60 lm/W<br>Daylight dimming controls |
| **Heating plant efficiency** | 91% SCoP with 10% losses (81.9%) |
| **Ventilation** | Natural Ventilation. |
| **Other** | BMS monitoring with Automatic Monitoring and Targeting (AM&T)<br>Power factor > 0.95 |

## Baseline Results

*Table 7: Baseline scenario results*

| This development | $CO_2$ Emissions (tonnes $CO_2$/year) |
|---|---|
| Heating | 29.0 |
| Cooling | 13.2 |
| Auxiliary | 32.6 |
| Lighting | 44.0 |
| DHW | 25.6 |
| **Total regulated** | **144.4** |
| Unregulated | 135.2 |
| **Total regulated & unregulated** | 279.6 |

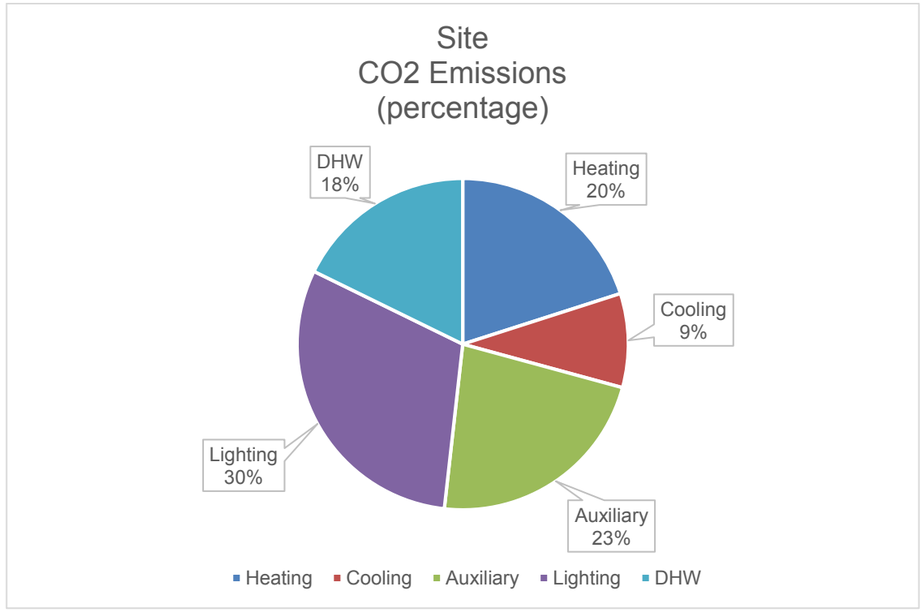



*Figure 4: Baseline scenario results - carbon emissions in percentage*

## Lean Scenario

Energy demand reduction within the building can be utilised to improve compliance with Part L 2013. This development has been reviewed to maximise both passive and active design measures to reduce the energy demand within the building.

### Envelope and constructions

#### Fenestration

The strategy depends on spectrally selective solar control glazing. In comparison to reflective or absorptive solar control, spectrally selective glazing retains a relatively neutral appearance (it's usually slightly tinted) whilst simultaneously filtering out solar gain and allowing daylight in. Fritted glass has been added to cover 32.5% of the window in the patients' bedrooms to prevent overheating and avoid the usage of cooling.

*Table 8: Glazed element properties*

| Element | U-value (glazing + framing) ($W/m^2K$) | g-value | Frame factor |
|---|---|---|---|
| Clear glass | 1.3 | **0.27** | 10% |
| Clear glass with 32.5% coverage of fritted | 1.3 | **0.21** | 10% |

#### Blinds

- Blinds can be used by occupants to control glare and comfort;
- Blinds do not form part of this analysis

#### Opaque construction elements

*Table 9: Building construction elements (Lean scenario)*

| Element | Description | U-value ($W/m^2K$) |
|---|---|---|
| Ground Floor | Reinforced concrete floor | 0.15 |
| Internal floor/ ceilings | Reinforced concrete ceiling with plasterboard finishing | 1.08 |
| External walls | Generic insulated wall system | 0.19 |
| Roof | Insulated concrete deck | 0.16 |
| Internal partitions | Generic lightweight plasterboard partition | 1.79 |

#### Air permeability

Air permeability is set at 5 $m^3/h/m^2$ @ 50 Pa.

**Shading:**

- Deep horizontal projecting planters and potting sheds have been modelled as overhangs
- Metal mesh panel has been modelled as an external shading within the window construction

## Cooling and overheating

- The following measures have been taken in accordance with the London Plan Cooling Hierarchy in order to minimise the risk of overheating and reduce the cooling load.

*Table 10: London Plan cooling hierarchy*

| | Cooling hierarchy | Response |
|---|---|---|
| **1.** | Minimise internal heat generation through energy efficient design | Highly insulated hot water pipework to minimise heat gain through hot water distribution. |
| **2.** | Reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls | • Solar control glazing. Work has been done to define the amount of fritted glass needed to prevent overheating and avoid the usage of cooling in patients' bedrooms.<br>• Deep horizontal projecting planters and potting sheds to create an overhang across ward bedrooms and dayrooms<br>• Metal mesh panel acting as a solar screen |
| **3.** | Manage the heat within the building through exposed internal thermal mass and high ceilings | Thermal mass will be provided from walls, floors and ceiling.<br>A balance between exposed thermal mass and acoustic requirements will be sought |
| **4.** | Passive ventilation | Due to noise pollution openable windows cannot be provided |
| **5.** | Mechanical ventilation | Mechanical ventilation with heat recovery is provided in most spaces of the building |
| **6.** | Active cooling systems (ensuring they are the lowest carbon options). | High performance ASHP/Chiller is provided for the offices, meeting rooms, nursing stations, dayrooms and pavilions in order to meet the cooling loads |

## HVAC Systems

Active measures like efficient HVAC and lighting are included to reduce the energy demand.

In this scenario it is assumed that the heating would be provided by gas boilers and that any active cooling would be provided by electrically powered equipment.

*Table 11: Mech Vent/Rads*

| | |
|---|---|
| NCM Type | LTHW |
| Heating Fuel | Natural Gas |
| Seasonal Eff. | 96% |
| Vent Heat Recovery Eff. | 73% |
| Used With CHP? | NO |
| Cooling/Ventilation Mechanism | Mechanical Ventilation |
| Seasonal EER (kW/kW) | N/A |
| System Specific Fan Power (SFP) W/(l/s) | 1.9 |

*Table 12: FCU*

| | |
|---|---|
| NCM Type | Fan coils |
| Heating Fuel | Natural Gas |
| Seasonal Eff. | 96% |
| Vent Heat Recovery Eff. | 73% |
| Used With CHP? | NO |
| Cooling/Ventilation Mechanism | Air conditioning |
| Seasonal EER (kW/kW) | 4.5 |
| System Specific Fan Power (SFP) W/(l/s) | 1.9 |
| Pump Power Density W/m² | 1.5 |
| Pump type | Variable speed differential sensor across pump |

*Table13: Nat Vent/Rads*

| | |
|---|---|
| NCM Type | LTHW |
| Heating Fuel | Natural Gas |
| Seasonal Eff. | 96% |
| Vent Heat Recovery Eff. | 73% |
| Used With CHP? | NO |
| Cooling/Ventilation Mechanism | Natural Ventilation |
| Pump Power Density W/m² | 0.5 |
| Pump type | Variable speed differential sensor across pump |

## Domestic Hot Water

*Table 14: DHW*

| | |
|---|---|
| NCM Type | Same as space heating |
| Heating Fuel | Natural Gas |
| Storage (litres) | 1500 |
| Storage losses (kWh/l/day) | 0.00630 |
| Loop length (m) | 1500 |
| Circulation losses (W/m) | 6 |
| Pump power (kW) | 0.8 |

## Lighting

- A  lighting design has not been undertaken at this stage
- Lighting efficacy: lumens per circuit watt
- Photoelectric dimming is used in all areas with a significant amount of external glazing

*Table 15: Lighting efficacy and controls*

| Room | Lum/cw | Controls |
|---|---|---|
| Consultation | 95 | Manual |
| Offices | 95 | Presence detection |
| Meeting rooms | 95 | Absence detection |
| Single bed (ward) | 85 | Manual |
| Multi-bed (ward) | 85 | Manual |
| Ensuite | 95 | Presence detection |
| Circulation | 95 | Presence detection |
| Plant | 90 | Absence detection |
| Dayroom | 80 | Presence detection |

## Other Settings

- Power factor corrected for any inductive loads to be between 0.9 and  0.95
- BMS has capability for Automatic Measurement and Targeting

## Lean Results

According to the SAP 2012 emission factors used for the issue of the BRUKL report (Appendix A), the Building emission rate (BER) is 36.00 $kgCO_2/m^2$ yr and the Target emission rate (TER) is 37.2 $kgCO_2/m^2$ yr (a total improvement of 3.2%).

*Table 16: Lean scenario results*

| This development | $CO_2$ Emissions (tonnes $CO_2$/year) |
|---|---|
| Heating | 25.8 |
| Cooling | 10.6 |
| Auxiliary | 38.5 |
| Lighting | 25.3 |
| DHW | 42.3 |
| **Total regulated** | **142.6** |
| Unregulated | 135.2 |
| **Total regulated & unregulated** | 277.8 |

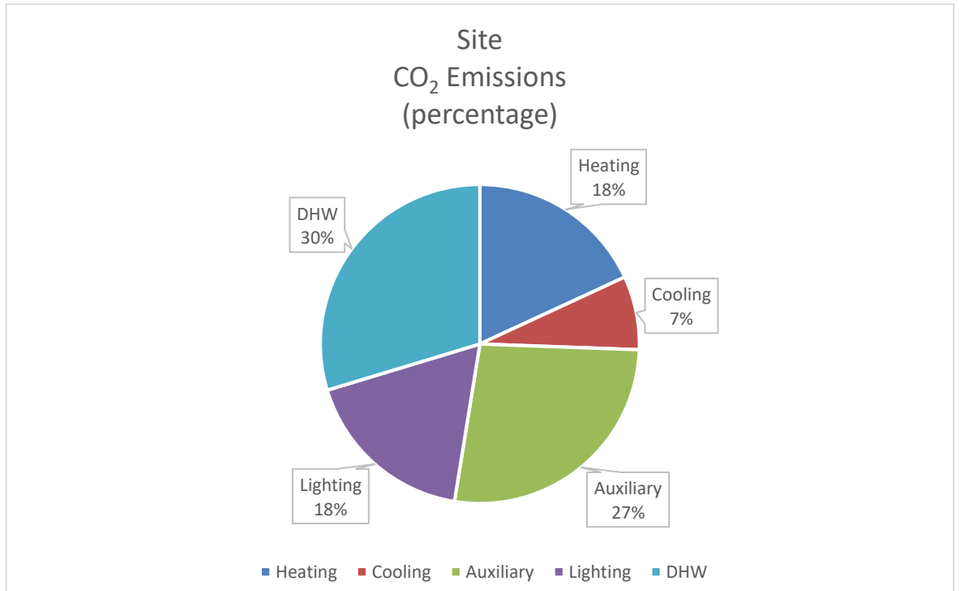



*Figure 5: Lean scenario results - carbon emissions in percentage*

# Clean Scenario

## Existing/ Planned District Heat Networks

Consideration was given to the possible connection to an existing or proposed area-wide decentralised energy network. There are a number of existing decentralised energy networks in the Borough of Camden, including Bloomsbury Heat and Power, Gower Street Heat and Power, King's Cross Central, Gospel Oak and Somers Town Energy. In addition, London Heat Map shows a proposed heat network across Euston road. However, none of the existing networks either the proposed are in a feasible distance from the development (less than 500m).Nevertheless, the development is located within the vicinity of a decentralised energy potential area but there are no planned networks in this zone. If the site is to operate as a potential future district heat customer, it must be noted that it is impossible to anticipate the grade of heat supply at this present stage. For example, steam, MTHW and LTHW systems have differing requirements for client connections.

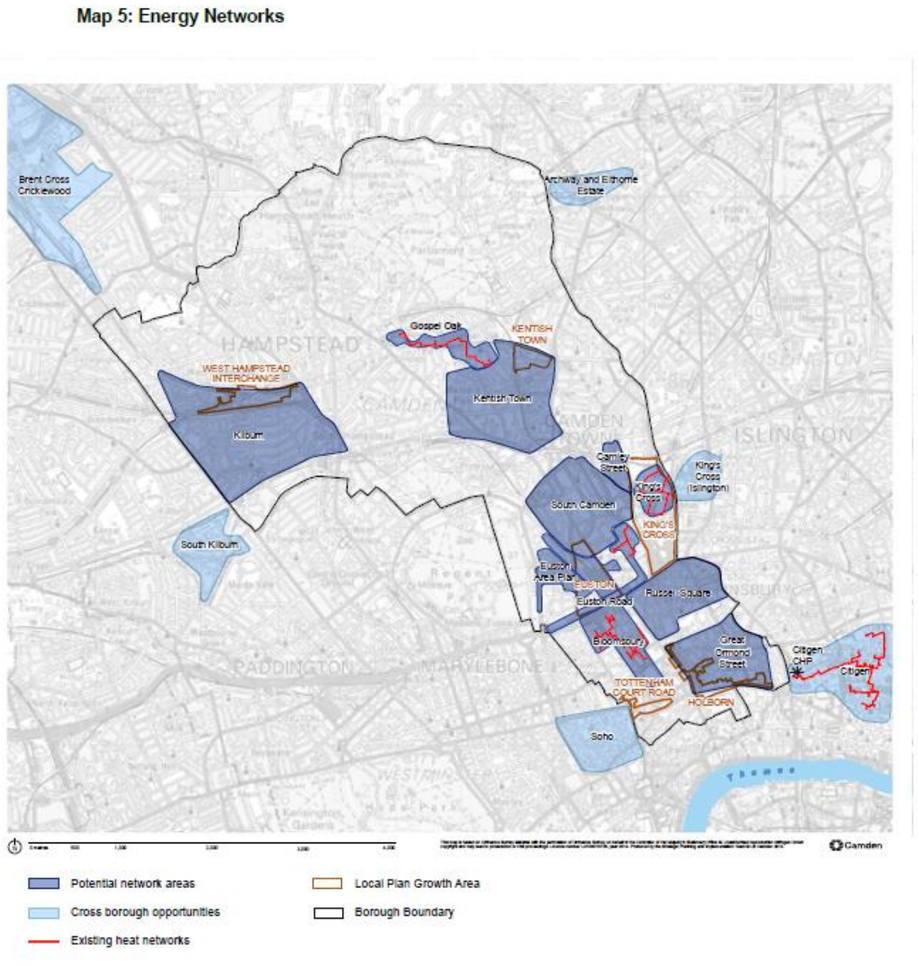



*Figure 6: Heat networks in Borough of Camden*

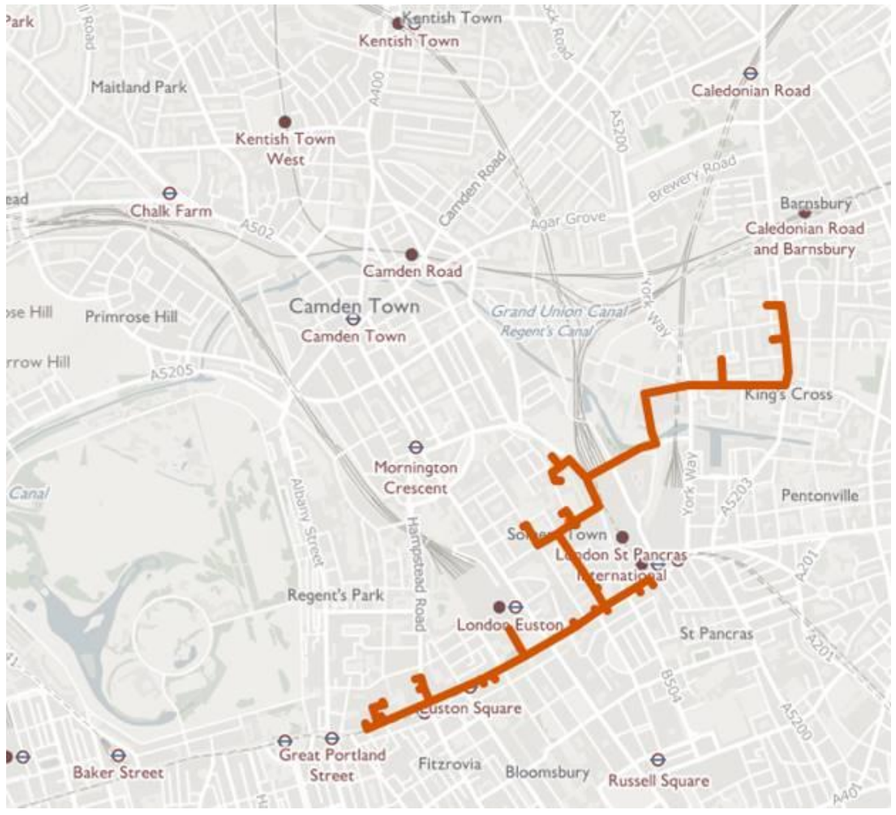



*Figure 7: The proposed heat network in Euston road shown in London Heat Map*

The following strategy has been adopted for district heat readiness:

- Plant space provision is provided for a future plate heat exchanger;
- A common pit within the main plant rooms is available for future connections;
- Precast sleeves and puddle flanges will not be provided.

Combined Heat and Power has not been considered for this development due to being within a not feasible distance from any existing or proposed heat network. CHP is also less favourable than it was in years past due to the decarbonisation of the electricity grid.

## Green Scenario

This section discusses the feasibility of using low and zero carbon (LZC) technologies for the proposed scheme. The London Plan and Camden Council aspire that all major developments reduce their carbon dioxide emissions by at least 20% through the use of on-site renewable energy generation, where feasible.

### Renewable energy pre-feasibility matrix

*Table 17: Possible renewable energy technologies*

| Technology | Pre-feasibility |
|---|---|
| Solar Hot Water | Results show a hot water demand however, due to higher $CO_2$ reductions from PV this technology has not been considered further. |
| Biomass | Limited space/access for plant and fuel store. Potential adverse effect on local air quality. |
| Water Source Heat Pump | No potential bodies of water to locate water source collector easily accessible directly from development site. |
| Air Source Heat Pump (ASHP | There are no technical feasibility restraints to this technology. |
| Ground Source Heat Pump | This technology has not been considered for this development due to the technical restriction and expense this technology would incur. |
| Geothermal | Unlikely to be potential geothermal resource available. |
| Transpired Solar Air Collectors | Unsuitable technology to integrate easily with the building type and proposed façade. |
| Solar Photovoltaic | Suitable shade free south facing roof space available and sufficient daytime electricity demands. |
| Hydro, Wave and Tidal | No potential resource of flowing or tidal water on-site. |
| Wind Turbine | Potential average wind speed estimated to be less than 5m/s minimum required for further investigation for typical turbine heights. |

The Pre-Feasibility study concluded that the most appropriate low carbon energy solutions for the proposed development are:

- Solar photovoltaics (PV)
- Air source heat pumps (split systems)

### Heat Pumps

Heat pumps use a refrigeration cycle to move heat from a cold reservoir to a warmer one. They can extract heat from ambient sources such as outdoor air or the ground. Heat pumps can be used to 'recycle' heat from other processes, promoting low grade waste heat to higher grade heat for space heating and hot water generation. For example, recovering heat from air conditioning systems.

Types of heat pump:

- Air source
- Ground (or water) source
- Gas driven variants of air and ground source
- Transcritical $CO_2$ based ASHP now delivering hot water at temperatures > 75°C with COP > 3.0
- Exhaust air heat pumps

A ground source heat pump system utilises the relatively constant temperature of the ground as a heat source / heat sink to provide heating and cooling to a building. In winter heat is extracted from the ground and upgraded by heat pumps to serve the building. In the summer heat is rejected to the ground to the cool the building.

As an alternative to traditional forms of air-side heat recovery, there are instances of exhaust air heat pumps being integrated into heat interface units for buildings. This arrangement has the advantage over traditional heat recovery in that the best opportunities to recover heat frequently don't coincide with the requirement for heat. Traditional heat recovery also limits heat recovery to the scope of zones served by the air handling unit. With exhaust air heat pumps, the heat can be stored and redistributed to alternative targets such as the domestic hot water pre-heat and underfloor heating systems.

#### Low temperature systems

In order to achieve high performance heat pumps require heating emitters designed for low temperature heating throughout. Flow water temperatures should preferably be maintained below 45°C. This benefits larger emitters such as:

- Radiant slabs or ceilings
- Underfloor heating
- Chilled beams
- Some VAV fan coil units can operate with very modest hot water and chilled water temperatures

Heat pumps can deliver heat at temperatures greater than 45°C. However, it should be noted that performance can fall off after this point, especially as heat sources (e.g. boreholes) become depleted through heat extraction.

#### Local Planning Issues

Larger air source heat pumps can create noise and may be subject to acoustic assessments. They are essentially the same as a chiller (but operate in reverse) and can be compared to chillers with respect to noise output.

#### Grants and subsidies

Certified heat pump systems installed through an accredited Microgeneration Certification Scheme (MCS) are eligible for payments under the Heat Incentive (RHI), administered under OFGEM. Details of

RHI rates are available at www.ofgem.gov.uk. The RHI is a financial support programme for renewable heat. It pays participants of the scheme that generate and use renewable energy to heat their buildings.

**Measures adopted**

- Air source heat pumps (ASHP) units to deliver up to 100% of the annual hot water and heating demand for entire building
- The SCOP should be no less than 3.2 for the heating and no less than 2.5 for the domestic hot water
- The SEER of the cooling aspect of the split system is presented in the HVAC parameters of section 'Be Lean'.
- The heat pump must comply with the minimum performance standards as set out in the Enhanced Capital Allowances (ECA) product criteria for the relevant technology (http://etl.decc.gov.uk)

## Photovoltaics

Photovoltaic cells (PVs) transform the sun's energy into electricity. Space constraints in urban environments mean that PVs are generally installed at roof level, south-oriented to maximise solar exposure. Solar arrays can be mounted vertically on the building façade but their energy yield is reduced significantly. Therefore it is best for the photovoltaic array to be optimally aligned and orientated.

**Grants and subsidies**

Certified PV installations installed through an accredited Microgeneration Certification Scheme (MCS) are eligible for payments under Feed in Tariffs scheme. Details of FiT rates are available at www.ofgem.gov.uk. Systems will qualify for a particular FiT rate depending on their installed power and commissioning date.

The Feed-In-tariff may assist with economic viability:

- Including FiT payments, payback can be in the region of 7 – 10 years, whereas the lifespan of the system is typically 25 years;
- Most installations are relatively simple to incorporate into design, especially on new build where they can be incorporated into the design;
- There is a relatively competitive market of MCS[1] approved installers, thereby reducing installation costs;
- Thought might be given to real-time monitoring of PV output upon installation. This could be used to diagnose performance shortfalls in the PV.

**Maintenance**

- Annual cleaning;
- PV performance typically degrades 0.8% per year;
- Typical guarantees are 25 years for the panel;
- Historically, PV inverters failure rates increase after 10 years operation

**Local Planning Issues**

PVs are completely silent in operation and as such are generally acceptable in local planning. Possible planning issues can result from glare from the panels in bright sunshine. Planning constraints may be applied in conservation areas, especially in retrofits. Apart from this, there are few known Planning constraints.

**Measures adopted**

Apart from future extension, the parameters of the PV system proposed are as follows:

- Size: Approximately 200m$^2$
- Orientation: South-West, aligned to building orientation
- Inclination: 30$^o$
- Location: Roof mounted
- Energy generated/year approx. 30,675 kWh
- PV module efficiency: 18%
- Inverter + DC losses: 10%

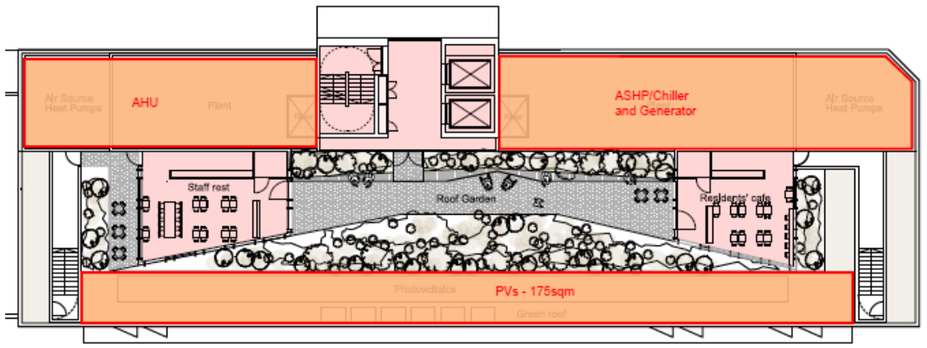



*Figure 8: PV panels to be placed within the area highlighted in orange*

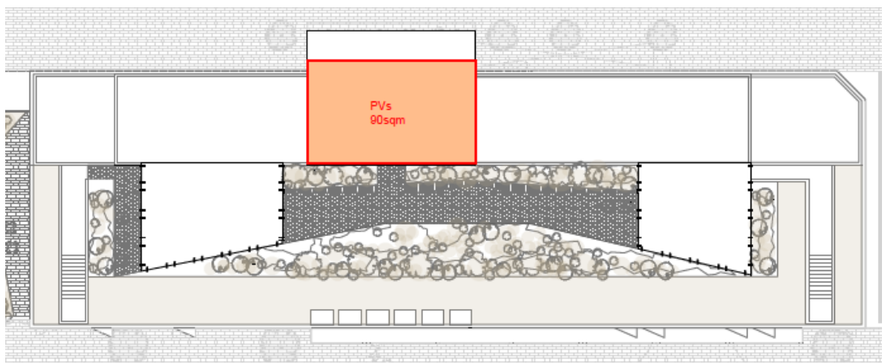



*Figure 9:* PV panels to be placed within the area highlighted in orange

[1] Microgeneration Certification Scheme (MCS): http://www.microgenerationcertification.org

## Results Green Scenario

According to the SAP 2012 emission factors used for the issue of the BRUKL report (Appendix B), the Building emission rate (BER) is 31.9 $kgCO_2/m^2$ yr and the Target emission rate (TER) is 35.4 $kgCO_2/m^2$ yr (a total improvement of 10%).

*Table 18: Green scenario results*

| This development | $CO_2$ Emissions (tonnes $CO_2$/year) |
|---|---|
| Heating | 8.2 |
| Cooling | 10.6 |
| Auxiliary | 38.5 |
| Lighting | 25.3 |
| DHW | 17.1 |
| From Renewables | -7.1 |
| **Total regulated** | **92.6** |
| Unregulated | 135.2 |
| **Total regulated & unregulated** | 227.8 |

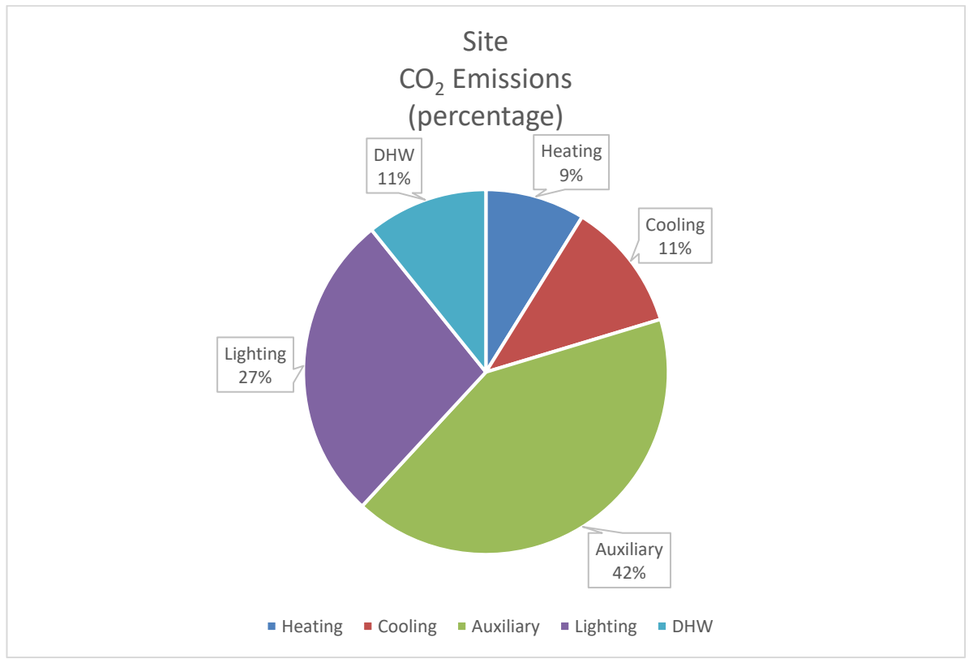



*Figure 10: Green scenario results - carbon emissions in percentage*

## Energy Assessment Conclusions

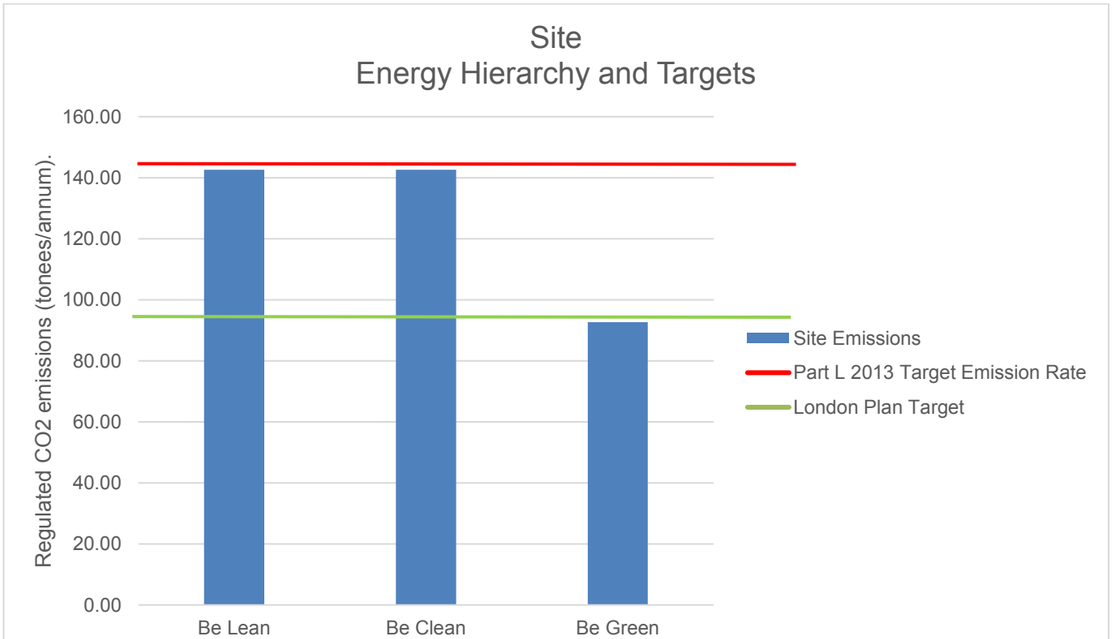



*Figure 11: Energy hierarchy and targets*

*Table 19: $CO_2$ emissions breakdown*

| | Carbon dioxide emissions (Tonnes $CO_2$ per annum) | |
|---|---|---|
| | Regulated | Unregulated |
| Baseline $CO_2$ emissions (Part L 2013 of the Building Regulations Compliant Development) | 144.4 | 135.2 |
| $CO_2$ emissions after energy demand reduction (be lean) | 142.6 | 135.2 |
| $CO_2$ emissions after heat network (be clean) | 142.6 | 135.2 |
| $CO_2$ emissions after renewable energy (be green) | 92.6 | 135.2 |

*Table 20: $CO_2$ savings breakdown*

| | Regulated Carbon dioxide savings | |
|---|---|---|
| | (Tonnes $CO_2$ per annum) | (%) |
| Be lean: Savings from energy demand reduction | 1.9 | 1% |
| Be clean: Savings from heat network | 0 | 0 |
| Be green: Savings from renewable energy | 50 | 35% |
| Total Cumulative Savings | 51.8 | 36% |
| Minimum Target Savings on Site for London Plan and Camden | 50.5 | 35% |
| Minimum Target Savings from onsite renewables for Camden and London Plan | 28.9 | 20% |
| Annual surplus against minimum target saving on site | 1.2 | |
| Savings from off-set payments | 92.6 | |

### Site-wide Results

*Table 21: Site-wide $CO_2$ emissions and savings breakdown*

| | Total regulated emissions | Carbon dioxide savings | Percentage savings |
|---|---|---|---|
| | (Tonnes $CO_2$ per annum) | (Tonnes $CO_2$ per annum) | (%) |
| Part L 2013 Baseline | 144.4 | | |
| Lean | 142.6 | 1.8 | 1% |
| Clean | 142.6 | 1.8 | 1% |
| Green | 92.6 | 51.8 | 36% |

### Cash-in-lieu

Assuming the zero carbon target under the future London Plan, the remaining 2.778 tonnes of carbon to achieve zero carbon over 30 years are to be off-set to a cash-in-lieu contribution to the borough at the price per tonne established by the local authority. In this case this has been considered £60 pounds per tonne of carbon resulting in £166,680.

# Part B – Overheating risk analysis

## Executive summary

- BDP has been appointed to complete the thermal comfort overheating assessment of the 70-86 Royal College Street development.
- Only the patient bedrooms were included in the assessment
- Furthermore, the dayrooms were also selected in order to assess the possibility of preventing the overheating risk without the need of cooling
- The spaces have been checked against the CIBSE TM59 thermal comfort criteria for mechanically ventilated homes and the Health Technical Memorandum (HTM) 03-01: specialised ventilation for healthcare premises
- The assessment was done using the Design Summer Year for the 2020s, high emissions, 50% percentile scenario (DSY1) for which the compliance criteria should be met
- Additional testing was undertaken using the 2020 versions of the following more extreme design weather years:
    - DSY2 – 2003: a year with a very intense single warm spell.
    - DSY3 – 1976: a year with a prolonged period of sustained warmth.
- Key elements of the facade:
    - Solar control glazing. Work has been done to define the amount of fritted glass needed to prevent overheating and avoid the usage of cooling in patients' bedrooms.
    - G-value of clear glass: 0.27
    - Average g-value of fritted glass (32.5% coverage): 0.21
    - Deep horizontal projecting planters and potting sheds to create an overhang across ward bedrooms and dayrooms
    - Metal mesh panel acting as a solar screen
- The results demonstrate the both criteria, CIBSE TM59 and HTM are met for the patient bedrooms under DSY1 weather file but not under DSY2 and DSY3. It should be noted that the usage of blinds and taking the advantage of thermal mass are essential in order for the bedrooms to be compliant with the HTM criteria
- Cooling is needed to the dayrooms as in order to get the dayrooms to be below HTM and CIBSE TM59 overheating criteria, a very small area of glazing would be required, this is unrealistic and would adversely affect aesthetics of the facade and reduce daylight penetration to the spaces

## Introduction

BDP has been appointed to complete the thermal comfort overheating assessment of the 70-86 Royal College Street development.

The purpose of this report is to establish a strategy for maintaining thermal comfort throughout the facility. This is done by taking into account the Project's anticipated usage, architecture, and HVAC servicing strategy.

## Tools and Methods

A dynamic simulation model (DSM) as described in CIBSE AM11: 2015 has been used.

- Network airflow was modelled
- Near field shading (local buildings) have been modelled
- HVAC was modelled with basic 'Apache systems'

The assessment follows the guidance included within CIBSE TM59: 2017

Software used: IES Virtual Environment 2018

The analysis was supervised by a CIBSE accredited Low Carbon Energy Assessor (LCEA) but undertaken by a Building Physicist.

# Design Inputs

## Location Weather data

- Paragraph 9.15 of the October 2018 “GLA Energy Assessment Guidance” requires that the urban heat island effect in the locality of the development to be taken into account for development within the following zones:
    - The Greater London Authority Central Activity Zone (CAZ) and other high density urban areas (e.g. Canary Wharf): London Weather Centre data.
    - Lower density urban and suburban areas: London Heathrow airport data
    - Rural and peri-urban areas around the edge of London: Gatwick Airport data
- London Weather Centre data is considered to be the most appropriate for the location

## Design Weather Files

In accordance to paragraphs 9.10 – 9.14 of the October 2018 “GLA Energy Assessment Guidance”, the following design weather files were selected for the purposes of this report:

- DSY1 (Design Summer Year) for the 2020s, high emissions, 50% percentile scenario
- DSY2 – 2003: a year with a very intense single warm spell
- DSY3 – 1976: a year with a prolonged period of sustained warmth

According to paragraphs 9.12 and 9.14 of the October 2018 “GLA Energy Assessment Guidance, a pass is only mandatory for the DSY1 2020s, high emissions, 50% percentile scenario weather file.

## Geometry

- The geometry was based on the architectural information (drawings received end of November) from Ian Chalk Architects
- The development comprises of 7 floors of total floor area of 6756.5m$^2$, primarily consisting of patient bedrooms, dayrooms, consult/exam rooms and nursing stations. Some office spaces are located in the basement and ground floor whereas the two pavilions on the roof act as a rest and eat/drink spaces for the staff and the patients

**Shading:**

- Deep horizontal projecting planters and potting sheds have been modelled as overhangs
- Metal mesh panel has been modelled as an external shading within the window construction

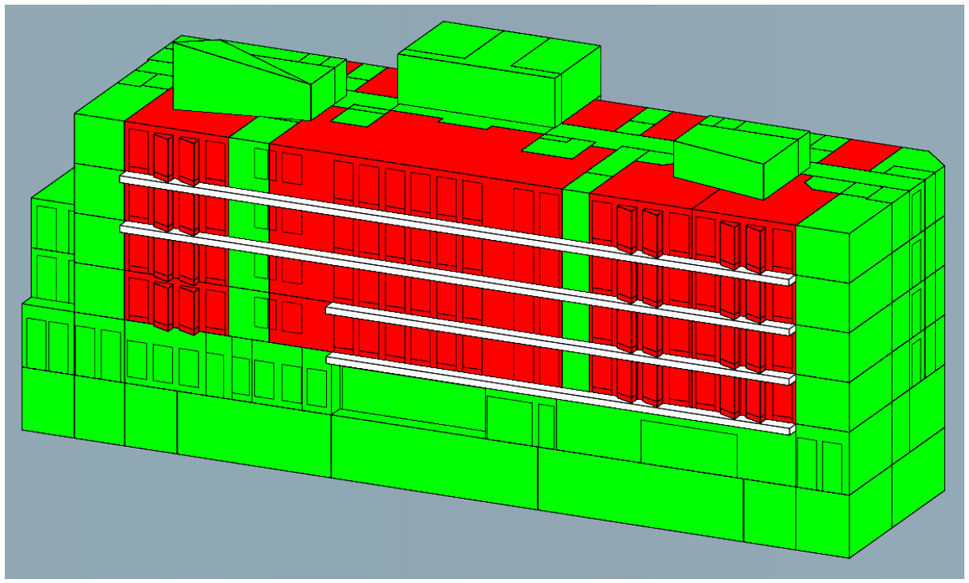


*Figure 12: View from South of analysis model - areas assessed in red*

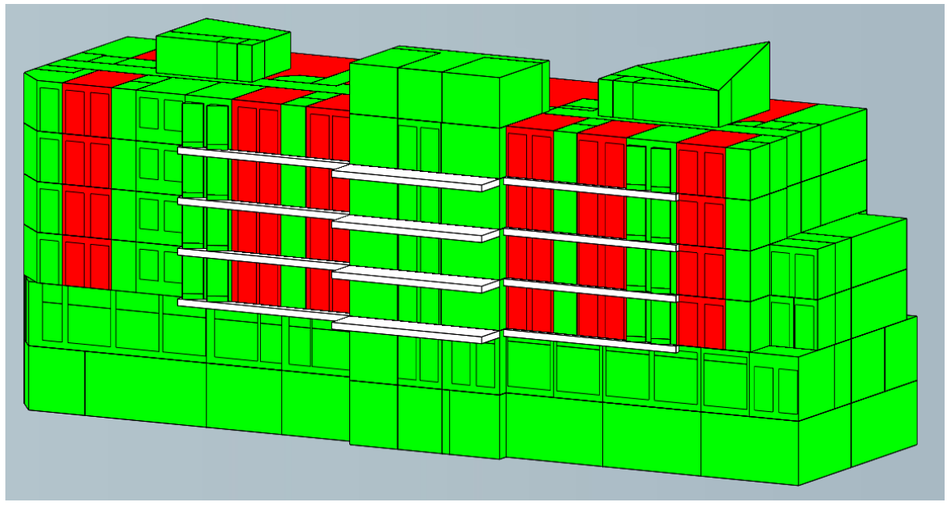


*Figure 13: View from North of analysis model - areas assessed in red*

## Envelope and constructions

### Transparent construction elements

The strategy depends on spectrally selective solar control glazing. In comparison to reflective or absorptive solar control, spectrally selective glazing retains a relatively neutral appearance (it's usually slightly tinted) whilst simultaneously filtering out solar gain and allowing daylight in. Fritted glass has been added to cover 32.5% of the window in the patients' bedrooms to prevent overheating and avoid the usage of cooling.

*Table 22: Transparent construction elements properties*

| Element | U-value (glazing + framing) ($W/m^2K$) | g-value | Frame factor |
|---|---|---|---|
| Clear glass | 1.3 | **0.27** | 10% |
| Clear glass with 32.5% coverage of fritted | 1.3 | **0.21** | 10% |

### Blinds

- Blinds can be used by occupants to control glare and comfort
- Blinds form part of this analysis

### Opaque construction elements

*Table 23: Opaque construction elements properties*

| Element | Description | U-value ($W/m^2K$) |
|---|---|---|
| Ground Floor | Reinforced concrete floor | 0.15 |
| Internal floor/ ceilings | Reinforced concrete ceiling with plasterboard finishing | 1.08 |
| External walls | Generic insulated wall system | 0.19 |
| Roof | Insulated concrete deck | 0.16 |
| Internal partitions | Generic lightweight plasterboard partition | 1.79 |

### Air permeability

Fixed infiltration rate of 0.25 $ACH^{-1}$ is modelled

## Lighting

- Lighting has been modelled as per TM59:
  - 2.0 $W/m^2$ are assumed in all spaces from 6pm to 11pm

## Internal gains

- TM59 internal gains are used:
  - Bedroom occupancy:
    - 75 W/person sensible load
    - 55 W/person latent load
    - 1 occupant for 1 bed-bay, 4 occupants for 4 bed-bay
    - 70% gains from 11pm to 8am and full gains from 8am to 11pm in 1 bed-bay
    - 70% gains from 11pm to 8am, full gains from 8am to 9am and 10pm to 11pm, 50% gains from 9am to 10pm in the 4 bed-bay
  - Bedroom small power
    - 80 W peak load in bedrooms (8am to 11pm)
    - Base load of 10 during sleeping hours and full gain from 8am to 11pm
  - Dayroom occupancy
    - 20 occupants per dayroom
    - 75 W/person sensible load
    - 55 W/person latent load
    - Occupancy time: 9am to 10pm
  - Dayroom small power:
    - 450 W peak load from 6 pm to 8 pm
    - 198 W from 8 pm to 10 pm
    - 108 W from 9 am to 6 pm and from 10 pm to 12 pm
    - Base load of 85.5 W for the rest of the day
- Occupied hours:
  - 24/7 for entire year

The figures below show the TM59 occupancy daily profiles:

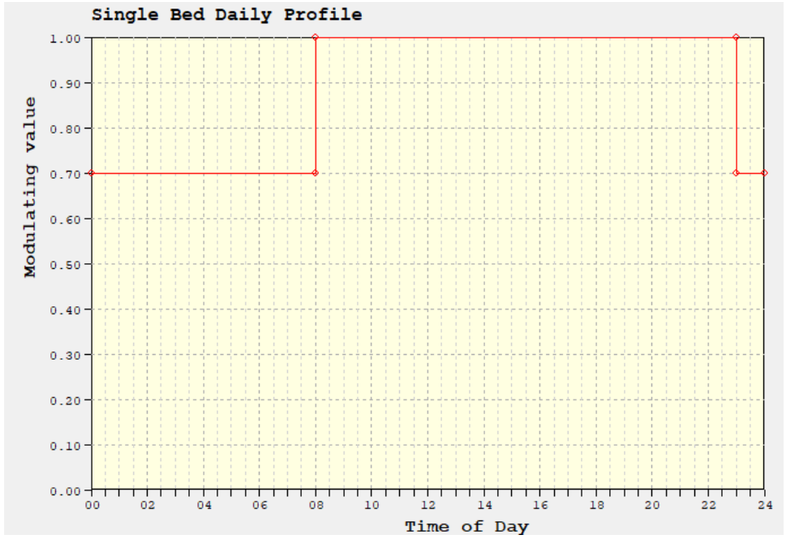



*Figure 14: Occupancy Profile – Single Bedroom*

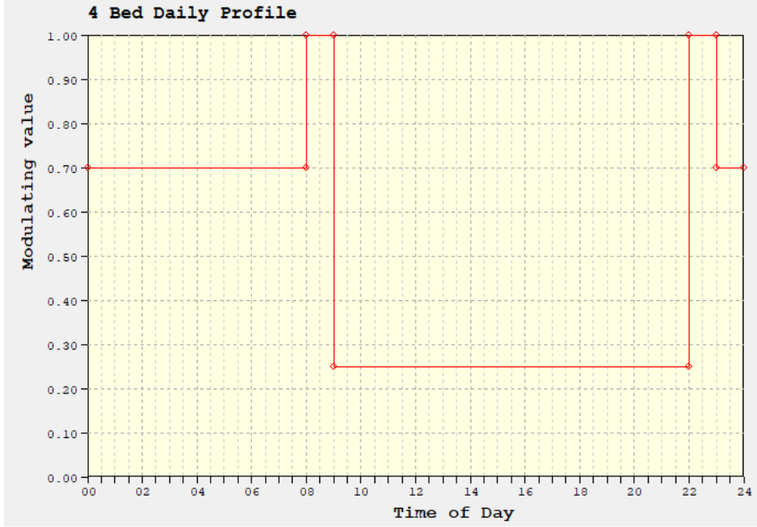



*Figure 15: Occupancy Profile – 4 Bed-bay*

## Mechanical ventilation

Due to noise pollution in the site openable windows cannot be provided and therefore mechanical ventilation is used as a means to keep thermal comfort within acceptable levels. According to HTM, 6 ACH are required in the patient bedrooms. 5 ACH were allowed in the dayroom.

## Requirements

### 1. CIBSE TM 59:2017 – Design methodology for the assessment of overheating risk in homes

- Criteria for homes predominantly mechanically ventilated:
    - For homes with restricted window openings, the CIBSE fixed temperature test must be followed, i.e. all occupied rooms should not exceed an operative temperature of 26 ˚C for more than 3% of the annual occupied annual hours (CIBSE Guide A (2015a)).
- Adjustments for homes with vulnerable occupants:
    - Care homes and accommodation for vulnerable occupants, which are predominantly mechanically ventilated, the fixed temperature method should be used as described above

### 2. Health Technical Memorandum (HTM) 03-01: Specialised ventilation for healthcare premises

- Summertime temperature:
    - Calculations and thermal modelling should be undertaken to see whether, during the summertime, internal temperatures in patient areas will exceed 28ºC dry bulb for more than 50 hours per year.

## Results

In summary, the following conclusions are drawn from the simulations results:

- CIBSE TM59 Criteria:
    - All bedrooms areas pass the CIBSE TM59 criteria for the DSY1 2020s, high emissions, 50% percentile scenario weather file, as well as for DSY2. However they are not compliant for DSY3 weather file.
    - All dayrooms fail CIBSE TM59 criteria for all the weather files

- HTM Criteria:
    - All bedrooms areas pass the HTM criteria for the DSY1 2020s, high emissions, 50% percentile scenario weather file. However they are not compliant for DSY2 and DSY3 weather files.
    - The usage of blinds by the occupants and taking the advantage of thermal mass are essential in order the bedrooms to be compliant with HTM criteria for DSY1 weather file
    - All dayrooms fail HTM criteria for all the weather files

- Since all the bedrooms meet the requirements set out in CIBSE TM59 and HTM for the DSY1 weather file as expected in paragraph 9.12 of the October 2018 “GLA Energy Assessment Guidance’, there is no overheating risk in these spaces and therefore no need of cooling
- Cooling is needed to the dayrooms as in order to get the dayrooms to be below HTM and CIBSE TM59 overheating criteria, a very small area of glazing would be required, this is unrealistic and would adversely affect aesthetics of the facade and reduce daylight penetration to the spaces

Detailed results for all spaces which have been assessed for the relevant HTM and TM59 criteria, are presented in Appendix C.

# Appendix A – Lean Scenario BRUKL Report Summary

## BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

**Royal College Street** — As designed

Date: Tue Jan 14 18:04:44 2020

### Administrative information

**Building Details**

**Address:** Address 1, City, Postcode

**Certification tool**

**Calculation engine:** Apache

**Calculation engine version:** 7.0.11

**Interface to calculation engine:** IES Virtual Environment

**Interface to calculation engine version:** 7.0.11

**BRUKL compliance check version:** v5.6.a.1

**Owner Details**

**Name:** Name

**Telephone number:** Phone

**Address:** Street Address, City, Postcode

**Certifier details**

**Name:** Name

**Telephone number:** Phone

**Address:** Street Address, City, Postcode

### Criterion 1: The calculated $CO_2$ emission rate for the building must not exceed the target

| | |
|---|---|
| $CO_2$ emission rate from the notional building, $kgCO_2/m^2.annum$ | 37.2 |
| Target $CO_2$ emission rate (TER), $kgCO_2/m^2.annum$ | 37.2 |
| Building $CO_2$ emission rate (BER), $kgCO_2/m^2.annum$ | 36 |
| Are emissions from the building less than or equal to the target? | BER =< TER |
| Are as built details the same as used in the BER calculations? | Separate submission |

### Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

**Building fabric**

| Element | $U_{a\text{-}Limit}$ | $U_{a\text{-}Calc}$ | $U_{i\text{-}Calc}$ | Surface where the maximum value occurs* |
|---|---|---|---|---|
| Wall** | 0.35 | 0.19 | 0.19 | GF000007:Surf[0] |
| Floor | 0.25 | 0.15 | 0.15 | RM000005:Surf[1] |
| Roof | 0.25 | 0.16 | 0.16 | 4T000001:Surf[0] |
| Windows***, roof windows, and rooflights | 2.2 | 1.3 | 1.31 | 1S000014:Surf[14] |
| Personnel doors | 2.2 | 2.2 | 2.2 | GF000027:Surf[0] |
| Vehicle access & similar large doors | 1.5 | - | - | No Vehicle access doors in building |
| High usage entrance doors | 3.5 | - | - | No High usage entrance doors in building |

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m²K)]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

| Air Permeability | Worst acceptable standard | This building |
|---|---|---|
| $m^3/(h.m^2)$ at 50 Pa | 10 | 5 |

## Technical Data Sheet (Actual vs. Notional Building)

### Building Global Parameters

| | Actual | Notional |
|---|---|---|
| Area [$m^2$] | 6756.5 | 6756.5 |
| External area [$m^2$] | 6886 | 6886 |
| Weather | LON | LON |
| Infiltration [$m^3/hm^2$@ 50Pa] | 5 | 3 |
| Average conductance [W/K] | 2947.69 | 3384.52 |
| Average U-value [$W/m^2K$] | 0.43 | 0.49 |
| Alpha value* [%] | 9.95 | 10 |

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

### Building Use

| % Area | Building Type |
|---|---|
| | A1/A2 Retail/Financial and Professional services |
| | A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways |
| | B1 Offices and Workshop businesses |
| | B2 to B7 General Industrial and Special Industrial Groups |
| | B8 Storage or Distribution |
| | C1 Hotels |
| 100 | **C2 Residential Institutions: Hospitals and Care Homes** |
| | C2 Residential Institutions: Residential schools |
| | C2 Residential Institutions: Universities and colleges |
| | C2A Secure Residential Institutions |
| | Residential spaces |
| | D1 Non-residential Institutions: Community/Day Centre |
| | D1 Non-residential Institutions: Libraries, Museums, and Galleries |
| | D1 Non-residential Institutions: Education |
| | D1 Non-residential Institutions: Primary Health Care Building |
| | D1 Non-residential Institutions: Crown and County Courts |
| | D2 General Assembly and Leisure, Night Clubs, and Theatres |
| | Others: Passenger terminals |
| | Others: Emergency services |
| | Others: Miscellaneous 24hr activities |
| | Others: Car Parks 24 hrs |
| | Others: Stand alone utility block |

### Energy Consumption by End Use [$kWh/m^2$]

| | Actual | Notional |
|---|---|---|
| Heating | 18.2 | 20.41 |
| Cooling | 7.12 | 8.42 |
| Auxiliary | 25.72 | 20.68 |
| Lighting | 16.94 | 27.95 |
| Hot water | 29.82 | 18.08 |
| Equipment* | 85.88 | 85.88 |
| TOTAL** | 97.8 | 95.53 |

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

### Energy Production by Technology [$kWh/m^2$]

| | Actual | Notional |
|---|---|---|
| Photovoltaic systems | 0 | 0 |
| Wind turbines | 0 | 0 |
| CHP generators | 0 | 0 |
| Solar thermal systems | 0 | 0 |

### Energy & $CO_2$ Emissions Summary

| | Actual | Notional |
|---|---|---|
| Heating + cooling demand [$MJ/m^2$] | 148.74 | 178.16 |
| Primary energy* [$kWh/m^2$] | 209.89 | 217.7 |
| Total emissions [$kg/m^2$] | 36 | 37.2 |

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

# Appendix B – Green Scenario BRUKL Report Summary

## BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

**Royal College Street** — As designed

Date: Tue Jan 14 18:57:55 2020

### Administrative information

**Building Details**

**Address:** Address 1, City, Postcode

**Certification tool**

**Calculation engine:** Apache

**Calculation engine version:** 7.0.11

**Interface to calculation engine:** IES Virtual Environment

**Interface to calculation engine version:** 7.0.11

**BRUKL compliance check version:** v5.6.a.1

**Owner Details**

**Name:** Name

**Telephone number:** Phone

**Address:** Street Address, City, Postcode

**Certifier details**

**Name:** Name

**Telephone number:** Phone

**Address:** Street Address, City, Postcode

### Criterion 1: The calculated $CO_2$ emission rate for the building must not exceed the target

| | |
|---|---|
| $CO_2$ emission rate from the notional building, $kgCO_2/m^2.annum$ | 35.4 |
| Target $CO_2$ emission rate (TER), $kgCO_2/m^2.annum$ | 35.4 |
| Building $CO_2$ emission rate (BER), $kgCO_2/m^2.annum$ | 31.9 |
| Are emissions from the building less than or equal to the target? | BER =< TER |
| Are as built details the same as used in the BER calculations? | Separate submission |

### Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

**Building fabric**

| Element | $U_{a\text{-}Limit}$ | $U_{a\text{-}Calc}$ | $U_{i\text{-}Calc}$ | Surface where the maximum value occurs* |
|---|---|---|---|---|
| Wall** | 0.35 | 0.19 | 0.19 | GF000007:Surf[0] |
| Floor | 0.25 | 0.15 | 0.15 | RM000005:Surf[1] |
| Roof | 0.25 | 0.16 | 0.16 | 4T000001:Surf[0] |
| Windows***, roof windows, and rooflights | 2.2 | 1.3 | 1.31 | 1S000014:Surf[14] |
| Personnel doors | 2.2 | 2.2 | 2.2 | GF000027:Surf[0] |
| Vehicle access & similar large doors | 1.5 | - | - | No Vehicle access doors in building |
| High usage entrance doors | 3.5 | - | - | No High usage entrance doors in building |

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

| Air Permeability | Worst acceptable standard | This building |
|---|---|---|
| $m^3/(h.m^2)$ at 50 Pa | 10 | 5 |

## Technical Data Sheet (Actual vs. Notional Building)

### Building Global Parameters

| | Actual | Notional |
|---|---|---|
| Area [$m^2$] | 6756.5 | 6756.5 |
| External area [$m^2$] | 6886 | 6886 |
| Weather | LON | LON |
| Infiltration [$m^3/hm^2$@ 50Pa] | 5 | 3 |
| Average conductance [W/K] | 2947.69 | 3384.52 |
| Average U-value [$W/m^2K$] | 0.43 | 0.49 |
| Alpha value* [%] | 9.95 | 10 |

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

### Building Use

| % Area | Building Type |
|---|---|
| | A1/A2 Retail/Financial and Professional services |
| | A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways |
| | B1 Offices and Workshop businesses |
| | B2 to B7 General Industrial and Special Industrial Groups |
| | B8 Storage or Distribution |
| | C1 Hotels |
| 100 | **C2 Residential Institutions: Hospitals and Care Homes** |
| | C2 Residential Institutions: Residential schools |
| | C2 Residential Institutions: Universities and colleges |
| | C2A Secure Residential Institutions |
| | Residential spaces |
| | D1 Non-residential Institutions: Community/Day Centre |
| | D1 Non-residential Institutions: Libraries, Museums, and Galleries |
| | D1 Non-residential Institutions: Education |
| | D1 Non-residential Institutions: Primary Health Care Building |
| | D1 Non-residential Institutions: Crown and County Courts |
| | D2 General Assembly and Leisure, Night Clubs, and Theatres |
| | Others: Passenger terminals |
| | Others: Emergency services |
| | Others: Miscellaneous 24hr activities |
| | Others: Car Parks 24 hrs |
| | Others: Stand alone utility block |

### Energy Consumption by End Use [kWh/$m^2$]

| | Actual | Notional |
|---|---|---|
| Heating | 5.48 | 6.88 |
| Cooling | 7.12 | 8.42 |
| Auxiliary | 25.72 | 20.68 |
| Lighting | 16.94 | 27.95 |
| Hot water | 11.45 | 6.09 |
| Equipment* | 85.88 | 85.88 |
| TOTAL** | 66.71 | 70.01 |

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

### Energy Production by Technology [kWh/$m^2$]

| | Actual | Notional |
|---|---|---|
| Photovoltaic systems | 4.54 | 0 |
| Wind turbines | 0 | 0 |
| CHP generators | 0 | 0 |
| Solar thermal systems | 0 | 0 |

### Energy & $CO_2$ Emissions Summary

| | Actual | Notional |
|---|---|---|
| Heating + cooling demand [$MJ/m^2$] | 148.74 | 178.16 |
| Primary energy* [$kWh/m^2$] | 254.2 | 248.4 |
| Total emissions [$kg/m^2$] | 31.9 | 35.4 |

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

# Appendix C – CIBSE TM59 & HTM results

### DSY 1 – 2020s high emissions, 50% percentile weather file

| Zone name | CIBSE TM59 - Dry resultant temperature (°C) - % hours in range > 26 | HTM - Air temperature (°C) - hours in range >28 |
|---|---|---|
| 1st FL 1 Bed Bay (6) | 2.1 | 50 |
| 1st FL 1 Bed Bay (3) | 1.9 | 47 |
| 1st FL 1 Bed Bay (1) | 2.1 | 50 |
| 1st FL 1 Bed Bay (5) | 2 | 48 |
| 1st FL 1 Bed Bay (4) | 2 | 48 |
| 1st FL 1 Bed Bay (2) | 2 | 48 |
| 1st FL 4 Bed Bay (1) | 1.7 | 45 |
| 1st FL 4 Bed Bay (2) | 1.6 | 44 |
| 1st FL 4 Bed Bay (3) | 1.6 | 44 |
| 2nd FL 1 Bed Bay (6) | 1.6 | 42 |
| 2nd FL 1 Bed Bay (3) | 1.6 | 41 |
| 2nd FL 1 Bed Bay (1) | 1.6 | 43 |
| 2nd FL 1 Bed Bay (5) | 1.6 | 42 |
| 2nd FL 1 Bed Bay (4) | 1.6 | 42 |
| 2nd FL 1 Bed Bay (2) | 1.6 | 41 |
| 2nd FL 4 Bed Bay (1) | 1.3 | 41 |
| 2nd FL 4 Bed Bay (2) | 1.3 | 42 |
| 2nd FL 4 Bed Bay (3) | 1.3 | 41 |
| 3rd FL 1 Bed Bay (6) | 1.6 | 43 |
| 3rd FL 1 Bed Bay (3) | 1.6 | 41 |
| 3rd FL 1 Bed Bay (1) | 1.6 | 43 |
| 3rd FL 1 Bed Bay (5) | 1.6 | 42 |
| 3rd FL 1 Bed Bay (4) | 1.6 | 42 |
| 3rd FL 1 Bed Bay (2) | 1.6 | 42 |
| 3rd FL 4 Bed Bay (1) | 1.3 | 40 |
| 3rd FL 4 Bed Bay (2) | 1.3 | 41 |
| 3rd FL 4 Bed Bay (3) | 1.3 | 41 |
| 4th FL 1 Bed Bay (6) | 1.6 | 43 |
| 4th FL 1 Bed Bay (3) | 1.6 | 43 |
| 4th FL 1 Bed Bay (1) | 1.6 | 43 |
| 4th FL 1 Bed Bay (5) | 1.6 | 43 |
| 4th FL 1 Bed Bay (4) | 1.6 | 43 |
| 4th FL 1 Bed Bay (2) | 1.6 | 43 |
| 4th FL 4 Bed Bay (1) | 1.4 | 41 |
| 4th FL 4 Bed Bay (2) | 1.4 | 41 |
| 4th FL 4 Bed Bay (3) | 1.4 | 41 |
| 1st FL Dayroom | 8.1 | 121 |
| 2nd FL Dayroom | 7.4 | 96 |
| 3rd FL Dayroom | 7.6 | 99 |
| 4th FL Dayroom | 8.6 | 122 |

**DSY 2 weather file**

| Zone name | CIBSE TM59 - Dry resultant temperature (°C) - % hours in range > 26 | HTM - Air temperature (°C) - hours in range >28 |
|---|---|---|
| 1st FL 1 Bed Bay (6) | 2.9 | 120 |
| 1st FL 1 Bed Bay (3) | 2.8 | 119 |
| 1st FL 1 Bed Bay (1) | 2.9 | 120 |
| 1st FL 1 Bed Bay (5) | 2.8 | 119 |
| 1st FL 1 Bed Bay (4) | 2.8 | 119 |
| 1st FL 1 Bed Bay (2) | 2.8 | 119 |
| 1st FL 4 Bed Bay (1) | 2.6 | 111 |
| 1st FL 4 Bed Bay (2) | 2.6 | 109 |
| 1st FL 4 Bed Bay (3) | 2.6 | 109 |
| 2nd FL 1 Bed Bay (6) | 2.8 | 113 |
| 2nd FL 1 Bed Bay (3) | 2.7 | 112 |
| 2nd FL 1 Bed Bay (1) | 2.8 | 114 |
| 2nd FL 1 Bed Bay (5) | 2.7 | 113 |
| 2nd FL 1 Bed Bay (4) | 2.7 | 112 |
| 2nd FL 1 Bed Bay (2) | 2.7 | 113 |
| 2nd FL 4 Bed Bay (1) | 2.5 | 104 |
| 2nd FL 4 Bed Bay (2) | 2.5 | 104 |
| 2nd FL 4 Bed Bay (3) | 2.5 | 104 |
| 3rd FL 1 Bed Bay (6) | 2.7 | 113 |
| 3rd FL 1 Bed Bay (3) | 2.7 | 112 |
| 3rd FL 1 Bed Bay (1) | 2.7 | 113 |
| 3rd FL 1 Bed Bay (5) | 2.7 | 113 |
| 3rd FL 1 Bed Bay (4) | 2.7 | 112 |
| 3rd FL 1 Bed Bay (2) | 2.7 | 113 |
| 3rd FL 4 Bed Bay (1) | 2.5 | 104 |
| 3rd FL 4 Bed Bay (2) | 2.5 | 104 |
| 3rd FL 4 Bed Bay (3) | 2.5 | 104 |
| 4th FL 1 Bed Bay (6) | 2.7 | 115 |
| 4th FL 1 Bed Bay (3) | 2.7 | 115 |
| 4th FL 1 Bed Bay (1) | 2.7 | 115 |
| 4th FL 1 Bed Bay (5) | 2.7 | 115 |
| 4th FL 1 Bed Bay (4) | 2.6 | 113 |
| 4th FL 1 Bed Bay (2) | 2.7 | 115 |
| 4th FL 4 Bed Bay (1) | 2.5 | 107 |
| 4th FL 4 Bed Bay (2) | 2.6 | 107 |
| 4th FL 4 Bed Bay (3) | 2.6 | 107 |
| 1st FL Dayroom | 8.3 | 180 |
| 2nd FL Dayroom | 7.7 | 175 |
| 3rd FL Dayroom | 7.8 | 176 |
| 4th FL Dayroom | 8.6 | 187 |

## DSY 3 weather file

| Zone name | CIBSE TM59 - Dry resultant temperature (°C) - % hours in range > 26 | HTM - Air temperature (°C) - hours in range >28 |
|---|---|---|
| 1st FL 1 Bed Bay (6) | 3.5 | 166 |
| 1st FL 1 Bed Bay (3) | 3.5 | 163 |
| 1st FL 1 Bed Bay (1) | 3.5 | 166 |
| 1st FL 1 Bed Bay (5) | 3.5 | 165 |
| 1st FL 1 Bed Bay (4) | 3.4 | 163 |
| 1st FL 1 Bed Bay (2) | 3.5 | 165 |
| 1st FL 4 Bed Bay (1) | 3.3 | 157 |
| 1st FL 4 Bed Bay (2) | 3.3 | 155 |
| 1st FL 4 Bed Bay (3) | 3.3 | 155 |
| 2nd FL 1 Bed Bay (6) | 3.4 | 155 |
| 2nd FL 1 Bed Bay (3) | 3.4 | 153 |
| 2nd FL 1 Bed Bay (1) | 3.4 | 155 |
| 2nd FL 1 Bed Bay (5) | 3.4 | 155 |
| 2nd FL 1 Bed Bay (4) | 3.3 | 153 |
| 2nd FL 1 Bed Bay (2) | 3.4 | 154 |
| 2nd FL 4 Bed Bay (1) | 3 | 141 |
| 2nd FL 4 Bed Bay (2) | 3.1 | 141 |
| 2nd FL 4 Bed Bay (3) | 3.1 | 141 |
| 3rd FL 1 Bed Bay (6) | 3.4 | 157 |
| 3rd FL 1 Bed Bay (3) | 3.4 | 155 |
| 3rd FL 1 Bed Bay (1) | 3.4 | 157 |
| 3rd FL 1 Bed Bay (5) | 3.4 | 156 |
| 3rd FL 1 Bed Bay (4) | 3.3 | 154 |
| 3rd FL 1 Bed Bay (2) | 3.4 | 155 |
| 3rd FL 4 Bed Bay (1) | 3 | 143 |
| 3rd FL 4 Bed Bay (2) | 3.1 | 143 |
| 3rd FL 4 Bed Bay (3) | 3.1 | 143 |
| 4th FL 1 Bed Bay (6) | 3.4 | 158 |
| 4th FL 1 Bed Bay (3) | 3.4 | 157 |
| 4th FL 1 Bed Bay (1) | 3.4 | 158 |
| 4th FL 1 Bed Bay (5) | 3.4 | 157 |
| 4th FL 1 Bed Bay (4) | 3.3 | 156 |
| 4th FL 1 Bed Bay (2) | 3.4 | 157 |
| 4th FL 4 Bed Bay (1) | 3.1 | 147 |
| 4th FL 4 Bed Bay (2) | 3.1 | 147 |
| 4th FL 4 Bed Bay (3) | 3.1 | 147 |
| 1st FL Dayroom | 9.7 | 234 |
| 2nd FL Dayroom | 9.2 | 228 |
| 3rd FL Dayroom | 9.3 | 231 |
| 4th FL Dayroom | 10 | 243 |

# Appendix D – Facade details

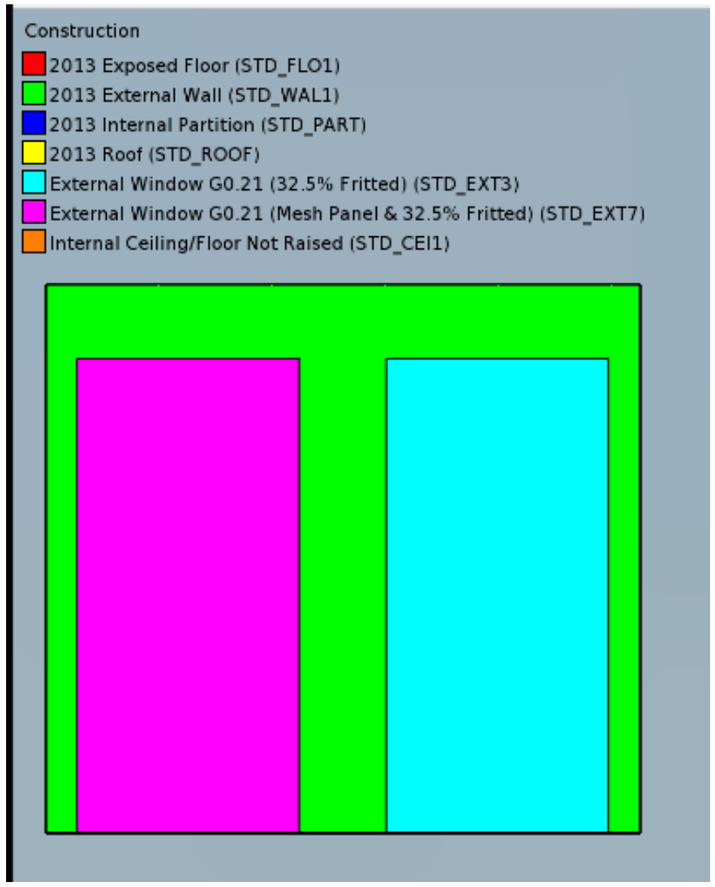



*Figure 16: Constructions in the single bedroom's facade*

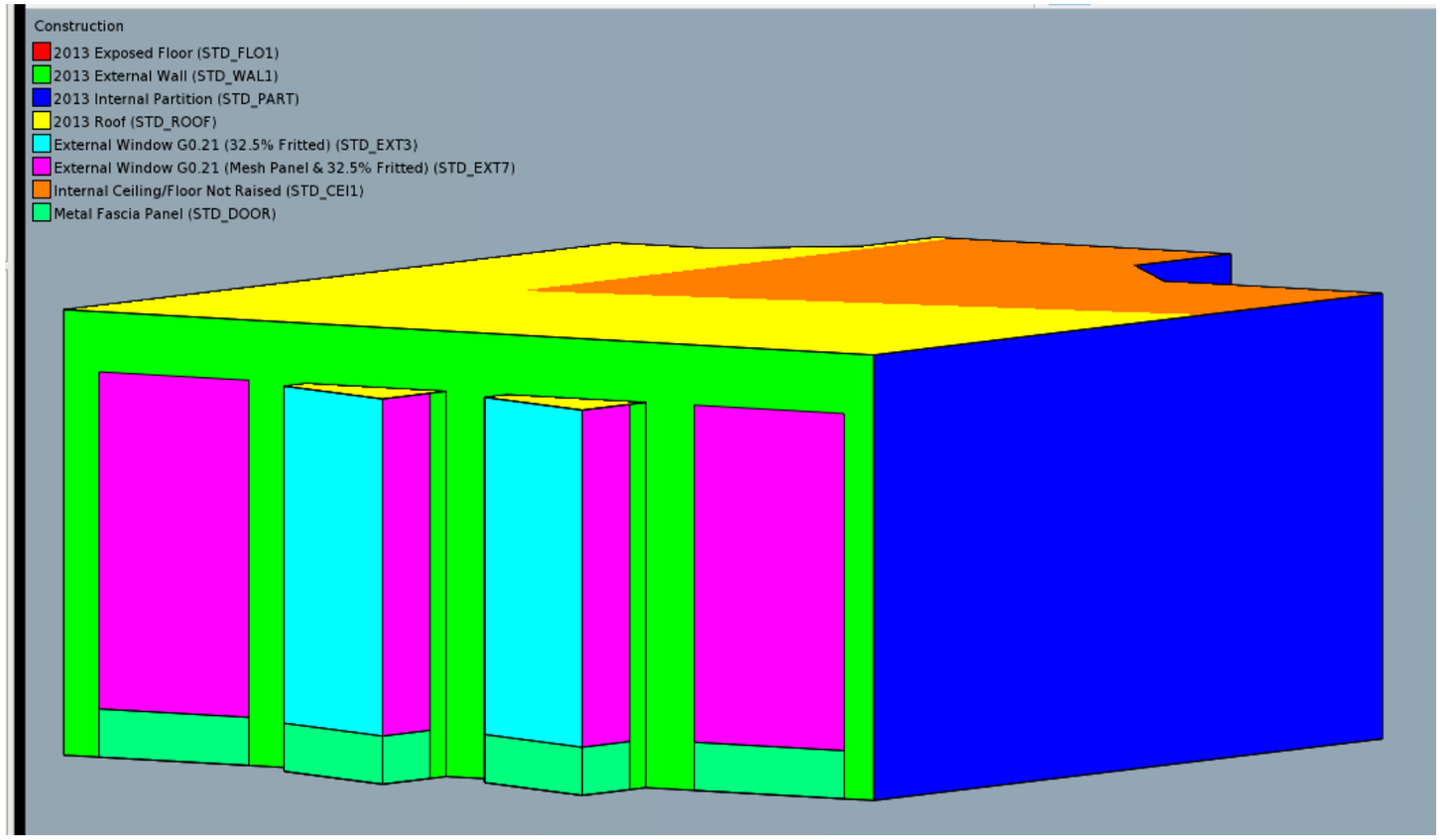



*Figure 17: Constructions in the 4 Bed-bay's facade*

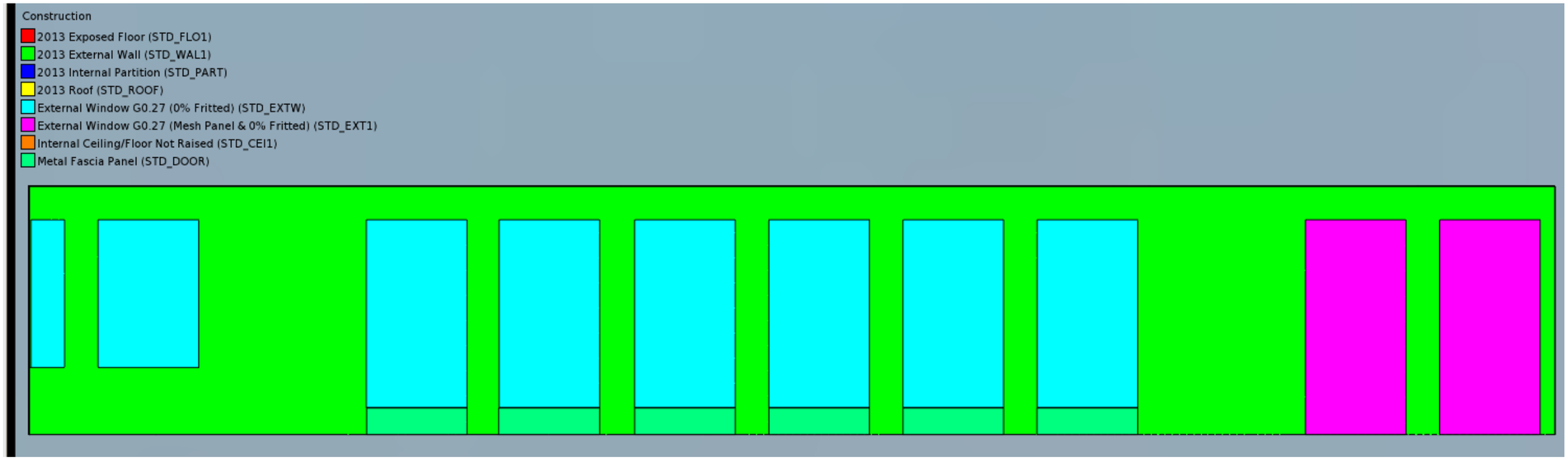



*Figure 18: Constructions in the dayroom's facade*

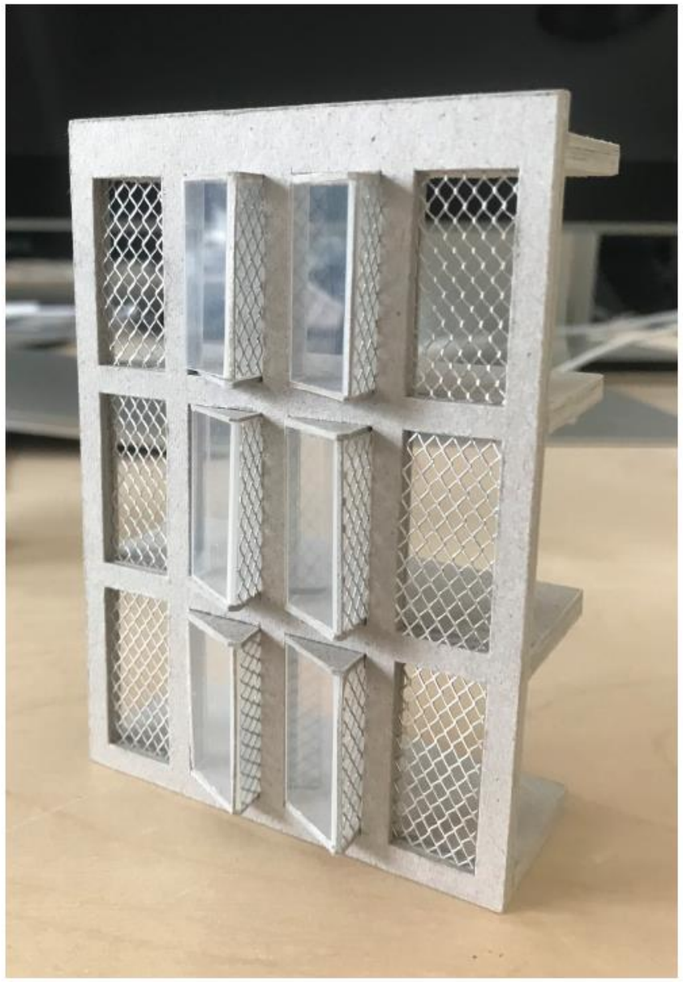
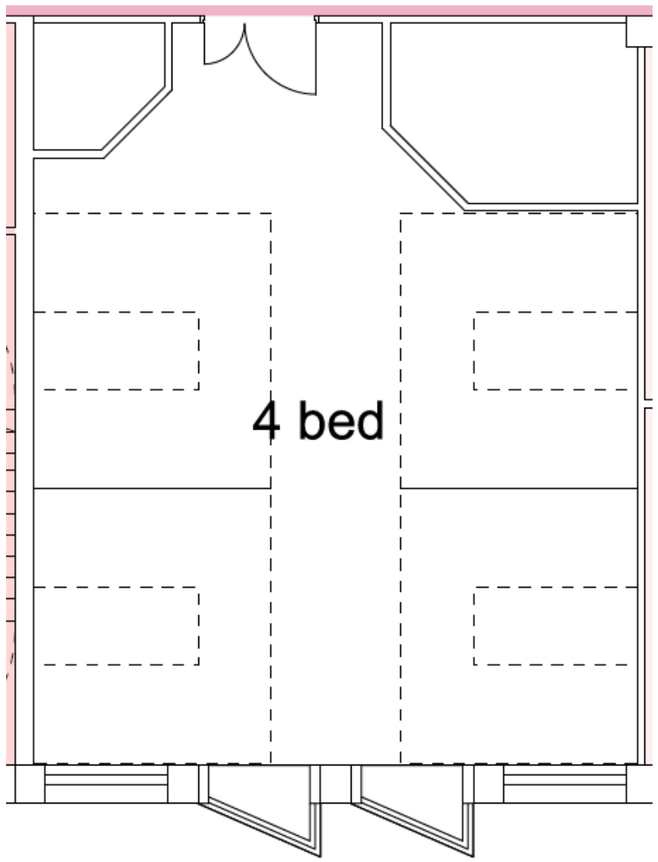
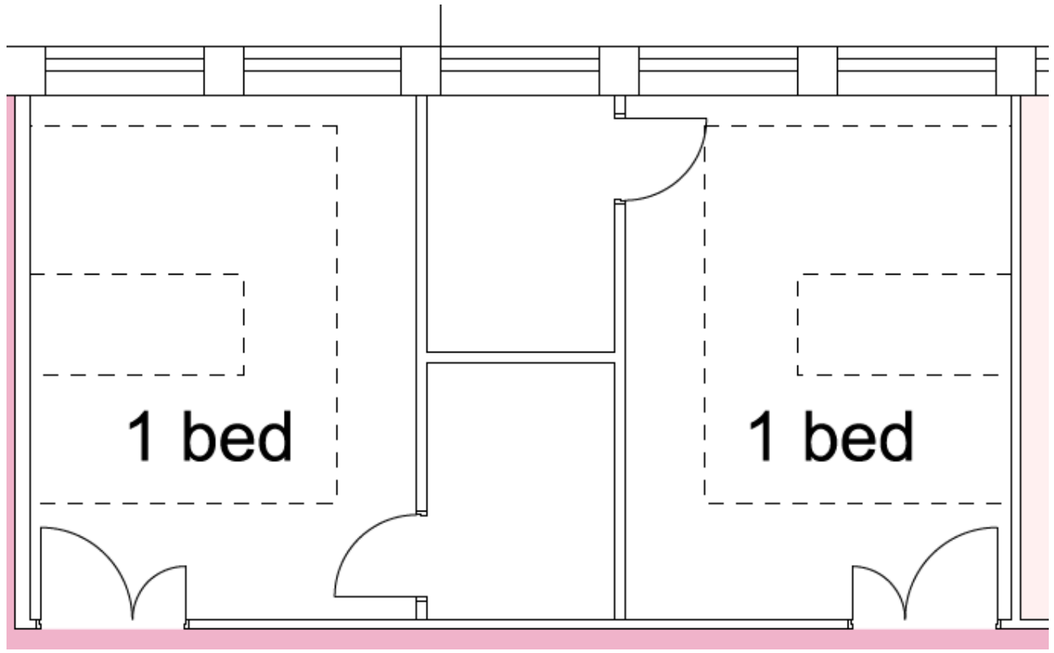


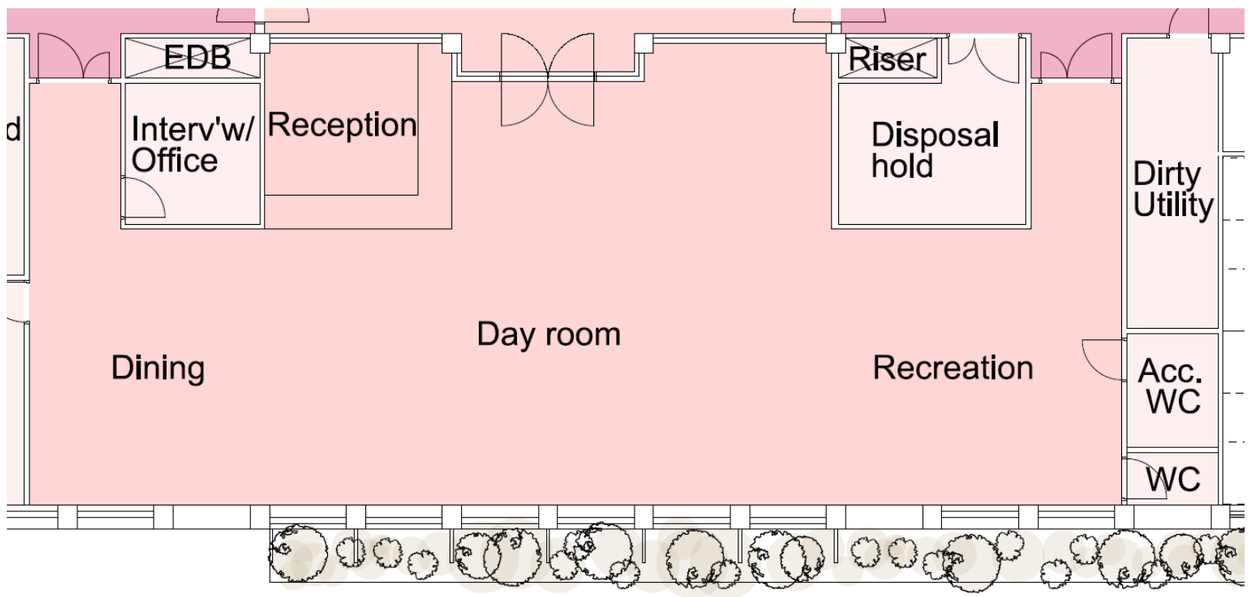
*Figure 19: Window arrangement in the 4 Bed-bays as shown in the small-scale model created by the architect*


*Figure 20: Window arrangement showing the bands of fritted glass. Height of fritted glass 1300mm in total, 32.5% coverage*

# Appendix E – Bedrooms and Dayroom layouts




Projecting planter

# Appendix 3: Pre-demolition Audit

**Pre Demolition Audit (PDA)**

# Pre-Demolition Audit

# 70-86 Royal College Street, Camden, NW1 0TH.

| The following report meets the requirements and scope of a Pre Demolition Audit. | | | | |
|---|---|---|---|---|
| **PDA drafted by:** | **Nick Blackman** | **Project Manager** | **Date:** | 16/01/2020 |
| **Authorised by:** | | **Project QA Rep** | **Date:** | |
| **Completed by:** | | **Contract Manager** | **Date:** | |
| **This report has been compiled and checked by a competent person.** | | | | |

# Pre Demolition Audit (PDA)

## CONTENTS

# Pre Demolition Audit (PDA)

## 1. EXECUTIVE SUMMARY

This report aims to improve the sustainable management of waste materials arising from the demolition of the site known as 70–86 Royal College Street, London NW1 0TH. The recommendations made in this report are based on the findings of the Pre-Demolition Audit carried out by General Demolition Ltd.

The report includes the results of the audit and a reclamation valuation survey. Together these identify the key demolition products and their potential for being recycled or reused.

The information in the report can be used to:

- Reduce the cost of disposal of the building
- Inform the project's Site Waste Management Plan

The results from the audit show an overall waste volume for 70–86 Royal College Street, London NW1 0TH, of 20,983 tonnes is predicted for the demolition works. It is expected that out of the overall tonnage the following values will apply: -

- 91% will be recycled
- 4% will be reused and
- 5% will go to landfill

## 2. CHANGE RECORD SHEET

| Revision Status: | Affected Page No's. | Details of change | Date Issued: | Authorised by: |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

## 3. PDA TEMPLATE NOTES

Copies of Waste consignment notes kept in General Demolition offices for record purposes

**SIGN OFF:**

## 4. ROLES AND RESPONSIBILITIES

Key roles and responsibilities for waste management be clearly defined, documented and communicated.

The **Client** is responsible for establishing the project PDA via instruction to the **Project Manager**, with the **Principal Contractor** responsible for maintaining the project PDA and for making available the necessary resources to ensure that the PDA is fully implemented. Key roles including:

**The Energy & Environmental Manager**

- Responsibility is to ensure the **Team** are aware of their duties.
- Responsibility to review and approve % targets suggested by the **Project Officer with** the **Principal Contractor**

*To prepare an PDA for this project, and this is passed down to the **Design Team** and **Principal Contractor** using the appropriate standards. The resulting PDA will then form part of the contract between the capital project office and any party involved in this project.*

- Responsibility for the instruction of the **Design Team** to initiate a suitable PDA / data to be collated at tender stage.
- Responsibility for the instruction of **Principal Contractors** for this project.
- Responsibility to review and approve % targets suggested by the **Project Officer with** the **Energy & Environmental Manager**.
- Responsible for the sign off of the project once completed in conjunction with the **Principal Contractor**.

**Project Manager**

- Coordinating the estimating of total volumes of waste expected to be generated by the project with the **Principal Contractor**, and the relay and review of % targets with the **Energy & Environmental Manager**.
- Responsible for identifying key PDA related issues to contractors at tender stage.
- Relay of the PDA to the **Principal Contractor** to enable successful implementation of the PDA on site.

## Pre Demolition Audit (PDA)

**Principal Contractor Construction/Site Manager**

- Responsible for estimating total volumes of waste expected to be generated by the project with the **Project Manager/Client**, and the setting of targets relating to re-use, recycling, and disposal of wastes on and off site prior to approval by the **Energy & Environmental manager**.

- Responsibility ensures suitable resources are made available during the construction phase in relation to working towards the requirements of the PDA.

- Overall responsibility for monitoring of the PDA.

- Ensure, so far as is reasonably practicable, that waste produced during demolition/construction is re-used, recycled or other form of recovery (e.g. energy recovery from incineration).

- Issue of the site waste matrix and implementation of the Site Waste Policy.

- Responsible for signing WTNs and assigning responsibility for this to nominated persons on site in his absence.

- The collation of data relating to waste management and the input of data into the nominated monitoring tool.

- Responsible for the sign off of the project once completed.

**Principal Designer**

- Responsibility to liaise directly with the **Project Officer** and the **Principal Contractor** regarding health and safety related issues and the PDA.

**Contractor Site Manager**

- Communication of the PDA to his operatives, e.g. identifying areas for improvements where segregation is not being followed.
- Responsible for the delivery of relevant toolbox talks where necessary.

## 5. NATURE OF THE PROJECT

The following broadly identifies the scope of works proposed:

- Ensure timber hoardings are erected to the site boundaries.
- Ensure all live services on the site have been terminated.
- Carry out a pre-demolition asbestos survey to the buildings to be demolished.
- Carry out a condition survey to surrounding roads and footpaths etc.
- Asbestos removal (survey dependent).
- Soft strip & demolition of main structure - complete demolition including soft strip, removal of any asbestos, taking up ground floor slabs, and grubbing up foundations.
- Installation of temporary works (subject to requirements)
- Reduce level dig

Prior to the development of this Pre Demolition Audit (PDA) the following strategic decisions were made by the **Client and Project Management team** to ensure that specific, and overall, project generated waste was either eliminated or reduced at the earliest stage:

- Design
- Demolition method
- Materials Removed

The following lessons learnt have been reviewed and incorporated from previous project PDA's etc.

- Segregation of waste materials on site
- Recycle as much materials as reasonably practicable
- Limit the number of licenced carriers
- Maintain records of waste carriers tickets

## 6. PURPOSE OF THE PRE DEMOLITION AUDIT

The purpose of this PDA is to describe the procedure by which waste to be managed by **The Project Manager** during the lifetime of this project.

The document will also act as a guide to project/construction personnel on how to manage all types of waste, in accordance with statutory and best practice requirements.

This PDA has been developed in line with the requirements of the SWMP Regulations 2008 (enacting Clause 54 of the Clean Neighbourhoods and Environment Act 2006).

The Project Manager/Officer reserves the right to amend the PDA accordingly, to ensure full compliance with any future legislation or changes to the existing regulatory framework.

PDA for the Client and associated contractors include:

- Providing a structured and forward thinking approach to waste management and sustainability on site;
- Assisting with compliance of internal environmental management systems, objectives and targets, and associated key performance indicators;
- Greater control of regulatory risks relating to virgin materials, waste storage, handling and disposal at a site level;
- Greater transparency with interested parties including BREEAM, Local Authority and the Environment Agency (EA);
- Identifying savings through improved resource efficiency, ordering, materials storage & handling to eliminate waste at source; and
- Enhance waste storage and segregation practices to facilitate higher recycling and recovery potential on site.

## Pre Demolition Audit (PDA)

### 6.1 PDA Management Arrangements

| Company | Position | Name | Contact Details |
|---|---|---|---|
| **PHASE 1 – Demolition** | | | |
| TBC | Contract Manager | Nick Blackman | 01932 252275 |
| **PHASE 2 – Reduce Level Dig** | | | |
| TBC | | | |
| **PHASE 3 – Enabling Works** | | | |
| TBC | | | |
| **PHASE 4 - Construction** | | | |
| TBC | | | |
| | | | |
| | | | |
| | | | |

The Client to take overall responsibility for the production of the PDA, with the **Project Management Company** holding the primary responsibility for the implementation of this PDA, and wastes generated on site during the lifetime of the project. The **Project Manager** is responsible for communicating the PDA requirements to the **Principal Contractor** and their construction managers, overseeing and documenting progress against the PDA.

### 6.2 Communication, Training & Distribution of the PDA

The **Principal Designer** will have full access to this PDA in order for comments to be made with regards to any additional health and safety requirements envisaged as part of the development of this project. Training and communication of this PDA will be made by the following means:

- Within the Principal Contractor's site induction;

- The delivery of toolbox talks by Principal / Sub contractor or waste champion

### 6.3 Waste Identification

**The** Client **and** Project Managers **have investigated all likely waste streams to be generated from this project, approximate volumes of material and assigned relevant % targets have been provided by the** Principal Contractor **(with the final approval of targets by the** Energy and Environmental Manager *or designated person*) **to achieve in terms of re-use, recycling and disposal of material both on and off site, in order to identify opportunities for savings in both financial and environmental terms. The details of which are as follows:**

NB. The **Project Officers** have assigned suggested targets for this development, however if the **Principal Contractor** feels he cannot meet these targets, justification needs to be made as to why these cannot be made, and / or identify how wastes can be eliminated or reduced in another way.

## Pre Demolition Audit (PDA)

| WASTE CATEGORY | TYPE OF MATERIAL | Actual VOLUME (m3) | % TARGET & METHOD OF TREATMENT / DISPOSAL |
|---|---|---|---|
| **PHASE 1 – Demolition** | | | |
| INERT | E.g. Uncontaminated demolition material, concrete, brick, glass. | TBC | 100% re-use on site |
| NON-HAZARDOUS | E.g. Plasterboard, general waste, timber, metals, carpets, vegetation, wiring / plumbing, plastics etc. | TBC | 100% recycled off site |
| HAZARDOUS | E.g. Asbestos, asbestos containing materials, contaminated ground (oil / solvents), oils / fuel, tanks, refrigerants (old AC units etc), Oil filled transformers (inc PCBs), contaminated demolition material, contaminated fume cupboards | TBC | 100% landfilled at a hazardous waste landfill (or for asbestos in a stable non-reactive hazardous waste cell) |
| | | | |
| **PHASE 2 – Reduce Level Dig** | | | |
| INERT | E.g Soil & Stone | TBC | 100% recycled off site |
| NON-HAZARDOUS | | | |
| HAZARDOUS | | | |
| | | | |
| **PHASE 3 – Enabling Works** | | | |
| INERT | | | |
| NON-HAZARDOUS | | | |
| HAZARDOUS | | | |
| | | | |
| **PHASE 4 - Construction** | | | |
| INERT | | | |
| NON-HAZARDOUS | | | |
| HAZARDOUS | | | |

The assessment includes site-generated wastes (e.g. arisings and demolition specific waste such as concrete break out / re-bar) and imported waste materials (e.g. imported secondary aggregates / third party construction / demolition sites)

The **Project Team** has ensured the principles of the waste hierarchy (eliminate, reduce, reuse, recycle, disposal) have been applied to this PDA to enable best practice on site and to improve the overall sustainability of the project. It is intended that this PDA should evolve during the course of the project.

### 6.4 Recycling & Reuse initiatives

As part of the development of this PDA the following initiatives have been reviewed and agreed upon, aiming to reduce the amount of waste produced in the first instance, and assisting in the recycling and reuse of waste as an alternative to offsite disposal.

**Recycling Off Site:**

- E.g. Plastic packaging
- E.g. Paper and cardboard
- E.g. Plasterboard via British Gypsum / Knauf
- E.g. Concrete and demolition wastes processed to engineered spec / WRAP
- E.g. Re-use of wood waste (e.g. shoring and shuttering)

### 6.5 Waste Storage and Disposal Options

Suitable waste storage facilities / arrangements must be made on site to ensure effective segregation of wastes on site.

Waste disposal, where possible, consider the implications of long-distance travel in terms of health and safety risk, commercial terms and increased emissions from vehicles.

Names of the waste handlers for the demolition waste can be found in the table below (where known)

| Waste Carrier | Waste Certification Ref | Waste Management Company |
|---|---|---|
| General Demolition Ltd | CBDU82505 | General Demolition Ltd |
| Southwark Metals | CBDU79006 | Southwark Metals |
| P.B Donoghue Ltd | CBDU184183 | P.B Donoghue Ltd |
| Westminster Waste | CBDU143849 | Westminster Waste |

### 6.6 Monitoring and Measurement

The effectiveness of the PDA will depend upon the enforcement of its requirements on site and include monitoring to be made by the nominated **Site Manager** on site. Responsibility for the formal recording of all waste movements shall be with the **Site Manager** and is to be recorded using a nominated system, expect **Principal Contractors** to use their own system that fully complies with the SWMP regulations 2008,

A 'spot check' will be made by the **Site Manager** in relation to the completeness of any Waste Transfer Note (WTN) and any Hazardous Waste Consignment note against the Site Waste Matrix.
This PDA will be reviewed **every week**, during the lifetime of the project by the **Project Manager** and the **Principal Contractor** to ensure that estimated targets are being achieved and that realistic solutions are provided for unplanned events or abnormal wastes.

### 6.7 Project Completion

Within **one month** of practical completion of the project, the **Project Officer** and the **Principal Contractor** will review the PDA and ensure that it is updated to reflect the following:

- Confirmation that the plan had been monitored and updated on a regular basis to ensure work progressed according to plan;
- A comparison of the estimated quantities of each waste type against the actual quantities of each waste type.
- An estimate of the cost savings that have been achieved by completing and implementing this PDA.

Retention of the PDA and associated records must be retained for a minimum of **three years** after the completion of the project. The **Principal Contractor** will also retain a copy for a minimum of two years at their place of business.

## 7 PROJECT WASTE POLICY

All materials on site are to be handled efficiently:

a) The site manager needs to ensure all waste collections are co-ordinated

b) Ensure dedicated storage yard / area provided and that materials susceptible to water damage (e.g. cement bags / plasterboard) are stored within a weather-proof area;

c) Ensure materials are stored in a manner that will not result in fire or damage

d) Ensure stores are locked when not in use to prevent misuse or vandalism.

Provision of suitable containers for the collection and storage of identified waste streams to be provided across the site;

Dedicated waste storage area with suitable hard standing for containers to be established (e.g. open builders skip / Rear End Loaders REL), in a secure location, preferably set back from public access (to prevent fly tipping), ensuring skips (wherever possible) are at least 8m away from any building. Area to be suitably signed, clearly identifying permitted wastes (aiding segregation) and marked on both the site plan and the traffic management plan;

Hazardous waste:

e) Used aerosols – throughout the lifetime of the project; store in segregated and labelled container e.g. empty 205L drum / wheelie bin;

f) Contaminated arisings encountered during remediation of contaminated land for brownfield developments or hot spot removal exercises;

All waste transfers from site MUST be dealt with in strict accordance with the Environmental Protection (Duty of Care) Regulations 1991 (as per section 34 of the Environmental Protection Act 1990). This will be enforced on site ensuring the commitment made by the project officer.

# 8 APPENDICES

- **Appendix A: - Pre Demolition Audit Data Sheet**

| | | | |
|---|---|---|---|
| WORK PACKAGE: | 70-86 Royal College Street, Camden, NW1 0TH. | PROJECT HAZERDOUS WASTE CODE | **TBC** |
| NOMINATED ENVIRONMENT MANAGER | TBC | PERSON COMPLETING FORM, IF DIFFERENT | |

| **Waste material** | **Waste type:** | **EWC Code** | **Estimate** | **Quantity m3 or yard skips (specify)** | | **Waste Management Option:** (1) Re-use on site; (2) Recycle; (3) Energy recovery (4) Hazardous disposal | **Waste Carrier** | | **End destination** |
|---|---|---|---|---|---|---|---|---|---|
| **Delete rows or insert as applicable** | **Hazardous Non-Hazardous Inert** | | Estimate weight / quantity (tonne) | Monthly Containers | Actual Skips over contract Period | | **Company name** | **Waste Carrier License Number** | **Site Name & location** |
| Soil & Stones | Inert | 17 05 04 | 20000 | 12000m3 | | (2) Recycle | TBC | | TBC |
| Concrete | Inert | 17 01 01 | 700 | 350m3 | | (1) Reuse on site | TBC | | TBC |
| Hardcore | Inert | 17 01 02 | 200 | 120m3 | | (1) Reuse on site | TBC | | TBC |
| Tiles & Ceramics | Inert | 170103 | 10 | 12m3 | | (2) Recycle | TBC | | TBC |
| Timber | Non-hazardous | 17 02 01 | 10 | 2 (40 yrd) | | (2) Recycle | TBC | | TBC |
| Plastic | Non-hazardous | 17 02 03 | 2 | 1 (8 yrd) | | (2) Recycle | TBC | | TBC |
| Iron & Steel | Non-hazardous | 17 04 05 | 30 | 3 (40 yrd) | | (2) Recycle | TBC | | TBC |
| Mixed general construction waste (not contaminated) | Non-hazardous | 17 09 04 | 15 | 3 (40 yrd) | | (2) Recycle | TBC | | TBC |
| Paper/cardboard | Non-hazardous | 20 01 01 | 3 | 1 (15 yrd) | | 2) Recycle | TBC | | TBC |
| Glass | Non-hazardous | 17 02 02 | 9 | 1 (15 yrd) | | (2) Recycle | TBC | | TBC |
| Plasterboard | Non-Hazardous | 17 08 02 | 4 | 1 (8 yrd) | | (2) Recycle | TBC | | TBC |
| Construction materials containing asbestos | Hazardous | 17 06 05 | Unknown | | | (4) Hazardous disposal | TBC | | TBC |
| *Other non-hazardous (specify)* | Non-hazardous | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

- # Appendix A.1: Pre Demolition Audit Checklist

| Project Stages | | Questions to consider | Tick if 'Yes' | Comment:<br>If 'yes', what action have you taken/do you propose to take?<br>If 'no', why not? |
|---|---|---|---|---|
| **Policy** | 1 | Has your organisation adopted a waste management policy? | ✓ | |
| | 2 | Has the client signed the Site Waste Management Plan? | | |
| | 3 | Have relevant sub-contractors producing significant wastes steams been identified? | | |
| | 4 | Have the identified sub-contractors signed the Site Waste Management Plan? | ✓ | |
| **Procurement** | 5 | Has a careful evaluation of materials been made so that over-ordering and site wastage is reduced? | ✓ | |
| | 6 | Has full consideration been given to the use of secondary and recycled materials? | ✓ | |
| | 7 | Is unwanted packaging to be returned to the supplier for recycling or re-use? | □ | n/a |
| | 8 | Can unused materials be returned to purchaser | □ | n/a |
| **Project planning** | 9 | Has responsibility for waste management planning and compliance with environmental legislation been assigned to a named individual at both main contractor and identified sub-contractors? | ✓ | |
| | 10 | Has a project programme been developed to include likely waste arisings (how much, when, and what types)? | ✓ | |
| | 11 | Has an area of the site been designated for waste management, including segregation of waste? | □ | n/a |
| | 12 | Have targets been set for the different types of waste likely to arise from the project? | ✓ | |
| | 13 | Have measures been put in place to deal with expected (and unexpected) hazardous waste? | ✓ | |
| | 14 | Has disposal of liquid wastes such as wash-down water and lubricants been considered? | □ | n/a |
| | 15 | Where relevant, has discharge consent been obtained from the Agency? | □ | n/a |
| | 16 | Has agreement been sought from the sewerage company for trade effluent discharge? | □ | n/a |
| | 17 | Have opportunities been considered for re-use of materials on site? | □ | n/a |
| | 18 | Have opportunities been considered for re-use of materials off site? | ✓ | Recycle and retain on site where possible |
| | 19 | Have opportunities been considered for on-site processing and re-use of materials? | □ | n/a |
| | 20 | Have opportunities been considered for reprocessing materials off-site? | ✓ | |
| | 21 | Have you considered the most appropriate sites for disposal of residual waste from the project? | ✓ | |
| | 22. | Are there opportunities for reducing disposal costs from waste materials which may have a commercial value? | ✓ | |
| **Site operations** | 24 | Has responsibility for waste management on site and compliance with environmental legislation been assigned to a named individual? | ✓ | |
| | 25 | Have toolbox talks been planned for all site personnel about waste management on site? | ✓ | |
| | 26 | Are selected waste materials segregated to allow best value to be obtained from good waste management practices? | ✓ | |
| | 27 | Are containers/skips clearly labelled to avoid confusion? | ✓ | |
| | 28 | Is Duty of Care procedures complied with, including provision of transfer notes and checking authorisation of registered carriers, registered exempt sites and licensed waste management facilities? | ✓ | |
| | 29 | Are any checks made that excavation waste is received at the intended site? | □ | n/a |

## Pre Demolition Audit (PDA)

| | | | | |
|---|---|---|---|---|
| | 30 | Is implementation of agreed waste management procedures monitored? | ✓ | |
| | 31 | Are reports regularly produced regarding waste quantities and treatment/disposal routes, and on costs incurred? | ✓ | |
| | 32 | During site operations, are barriers to good waste management practice considered and noted for incorporation into the post-completion review? | ✓ | |
| **Post completion** | 33 | Has a final report of use of recycled and secondary materials, waste reduction, segregation, recovery and disposal, been completed? | ✓ | Report above indicates materials removed for recycling |
| | 34 | Has the final report been signed by the relevant contractors and the client? | ☐ | |
| | 35 | Have key waste management issues been considered for action at future projects? | ☐ | n/a |

For General Demolition: Nick Blackman

Signed: ……..……

# Appendix 4: Circular Economy Statement

# 70-86 Royal College Street, London NW1 0TH
# Circular Economy Statement

## Introduction

We acknowledge the purpose of a circular economy as follows:

> *A circular economy is one where materials are retained in use at their highest value for as long as possible and are then re-used or recycled, leaving a minimum of residual waste.*

Within this project we have tried to follow the principles set out within 'Circular economy guidance for construction clients' by the UK Green Building Council. A large number of components are still to be selected, but we have considered a number of the main moves in the design up to planning that will influence how close we can move the project to fulfilling the requirements of the circular economy and we have provided commentary on these moves later in this statement.

This has included following the selection hierarchy for components as follows:

| | |
|---|---|
| Design out | • Design out the need for the component or material (e.g. passive design negating the need for cooling or ventilation; inherent finishes avoiding the need for paint, etc.) |
| Reclaimed, remanufactured components | • Use reclaimed materials over new<br>• Use remanufactured components over new |
| Product selection | • Use products with labels such as Cradle to Cradle (C2C) and Natureplus<br>• Select products that can be remanufactured or reused at end of first life<br>• Use materials with recycled content<br>• Select products that are designed for disassembly<br>• Select materials that can be reused at end of first life<br>• Select materials that can be recycled or composted at end of life<br>• Consider leasing short-lived components |

At this stage we have mostly been concentrating on what we can design out of the proposals, adaptable and flexible layouts and material choices for the external appearance of the proposals.

## Circular Economy Principles and their application within the proposals for 70-86 Royal College Street

### Re-use of Existing Assets:

The existing buildings are purpose built for a car tyre workshop and provide approx. 644m² of gross internal area over a single storey. The proposed building is to provide a modern healthcare facility of over 7,000m² of gross internal area on a constrained site over basement and six storeys. It is not feasible to retain or reuse any of the existing buildings in this instance.

### Re-use of Materials:

We have undertaken a pre-demolition audit in order to identify what materials can be utilised at their highest value within the new proposals (or for other projects in the near vicinity) and the best demolition process in order to extract the materials in the best condition for re-use. Then what materials can be effectively re-used

in a less valuable form (ie. crushed concrete and masonry for hardcore/piling mat). Then finally how materials can be best separated for recycling.

**Design for Longevity:**

The main facade materials, masonry and faiance, have been chosen partly for their longevity, but also because weathering over time adds to their character or their original condition can be restored in situ. Aluminium framed glazing has been chosen chosen for it's longevity. The use of blue and green roofs adds a layer of protection to the waterproof roof coverings to significantly extend their life. Similar choices will be made with other elements that can add to the longevity of the building whilst being mindful of the other circular economy principles.

**Design for Flexibility:**

The building has been designed for leasing to a NHS Trust for the 30 years. The programme of use is varied (from offices, to clinics, to wards) and it is highly likely that the internal arrangements will need to change within the lease period. In developing the overall building proposals the design team have looked at a number of layout options to test the flexibility of the proposals to be able to accommodate different layouts. In addition we have liaised with the local authority over potential future local development and they have identified their hope to implement a mews street down the rear of the building if/when the Royal Mail site comes forward for re-development. This would allow the building to be serviced from the rear without the need to drive into the internal loading bay. There is a difference in level between Royal College Street (the ground floor) and the rear, therefore in order to allow for this level change the arrangement of the lifts and their lobbies have been designed such that this level change can be easily made in the future with minimal adaptations to the structure.

**Design for Adaptability:**

In addition to designing in the right layout and easily adaptable structure for the level changes to access from the rear. We have looked at potential future uses for the building if at the end of 30 years there wasn't the need to continue with Healthcare. The most likely uses would be as office space and/or residential. The building could be very easily be adapted to either. Office would be easier and the depth of the floor plates would suit this better, but the structure will include space for additional soil stacks and risers, partly to allow different healthcare layouts, but also to ensure that minimal alterations would be required for residential. One other area we have looked at is the external glazing. Wherever possible we have looked to maximise glazing and daylight, but in some locations it has made sense to have either solid panels in the facade or part glazed/part solid. As we progress into detailed design we will look into how these could be relatively easily be swapped out (subject to planning approval) to suit evolving layouts and requirements.

**Design for Assembly, Disassembly and Recoverability:**

We have run a number options appraisals for the main structure, but we have identified that RC frame is the only viable choice for the proposals. On top of this we will look to pre-fabricate facade elements offsite. This should give advantages in the speed of the build, minimising waste and quality control, but also gives us more flexibility in looking at how we can compose the building in a way that materials can be easily disassembled into their component parts for re-use. Building Information Modelling will be used to allow better management of the building and identification of different elements in the future.

**Standardisation or Modularisation:**

The interior fit out specification for the tenant will be standardised to suit their existing supply chain. This should provide efficiencies in installation, repairs and maintenance. Elsewhere we will look to utilise standardised products (and product sizes) wherever possible to reduce waste, maximise the potential for re-use and maximise the range of replacement options.

**Servitisation and Leasing:**

When developing the detailed design we will look into what components and services can be leased. Most notably lifts, plant, etc.

**Use of Low Impact New Materials:**

As part of achieving BREEAM excellent we are going after the Material points related to life cycle analysis. This means that we will look to optimise the life cycle impact of materials against other design requirements. Wherever possible we will look to drive down the life cycle impacts of the new materials. To meet the requirements of the NHS tenants and their sensitive users we will minimise the use of products that contain materials that have a negative impact on the health of the building users and the environment.

**Use of Recycled Content or Secondary Material:**

Wherever possible we will specify products with recycled content. For example the concrete will include recycled aggregate and we will look to maximise the content of Ground Granulated Blast Furnace Slag and reduce cement content. The other priorities will be high recycled content for plasterboard, floor coverings, sub bases, piling mat, insulation and other concrete/cement products.

**Designing Out Waste:**

We note that all of the above principles contribute to designing out waste in the construction, maintenance, adaptation and re-use of the building and materials, but we will stress to the design and construction team that this is a goal in itself that the other areas are contributing towards.

**Reducing Construction Impacts:**

We will stipulate that the contractor works with their suppliers to ensure all products delivered to site use packaging that is taken back by the supplier for reuse or recycling and ensure onsite waste management is set up to enable reuse, with recycling as a final option.

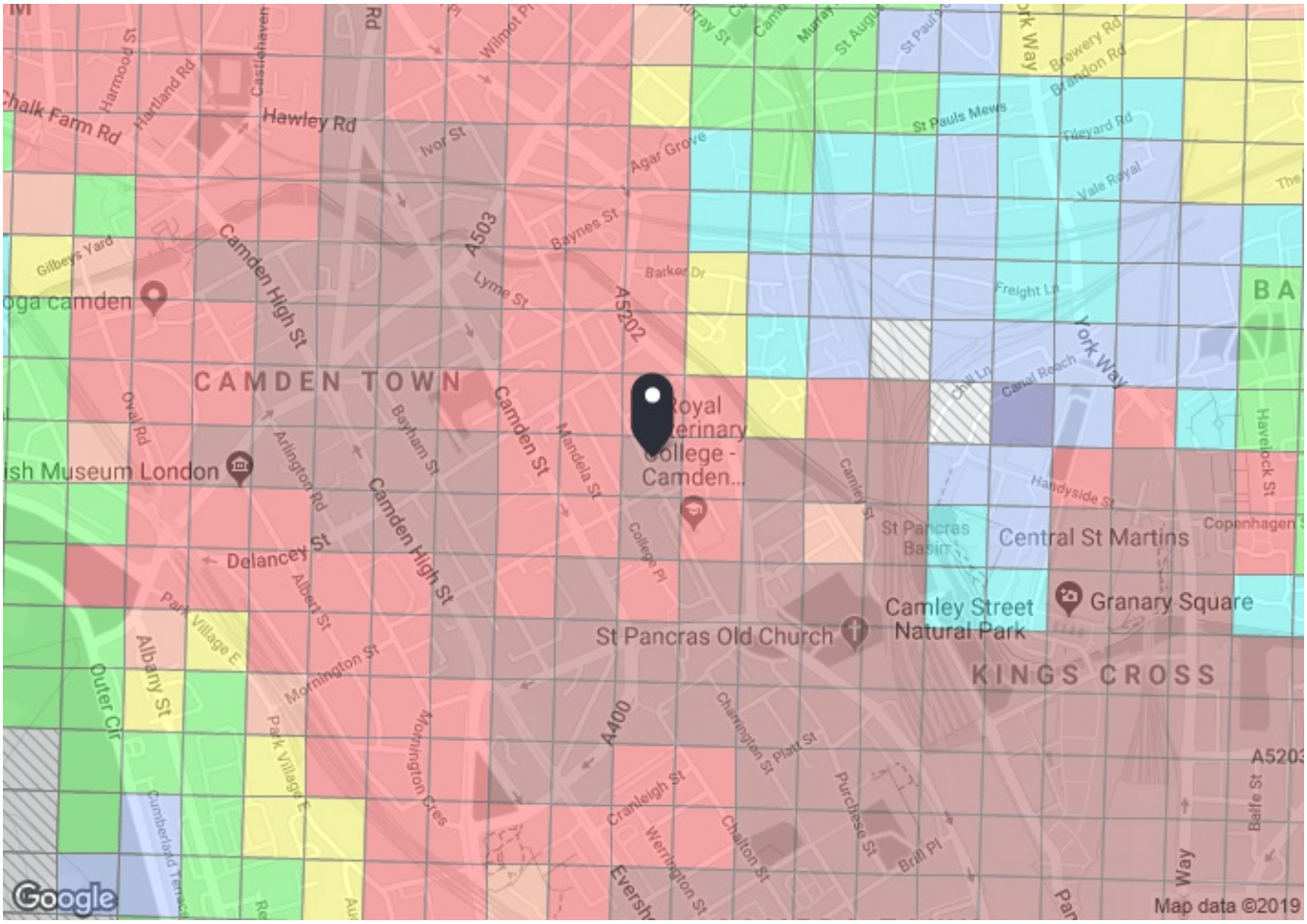
**Other Targets**

In addition to pursuing a more circular economy by following the above principles the project will endeavour to achieve the other London Plan Requirements for resource conservation, waste reduction, increases in materials re-use and recycling, and reductions in waste going for disposal as follows:

- *Achieve >95% of construction and demolition waste to reuse/recycling/recovery and >95% of excavation waste for beneficial use;* We will work with the best performing companies with verified recycling certificates to get as close to or meet this target.
- *Design developments with adequate, flexible and easily accessible storage space and collection systems that support, as a minimum, the separate collection of dry recyclables (at least card, paper, mixed plastics, metals, glass) and food;* The development allows substantial facilities management space to separate 'waste' for recycling.

# Appendix 5: PTAL Report

TRANSPORT FOR LONDON




**PTAL output for Base Year**
6b

NW1 0TH
Royal College St, London NW1 0TH, UK
Easting: 529449, Northing: 183753

Grid Cell: 97190

Report generated: 10/10/2019

**Map key - PTAL**

| | |
|---|---|
| 0 (Worst) | 1a |
| 1b | 2 |
| 3 | 4 |
| 5 | 6a |
| 6b (Best) | |

**Map layers**

PTAL (cell size: 100m)

Calculation Parameters

| | |
|---|---|
| **Day of Week** | M-F |
| **Time Period** | AM Peak |
| **Walk Speed** | 4.8 kph |
| **Bus Node Max. Walk Access Time (mins)** | 8 |
| **Bus Reliability Factor** | 2.0 |
| **LU Station Max. Walk Access Time (mins)** | 12 |
| **LU Reliability Factor** | 0.75 |
| **National Rail Station Max. Walk Access Time (mins)** | 12 |
| **National Rail Reliability Factor** | 0.75 |

Calculation data

| Mode | Stop | Route | Distance (metres) | Frequency (vph) | Walk Time (mins) | SWT (mins) | TAT (mins) | EDF | Weight | AI |
|---|---|---|---|---|---|---|---|---|---|---|
| Bus | R COLLEGE ST CAMDEN ROAD | 274 | 435.53 | 7.5 | 5.44 | 6 | 11.44 | 2.62 | 0.5 | 1.31 |
| Bus | BAYHAM STREET PLENDER ST | 24 | 480.54 | 10 | 6.01 | 5 | 11.01 | 2.73 | 0.5 | 1.36 |
| Bus | BAYHAM STREET PLENDER ST | 134 | 480.54 | 12 | 6.01 | 4.5 | 10.51 | 2.86 | 0.5 | 1.43 |
| Bus | BAYHAM STREET PLENDER ST | 29 | 480.54 | 15 | 6.01 | 4 | 10.01 | 3 | 0.5 | 1.5 |
| Bus | BAYHAM STREET PLENDER ST | 88 | 480.54 | 8 | 6.01 | 5.75 | 11.76 | 2.55 | 0.5 | 1.28 |
| Bus | BAYHAM STREET PLENDER ST | 27 | 480.54 | 8 | 6.01 | 5.75 | 11.76 | 2.55 | 0.5 | 1.28 |
| Bus | BAYHAM STREET PLENDER ST | 168 | 480.54 | 9 | 6.01 | 5.33 | 11.34 | 2.65 | 0.5 | 1.32 |
| Bus | BAYHAM STREET PLENDER ST | 253 | 480.54 | 12 | 6.01 | 4.5 | 10.51 | 2.86 | 0.5 | 1.43 |
| Bus | CROWNDALE RD R COLL ST | 214 | 325.36 | 8 | 4.07 | 5.75 | 9.82 | 3.06 | 0.5 | 1.53 |
| Bus | ROYAL COLLEGE ST PLENDER ST | 46 | 63.79 | 6 | 0.8 | 7 | 7.8 | 3.85 | 1 | 3.85 |
| Bus | PRATT STREET | C2 | 563.76 | 8 | 7.05 | 5.75 | 12.8 | 2.34 | 0.5 | 1.17 |
| Rail | St Pancras | 'BEDFDM-SVNOAKS 1E62' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'BEDFDM-BROMLYS 1E83' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'BEDFDM-ORPNGTN 1L60' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'BEDFDM-SUTTON 1O13' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'BEDFDM-KENTHOS 1S85' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'BEDFDM-BRGHTN 1T11' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'BEDFDM-BRGHTN 1T15' | 908.11 | 0.67 | 11.35 | 45.53 | 56.88 | 0.53 | 0.5 | 0.26 |
| Rail | St Pancras | 'BRGHTN-BEDFDM 1T83' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'BEDFDM-SUTTON 1V23' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'BEDFDM-SUTTON 1V82' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'BRGHTN-BEDFDM 1W06' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'BRGHTN-BEDFDM 1W81' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'BEDFDM-BRGHTN 1W84' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'BEDFDM-BRGHTN 1W86' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'STALBCY-SVNOAKS 2E11' | 908.11 | 1 | 11.35 | 30.75 | 42.1 | 0.71 | 0.5 | 0.36 |
| Rail | St Pancras | 'BEDFDM-SVNOAKS 2E19' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'LUTON-SVNOAKS 2E21' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'STALBCY-SVNOAKS 2E95' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'SUTTON-LUTON 2O00' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'SUTTON-BEDFDM 2O04' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'SUTTON-STALBCY 2O06' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'SUTTON-LUTON 2O10' | 908.11 | 1 | 11.35 | 30.75 | 42.1 | 0.71 | 0.5 | 0.36 |
| Rail | St Pancras | 'LUTON-SUTTON 2O17' | 908.11 | 0.67 | 11.35 | 45.53 | 56.88 | 0.53 | 0.5 | 0.26 |
| Rail | St Pancras | 'STALBCY-SUTTON 2O21' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'STALBCY-SUTTON 2O29' | 908.11 | 0.67 | 11.35 | 45.53 | 56.88 | 0.53 | 0.5 | 0.26 |
| Rail | St Pancras | 'LUTON-BCKNHMJ 2S91' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'STALBCY-BROMLYS 2S93' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'BRGHTN-BEDFDM 2T02' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'BRGHTN-BEDFDM 2T04' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'BEDFDM-BRGHTN 2T15' | 908.11 | 1 | 11.35 | 30.75 | 42.1 | 0.71 | 0.5 | 0.36 |
| Rail | St Pancras | 'BEDFDM-BRGHTN 2T25' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'BRGHTN-LUTON 2T99' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'SUTTON-STALBCY 2V02' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'SUTTON-STALBCY 2V08' | 908.11 | 0.67 | 11.35 | 45.53 | 56.88 | 0.53 | 0.5 | 0.26 |
| Rail | St Pancras | 'BEDFDM-SUTTON 2V15' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'SUTTON-BEDFDM 2V16' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'LUTON-SUTTON 2V19' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'SUTTON-KNTSHTN 2V20' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'STALBCY-SUTTON 2V27' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'LUTON-SUTTON 2V31' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'BRGHTN-BEDFDM 2W08' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'BRGHTN-BEDFDM 2W12' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'BRGHTN-BEDFDM 2W16' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'ASHFKY-BEDFDM 1E61' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'ASHFKY-BEDFDM 1E63' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'RCHT-BEDFDM 1E67' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'SVNOAKS-BEDFDM 1E69' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |

| Mode | Stop | Route | Distance (metres) | Frequency(vph) | Walk Time (mins) | SWT (mins) | TAT (mins) | EDF | Weight | AI |
|---|---|---|---|---|---|---|---|---|---|---|
| Rail | St Pancras | 'BROMLYS-BEDFDM 1E82' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'BCKNHMJ-BEDFDM 1G65' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'KENTHOS-BEDFDM 1G71' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'ORPNGTN-STALBCY 2D93' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'ORPNGTN-LUTON 2D95' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'SVNOAKS-STALBCY 2E59' | 908.11 | 0.67 | 11.35 | 45.53 | 56.88 | 0.53 | 0.5 | 0.26 |
| Rail | St Pancras | 'SVNOAKS-LUTON 2E61' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'SVNOAKS-WHMPSTM 2E63' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'SVNOAKS-KNTSHTN 2E65' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'SVNOAKS-KNTSHTN 2E67' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'BROMLYS-LUTON 2E93' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'ORPNGTN-LUTON 2L59' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'ORPNGTN-KNTSHTN 2L65' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'BEDFDM-ELPHNAC 1J87' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'BEDFDM-ELPHNAC 1J88' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'STPANCI-FAVRSHM 1F08' | 908.11 | 2 | 11.35 | 15.75 | 27.1 | 1.11 | 0.5 | 0.55 |
| Rail | St Pancras | 'BRSR-STPANCI 1F13' | 908.11 | 0.67 | 11.35 | 45.53 | 56.88 | 0.53 | 0.5 | 0.26 |
| Rail | St Pancras | 'FAVRSHM-STPANCI 1F17' | 908.11 | 1 | 11.35 | 30.75 | 42.1 | 0.71 | 0.5 | 0.36 |
| Rail | St Pancras | 'EBSFLTI-STPANCI 1F85' | 908.11 | 1.33 | 11.35 | 23.31 | 34.66 | 0.87 | 0.5 | 0.43 |
| Rail | St Pancras | 'STPANCI-MARGATE 1J08' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'STPANCI-DOVERP 1J10' | 908.11 | 1 | 11.35 | 30.75 | 42.1 | 0.71 | 0.5 | 0.36 |
| Rail | St Pancras | 'RAMSGTE-STPANCI 1J11' | 908.11 | 0.67 | 11.35 | 45.53 | 56.88 | 0.53 | 0.5 | 0.26 |
| Rail | St Pancras | 'STPANCI-MARGATE 1J12' | 908.11 | 0.67 | 11.35 | 45.53 | 56.88 | 0.53 | 0.5 | 0.26 |
| Rail | St Pancras | 'MARGATE-STPANCI 1J13' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'MARGATE-STPANCI 1J17' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'DOVERP-STPANCI 1J19' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'MARGATE-STPANCI 1J21' | 908.11 | 0.33 | 11.35 | 91.66 | 103.01 | 0.29 | 0.5 | 0.15 |
| Rail | St Pancras | 'MSTONEW-STPANCI 1T91' | 908.11 | 1 | 11.35 | 30.75 | 42.1 | 0.71 | 0.5 | 0.36 |
| Rail | Camden Road | 'CLPHMJ2-STFD 2L50' | 587.68 | 3.67 | 7.35 | 8.92 | 16.27 | 1.84 | 1 | 1.84 |
| Rail | Camden Road | 'STFD-CLPHMJ2 2Y11' | 587.68 | 3.67 | 7.35 | 8.92 | 16.27 | 1.84 | 0.5 | 0.92 |
| LUL | Camden Town | 'Edgware-Morden' | 799.53 | 9 | 9.99 | 4.08 | 14.08 | 2.13 | 0.5 | 1.07 |
| LUL | Camden Town | 'Morden-HighBarnet' | 799.53 | 14.67 | 9.99 | 2.79 | 12.79 | 2.35 | 0.5 | 1.17 |
| LUL | Camden Town | 'Morden-MillHillE' | 799.53 | 4 | 9.99 | 8.25 | 18.24 | 1.64 | 0.5 | 0.82 |
| LUL | Camden Town | 'Morden-Edgware' | 799.53 | 4.67 | 9.99 | 7.17 | 17.17 | 1.75 | 0.5 | 0.87 |
| LUL | Mornington Crescent | 'HighBarnet-Morden' | 581.43 | 0.33 | 7.27 | 91.66 | 98.93 | 0.3 | 0.5 | 0.15 |
| LUL | Mornington Crescent | 'Kennington-Edgware' | 581.43 | 14.67 | 7.27 | 2.79 | 10.06 | 2.98 | 1 | 2.98 |
| LUL | Mornington Crescent | 'HighBarnet-Kenningt' | 581.43 | 5.33 | 7.27 | 6.38 | 13.65 | 2.2 | 0.5 | 1.1 |
| LUL | Mornington Crescent | 'MillHill-Morden' | 581.43 | 1.67 | 7.27 | 18.71 | 25.98 | 1.15 | 0.5 | 0.58 |
| LUL | Mornington Crescent | 'MillHillE-Kenningt' | 581.43 | 1.67 | 7.27 | 18.71 | 25.98 | 1.15 | 0.5 | 0.58 |
| | | | | | | | | | **Total Grid Cell AI:** | **43.6** |