Elleray Hall
Energy Assessment Report

London Borough of Richmond upon Thames

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May 2021

Document Control

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INTERNAL APPROVALS

This document requires the following approvals.

Revision	Date	Prepared By	Signature	Approved by	Signature
P1	20-05-21	Claudia Cioli	Claudia Cioli	Rolfe Jackson	

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McBains

Contents

1.0 Executive summary

This Energy Statement report has been prepared by McBains Ltd for the new Elleray Hall building. This document has been prepared as part of a series of documents to support the Planning application, in conjunction with which it should be read, and addresses requirements related to energy use and carbon dioxide emissions reduction in accordance with local and national policy.

The energy strategy for the proposal includes a series of passive design measures with the aim to minimise CO_2 emissions associated with the fabric and operation of the building. The energy strategy has been prepared to address the local plan requirements to comply with the Part L2A of the UK Building Regulations.

The main policy and guidance context of the responses includes:

- National Planning Policy Framework
- New London Plan (March 2021)
- Richmond Local Plan (July 2018)
- UK Building Regulation Part L2A
- BREEAM UK New Construction 2018

The development uses energy-positive technology and passive design measures to ensure climate resilience. A number of measures have been incorporated into the proposal to maximise the energy efficiency of the building and to minimise the associated carbon emissions.
The reduction in regulated carbon dioxide emissions of the proposed development at this stage has been estimated as 35.7% from a Part L 2013 compliant Baseline. Table 1 and 2 shows the carbon emissions and CO_2 savings associated to each step of the energy hierarchy. At this design stage the 'unregulated' consumptions figure has been taken from the BRUKL output. At next stage, an accurate evaluation of the actual consumptions associated to the appliances and equipment specified for the project will be carried out and the overall carbon reduction figure will be updated accordingly.

A pre-assessment workshops have been held by the design teams to evaluate the expected score and to inform the design. A score of of 72% is achieved at this stage and that does exceeds the minimum 70% required to get the 'Excellent' rating.

Policies LP20 Climate Change Adaptation and LP22 Sustainable Design and Construction of the current Local Plan require the new development to achieve at least 35% CO_2 emissions reduction, in line with London Plan policy.

This document sets out how the expected energy demands of the proposed development have been analysed and forms the site-wide energy strategy in accordance with the energy hierarchy:

Be Lean: Passive design plays a key role in minimising the energy requirements of the development. The energy demand has been minimised through a highly efficient building envelope in terms of orientation, fabric thermal performance, air-tightness and reduced thermal bridges.

Be Clean: The new proposed design solution does not include a connection to a District Heating Network, since there are not any in the close proximity of the site, nor the installation of an on-site CHP system, given that the carbon savings from gas engine CHP are now declining as a result of national grid electricity decarbonising.

Be Green: To further reduce the carbon dioxide emissions of the proposed development, an assessment of potential low and zero carbon technologies has been undertaken. The new proposal would be to use an ASHPs system providing heating and domestic hot water, as well as installing a 26m² PV array to contribute towards the electrical load of the development.

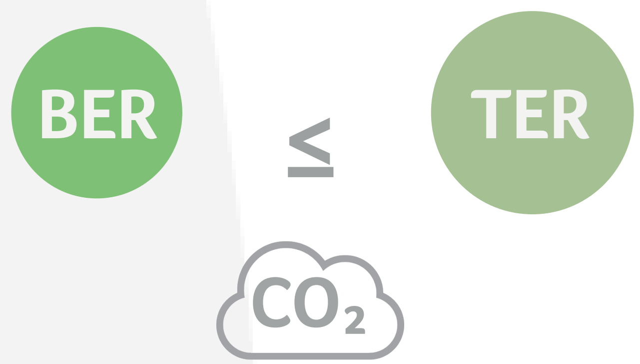
Please refer to paragraph 8 for the PV layout plan.

Table 1: CO_2 Emissions after each stage of the Energy Hierarchy

	Carbon Dioxide Emissions from proposed measures (tonnes CO_2/annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of Building Regulation	8.6	28
After Be Lean measures	7.3	28
After Be Clean measures	7.3	28
After Be Green measures	5.5	28

Table 2: Regulated CO_2 savings from each stage of the Energy Hierarchy

	Regulated Carbon Dioxide Savings	
	(Tonnes CO_2 per annum)	(%)
Savings from Be Lean measures	1.3	15.2%
Savings from Be Clean measures	-	0.0%
Savings from Be Green measures	1.8	20.5%
Cumulative on-site savings	3.1	35.7%



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2.0 Introduction

2.1 The Site

The Elleray site is occupied by the existing Elleray Hall managed by Elleray Community Association (ECA) on behalf of LBRuT and the neighbouring site which comprises the North Lane Depot and East car park. The proposed new building site is currently in use as an overfl ow car park and a former depot site.

2.2 The Proposed Scheme

The design proposal would consists in redeveloping a new Elleray Hall which will consist in two buildings connected. Those will include:

- Hall (North-wing building)
- Kitchen
- Admin offices
- Lounge area
- Specialist rooms
- Quiet room
- Activity rooms (top first floor)

Sustainability factors are integrated in the proposed development that enhances the natural environment and that uses zero-carbon and energy-positive technology to ensure climate resilience.

Site location

Site plan

3.0 Planning policy

In order to address the issue of climate change, policy, guidance and regulations have been developed at national, regional and local level, in relation to which the development proposals have been considered. The most relevant to this scheme, in terms of energy and sustainability, are summarised below:

National level

National Planning Policy Framework

The National Planning Policy Framework (NPPF) was first introduced in 2012, superseding all Planning Policy Statements (PPS) and Planning Policy Guidance (PPG) documents. The revised National Planning Policy Framework has been published in 2019.
The NPPF sets out the Government's strategy on the delivery of sustainable development through the planning system in a more simplified approach. It supports the transition to a low carbon future in a changing climate.

Building Regulations Part L

The Approved Document Part L sets minimum requirements in terms of a building's energy performance (and associated CO_2 emissions) in residential dwellings (Part L1A) and non-domestic buildings (Part L2A). This document highlights the different criteria for demonstrating building regulation compliance, both at design stage and after the building is built.
Criterion One of the Building Regulations Part L (2013) requires that a property to achieve a Building Emission Rate (BER) equal to or lower than the Target Emission Rate (TER) calculated in accordance with the approved National Calculation Methodology (NCM).
Criterion Two places limits on the minimum standards for controlled fittings and services.
Criterion Three requires that spaces are not subject to excessive solar gains in the case of non-dwellings.

Local level

The following extracts summarises the relevant London Borough of Richmond upon Thames Local Plan requirements (at time of writing) in terms of carbon reduction:

Policy LP 22 - Sustainable Design and Construction

A. Developments will be required to achieve the highest standards of sustainable design and construction to mitigate the likely effects of climate change. Applicants will be required to complete the following:

1. Development of 1 dwelling unit or more, or 100sqm or more of non-residential floor space (including extensions) will be required to complete the Sustainable Construction Checklist SPD. A completed Checklist has to be submitted as part of the planning application.

2. Development that results in a new residential dwelling, including conversions, change of use, and extensions that result in a new dwelling unit, will be required to incorporate water conservation measures to achieve maximum water consumption of 110 litres per person per day for homes (including an allowance of 5 litres or less per person per day for external water consumption).

3. New non-residential buildings over 100sqm will be required to meet BREEAM 'Excellent' standard.

B. Developers are required to incorporate measures to improve energy conservation and efficiency as well as contributions to renewable and low carbon energy generation. Proposed developments are required to meet the following minimum reductions in carbon dioxide emissions:

1. All new major residential developments (10 units or more) should achieve zero carbon standards in line with London Plan policy.

2. All other new residential buildings should achieve a 35% reduction.

3. All non-residential buildings over 100sqm should achieve a 35% reduction. From 2019 all major non-residential buildings should achieve zero carbon standards in line with London Plan policy.

Targets are expressed as a percentage improvement over the target emission rate (TER) based on Part L of the 2013 Building Regulations.

C. This should be achieved by following the Energy Hierarchy:

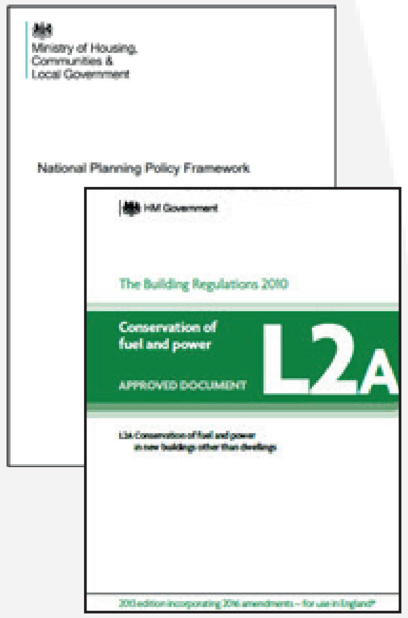
1. Be lean: use less energy
2. Be clean: supply energy efficiently
3. Be green: use renewable energy

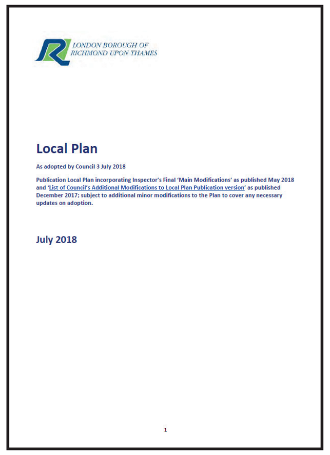
Sustainable Construction Checklist

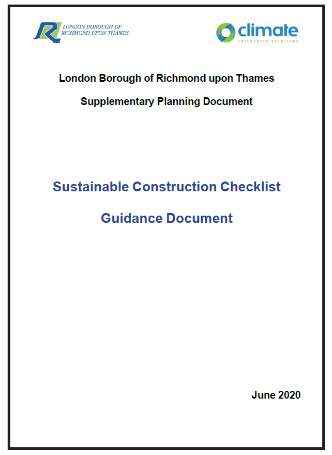
This Sustainable Construction Checklist SPD forms part of the assessment for planning applications for new build, conversion and retrofit properties within the London Borough of Richmond upon Thames.

LBRuT ask that all developments seeking to reduce CO_2 emissions follow the Mayor of London's 'Energy Hierarchy', which first focuses on reduction in energy demand through energy efficiency measures, then on 'clean' energy supply through heat networks or community heating where appropriate, and finally considers applicability of renewable energy supply to the site. (Further details on this are available in the guidance for Section 1 below.) This is to ensure that developments are designed for energy efficiency as far as possible before renewable energy is considered. The Intend to Publish London Plan (2019) requires major developments to be zero carbon with a minimum 35% reduction on building regulations achieved on site and 10% (residential) or 15% (non-residential) achieved though energy efficiency.

The reduction in total site CO_2 emissions must be calculated using an energy baseline which includes both 'regulated' energy (for space and hot water heating, electricity for lighting and all other fixed items) and 'un-regulated energy' (covering the use of energy for cooking and all appliances).


Ministry of Housing, Communities & Local Government
National Planning Policy Framework
HM Government
The Building Regulations 2010
Conservation of fuel and power
APPROVED DOCUMENT
L2A


Local Plan
July 2018


climate
London Borough of Richmond upon Thames
Supplementary Planning Document
Sustainable Construction Checklist
Guidance Document
June 2020

4.0 Methodology

4.1 The Approach

This strategy outlines how the development will have a reduced impact on climate change by reducing the carbon footprint associated with energy use of the building. The proposal will minimise energy requirements and operating costs through: use of form, fabric and landscape to optimise ambient lighting, heating and ventilation with heat recovery; use of efficient mechanical and electrical systems and user-friendly controls.
The Energy and CO_2 appraisal is based on the following approach reflecting the energy hierarchy:

Be Lean	Reduce the building's energy requirements by incorporating passive design measures and reduce the building's energy consumption through the use of energy efficient mechanical and electrical engineering systems.
Be Clean	Reduce the building's carbon dioxide emissions by supplying energy more efficiently, i.e. by CHP or district heating network.
Be Green	Reduce the building's carbon dioxide emissions through the use of renewable technologies.

Following the energy calculations it is expected that the overall regulated carbon dioxide emissions will be reduced by xx% across the development compared to Part L 2013 of Building Regulations.

The Building Emission Rate (BER) of the development and the Target Emission Rates (TER) of the corresponding Notional buildings were calculated using SBEM in accordance with Building Regulations Part L 2013 to estimate the associated energy demand and regulated carbon dioxide emissions.

The tables provided in the next page list the parameters applied to the energy model to assess the performance of the proposed building.

3D view TAS Dynamic energy model

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5.0 The Baseline

Table 1: Building fabric performance - improvement over UK Building Regulations

FABRIC ELEMENT PERFORMANCE				
Parameter	Unit	Elleray Hall	Notional building (Part L2A 2013)	Limiting Values (Part L2A 2013)
Ground floor U-value	W/m²K	0.13	0.22	0.25
External wall U-value	W/m²K	0.18	0.26	0.35
Roof U-value	W/m²K	0.13	0.18	0.25
Window, glazed door U-value	W/m²K	1.1	n/a	2.2
g-value	-	0.35	0.4	-
Frame U-value	W/m²K	1.9	n/a	-
Rooflights U-value (pane)	W/m²K	1.1	-	-
g-value	-	0.3	-	-
Frame U-value	W/m²K	1.3	-	-
Air permeability	m³/m²h@50Pa	3.0	5.0	10.0

*Net windows U-value including frame

Table 2: Building services parameters input in SBEM

BUILDING SERVICES	Unit	Description
Heating		
Main heating system	-	centralised ASHP
Efficiency (SCOP)	-	3.57
Domestic Hot Water		
System type / efficiency (COP)	-	from main ASHP system / 3.57
Hot water cylinder volume	L	300
Insulation thickness/conductivity	mm	60 / 0.03 (TBC)
Ventilation		
MVHR SFP	W/l/s	varies (please refer to mechanical specifications)
Heat recovery efficiency	%	same as above
Cooling		
Type	-	not present
Lighting		
Electricity Power Factor	-	0.90-0.95
Efficacy	lm/circW	varies (please refer to electrical specifications)
Presence Detection: Offices/Activity rooms/Kitchen Store/Plant rooms	-	Auto ON/Auto OFF Auto ON/Auto OFF & Dimming Manual ON/Auto OFF
Daylight control: open plan	-	Photocell control ON/OFF (where windows are present)
Design room illuminance	-	Offices 400 lux Lounge/Cafe area 300 lux Reception 200 lux Kitchen 300 lux Activity room 200 lux Specialist Room/Quiet room 400 lux Stairs 100 lux Circulation Areas 100 lux Stores 50 lux Toilets 200 lux Plant rooms 100 lux
Photovoltaic		
Surface area	m²	26
Inclination	degrees	48° (above pitched roof)
Efficiency	%	20
Solar reflectance	-	0.1

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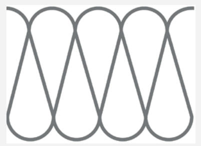
6.0 Improvement from reducing energy demand

The proposed building will be designed using a 'fabric first' approach, maximising the performance of the components that make up the building fabric itself before considering the use of mechanical or electrical building services systems. Focusing on the building fabric is more sustainable than relying only on efficient mechanical systems or renewable technologies.
Passive design plays a key role in minimising the operational costs and carbon emissions of a development and it needs to be evaluated since the very early design stage of the project. This paragraph analyses the key design aspects to reduce the energy demand and carbon emissions associated to the building.
It is estimated that a regulated carbon dioxide emissions reduction of 15.2% over Part L 2013 across the development can be achieved through passive 'lean' measures alone.
The following passive design strategies have been implemented within the development and will aid the BREEAM credits for Ene 04 issue.

6.1 Building Fabric Improvements and Overheating

High levels of envelope insulation will be provided in order to achieve low U-values and limit the heat losses. External wall U-values of 0.18 W/m²K have been selected for the new building. Furthermore, windows with a (pane) U-value of 1.1 W/m²K and solar factor (g-value) of 0.35 are proposed. Rooflights will have a solar factor of 0.3. These figures will help minimising the heat loss in winter and solar gain in the summer, reducing the associated heating load in winter and the risk of overheating in summer.
The proportion of glazing to façade area was assessed with careful consideration of beneficial heat gain, winter heat losses, daylight and aesthetic appeal of the building.



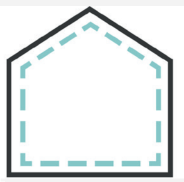
6.2 Form Factor

The proposal has been designed trying to keep the shape of the building as compact as possible. The Form Factor is a useful measure of the compactness of a building and it is one of the key factors for a passive building. A simple thermal envelope that is easy to build offers the greatest opportunity for cost savings. Furthermore, decreasing the surface area of the building results in reduced heat losses and therefore less energy consumption for space heating.

Referring to the LETI Design Guide, a good value for a commercial building would be between 1 and 2.

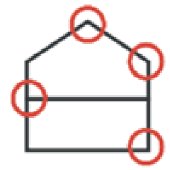
6.3 Air Tightness Improvements

The current design proposal allows for a substantial improvement upon the minimum requirements of the Part L 2013. An air-tightness of 3.0 m³/m²hour at 50 Pa pressure is targeted. The Contractor will have to incorporate suitable construction details into the design and adopt best practice construction practices in order to achieve these figures.



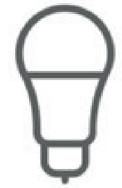
6.4 Thermal Bridging

Thermal bridging will be carefully considered to ensure that heat transferred through to the building is reduced.



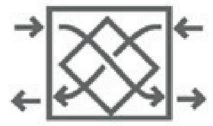
6.5 Luminaires and Controls

Low energy lighting has become an essential feature of building design. Advances in lamp and ballast design have led to higher efficiency luminaires with control measures having become standard in most new developments in order to respond to changes to standards such as Part L of the Building Regulations and sustainability assessment methods such as BREEAM.
Lighting controls can consist of simple presence detection which when combined with daylight control can switch luminaires on/off automatically or regulate the lighting levels in accordance with the outside conditions. These systems are proposed for use in conjunction with each other for the most energy efficient installation. Please refer to Table 2 as well as the M&E specification report for more details.



6.6 Ventilation

Due to the high performance of the building fabric, a balanced mechanical ventilation strategy with mechanical extract is proposed. This will ensure minimum fresh air requirements, moisture and odour removal from the kitchen and toilet areas and allow for a boost / purge facility to increase the volume of air flow controlled. In order to optimise the energy performance of the system, each unit will incorporate heat recovery.
The use of a primary natural ventilation strategy would reduce the energy use of the building.



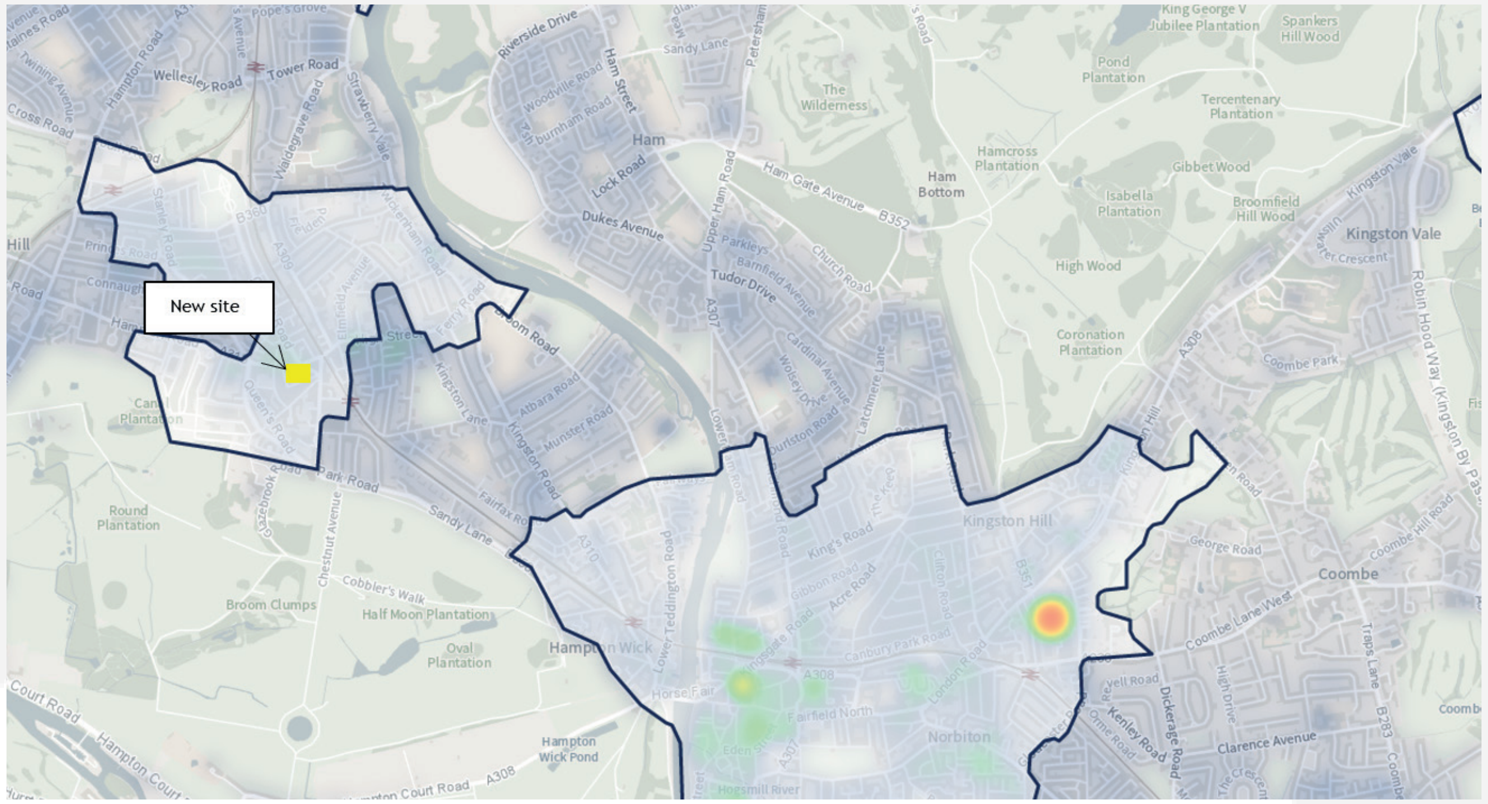
The thermal comfort of the building has been assessed against CIBSE TM52 criteria in order to check whether there would be any overheating risks in extreme future weather scenario. The TM52 assessment report is provided in Appendix B.

7.0 Supplying energy more efficiently

7.1 District Heating Network

Once demand for energy has been minimised, all planning applications must demonstrate how their energy systems will exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly to reduce CO_2 emissions, by following the heating hierarchy in London Plan Policy SI 3. Heat networks offer an efficient and competitive solution for heating buildings in urban areas with high heat density and provide the added benefit of enabling the use of secondary energy or waste heat sources.

As can be seen from the extract below of the London Heat Map, the proposed development is inside a Heat Network Priority Area (HNPA); however is not located in close proximity to any planned or existing networks, so the connection to an existing heat network is not viable.



Site location shown on the London Heat M. The image identifies the Heat Network Priority Area (HNPA) and the distribution of the Annual heat demand (kWh) across London. Areas with a high density of heat demand are coloured in red.

7.2 Combined Heat and Power (CHP)

In the Decarbonised gas scenario, the London Plan limits the role of CHP to low-emission CHP and only in instances where it can support the delivery of an area-wide heat network at large, strategic sites.

This develoment has a total floor area around 500m². The installation of a communal system is encouraged, but not mandated due to the small benefit in terms of carbon reduction in these circumstances. The installation of a stand-alone air source heat pump is considered more economic and suitable to meet the small heating demands of the new proposed building. For this reason the inclusion of a CHP plant has not been developed as such no benefit in terms of carbon dioxide reduction are offered in this part of the Energy Hierarchy.

8.0 Improvement from introducing renewable energy technologies

8.1 Proposed option for Renewable technologies

'Be Green' measures are those which serve to reduce the overall emissions of the development through the inclusion of renewable technologies. A renewable and low carbon technology feasibility study has been carried out to investigate the most suitable solutions and the contribution that on-site generation from renewable energy technologies could make to further reduce the carbon dioxide emissions in the proposed development.

To reflect the rapid decarbonisation of the grid and the new London Plan requirements, heating and hot water will not be generated using fossil fuels. A all-electric heat pump system has been considered the most carbon efficient and cost effective solution. Furthermore, on-site renewables energy generation has been proposed to reduce the energy demand of the building: heat pumps will supply heating and hot water to the building and a photovoltaic array installed on the roof will further reduce the energy consumptions associated to the building operation.
The proposed roof plan PV layout on the right shows 26m² of photovoltaics panels above the South-wing building.

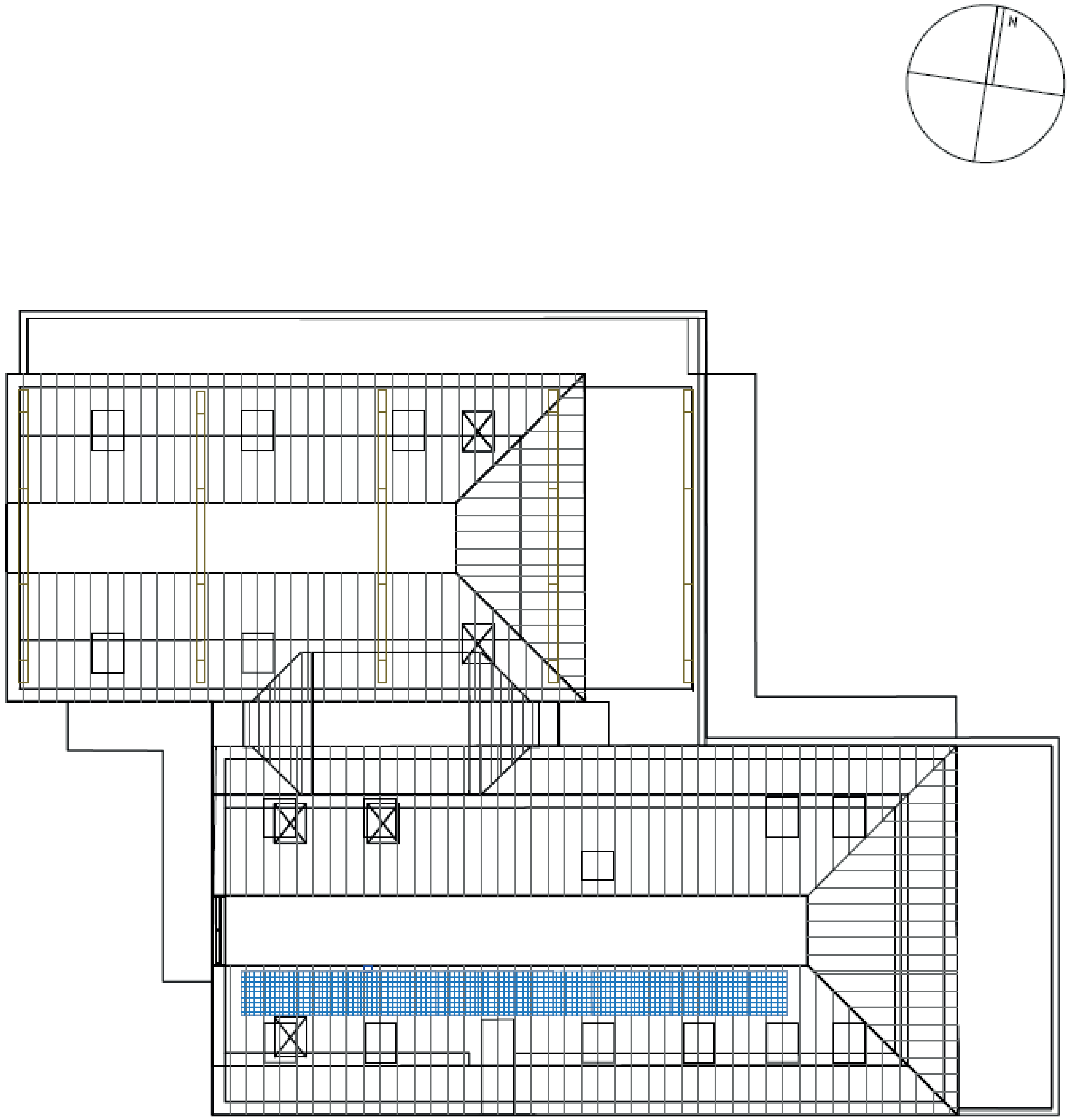
It is estimated that the contibution of these renewable technologies could reduce CO_2 emissions by 20.5% beyond the Building Regulations Part L (2013) 'Baseline', i.e. 1.8 tonnes of CO_2 per annum.

8.2 Feasibility study LZC technologies

The technical feasibility of the following technologies have been assessed as well as the potential CO_2 emissions savings:

- Ground source heat pumps (GSHP);
- Air source heat pumps (ASHP);
- Photovoltaics;
- Solar thermal water heating;
- Biomass heating;
- Building-mounted wind turbines.

Please refer to the summary table in the next page.



Proposed PV layout

Renewable Technology	Feasibility	Notes
Ground Source Heat Pump 		Ground source heat pumps are used to extract heat from the ground to provide space and water heating to the building. It requires extensive digging work, therefore high installation costs. Heat Pumps optimum performance is yielded when both heating and cooling are provided as this ensures that over the long term, the temperature of the ground remains relatively constant over a typical year. Given the not constant use of the building and the expected hot water demand, the optimal performance of this heat pump system could not be guaranteed. The payback period for this technology would be too long, therefore it has been discounted.
Photovoltaics 		Photovoltaic panels are flat panel devices, that, using semi-conductor technology, can generate electricity from the sun's electromagnetic radiation. PV panels are a complimentary technology to other LZC solutions that provide heat, like the heat pumps. This is because PVs and heat pumps both work independently, providing different sources of energy, and so the energy production is maximised. This renewable system is particularly suitable to be installed on the south facing pitched roofs of the proposed building. The proposal include the installation of a PV array of No.14 panels (26m² array area) on the South-wing pitched roof.
Air Source Heat Pumps 		Air Source Heat Pumps use heat pump technology to extract heat (or cool) from the air and provide it to dwellings or other buildings. It uses the refrigerant cycle to do this with reasonably high efficiencies. They can be used for both heating and cooling and they have a low carbon footprint. In heating mode, the external air is the heat source and ASHPs are considered a renewable technology. Air source heat pumps are proposed as part of the energy strategy for the new Elleray Hall building. The efficiency is higher than a normal direct electric system and that will aid the reduction of the carbon footprint and energy demand of the buildings.
Solar Hot Water Systems 		Solar Hot Water uses the sun to provide energy to hot water systems. This technology is best suited to developments with high hot water demands all year around, e.g. hotels, leisure centre, multi-residential properties. The hot water load is not substantial in this particular project, and therefore solar thermal has not been considered.
Biomass Heating 		Biomass is obtained from organic matter, either directly from dedicated energy crops, or indirectly from industrial and agricultural by-products such as wood-chips. A large storage space and larger plantroom would be required for a biomass fuel store. Furthermore, associated air quality issues, increased lorry movements from deliveries and reliable local fuel suppliers would be other major items to be overcome. This technology has then been disregarded.
Micro Wind Turbines 		Roof mounted wind turbines are not recommended for this site due to noise, flicker and vibration implications on the surrounding residential buildings. Also, numerous inner-city wind turbine trials have shown that such turbines' energy yields are significantly lower than manufacturers' estimations.

9.0 Conclusions

This Energy Strategy has demonstrated that through the implementation of passive design measures and the installation of high efficient and low carbon technologies, the new Elleray Hall building is estimated to achieve 35.7% reduction in regulated CO_2 emissions compared with the Building Regulations Part L 2013 Baseline.

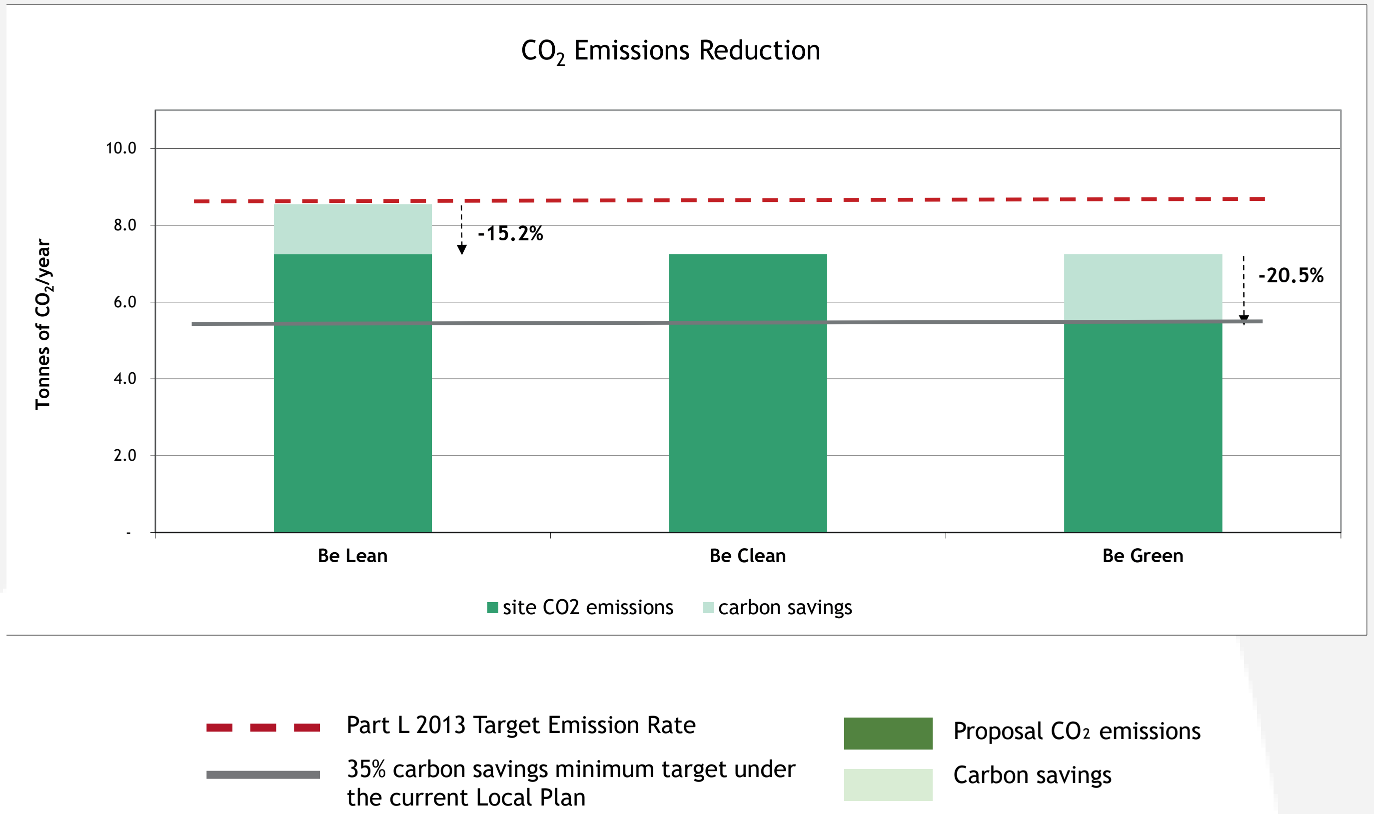
The overall contribution of renewable energy measures across the site is 20.5% savings in carbon dioxide emissions. The proposed energy efficiency measures to deliver the above performance are summarised below:

- Construction of highly insulated fabric and high performance windows/rooflights;
- Low airtightness envelope;
- Heat recovery on MVHR;
- Provision of luminaires with high efficacy and efficient lighting controls;
- Provision of efficient Air Source Heat Pumps (ASHP) system;
- Provision of roof-mounted PV panels.

The expected contributions from each step of the hierarchy of the development are shown graphically below. For the BRUKL results please refer to Appendix A.

The development is also assessed under BREEAM 2018. An initial pre-assessment workshop has been held and the BREEAM score has been reviewed at this stage before Planning submission.

The design team is currently expecting a score of 72% that would meet the minimum rating to get 'Excellent'.



Carbon emissions savings chart

Summary of BREEAM credit score

Appendix A - BRUKL outputs

Be Lean

BRUKL Output Document

Compliance with England Building Regulations Part L 2013

HM Government

Project name

Elleray Hall

As designed

Date: Thu May 20 11:08:46 2021

Administrative information

Building Details

Address: Elleray Road, Teddington,

Certification tool

Calculation engine: TAS

Calculation engine version: "v9.5.0"

Interface to calculation engine: TAS

Interface to calculation engine version: v9.5.0

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

Owner Details

Name: Elleray Community Hall

Telephone number:

Address: North Lane Depot and East Car Park, North Lane, Teddington, London Borough of Richmond upon Thames, London, TW11

Certifier details

Name: Claudia Cioli

Telephone number: 020 7786 7900

Address: 26 Finsbury Square, London, EC2A 1DS

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	17.1
Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	17.1
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	14.5
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	$U_{a-Limit}$	U_{a-Calc}	U_{i-Calc}	Surface where the maximum value occurs*
Wall**	0.35	0.18	0.25	passive louvre-frame
Floor	0.25	0.13	0.13	Ground Floor
Roof	0.25	0.13	0.13	Roof
Windows***, roof windows, and rooflights	2.2	1.26	1.39	W_GF_10
Personnel doors	2.2	1.33	1.36	Ext door
Vehicle access & similar large doors	1.5	-	-	No vehicle doors in project
High usage entrance doors	3.5	-	-	No high usage entrance doors in project

$U_{a-Limit}$ = Limiting area-weighted average U-values [W/(m²K)]
U_{a-Calc} = Calculated area-weighted average U-values [W/(m²K)]
U_{i-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	3

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	0.9 to 0.95

1- MVHR 3-WCs

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.57	-	-	-	0.83
Standard value	2.5*	N/A	N/A	N/A	0.65
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system	YES				

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

2- MVHR 2-First floor

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.57	-	-	1.55	0.83
Standard value	2.5*	N/A	N/A	1.5^	0.65
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system	YES				

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

3- MVHR 1-Ground floor

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.57	-	-	1.49	0.8
Standard value	2.5*	N/A	N/A	1.5^	0.65
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system	YES				

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

4- AHU02-Kitchen (GF_Kit)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.57	-	-	1.71	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system	YES				

5- Circ

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.57	-	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system	YES				

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

6- AHU04-Hall

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.57	-	-	1.76	0.75
Standard value	2.5*	N/A	N/A	1.5^	0.65
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system	YES				

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

1- New HWS Circuit

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	3.57	0
Standard value	N/A	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	**Zone**	**Standard**
GF_Hall	-	-	-	-	1.8	-	-	-	-	-	N/A
GF_Admin	-	-	-	1.5	-	-	-	-	-	-	N/A
GF_Cafe	-	-	-	1.5	-	-	-	-	-	-	N/A
GF_Quiet room	-	-	-	1.5	-	-	-	-	-	-	N/A
GF_Specialist r 1	-	-	-	1.5	-	-	-	-	-	-	N/A
GF_Specialist r 2	-	-	-	1.5	-	-	-	-	-	-	N/A
GF_WC	-	-	-	0.8	-	-	-	-	-	-	N/A
1F_Activity room W	-	-	-	1.6	-	-	-	-	-	-	N/A
1F_WC	-	-	-	0.8	-	-	-	-	-	-	N/A
1F_Activity room E	-	-	-	1.6	-	-	-	-	-	-	N/A
1F_Admin	-	-	-	1.6	-	-	-	-	-	-	N/A
GF_Lounge area N	-	-	-	1.5	-	-	-	-	-	-	N/A
GF_Lounge area S	-	-	-	1.5	-	-	-	-	-	-	N/A
GF_Hall E	-	-	-	-	1.8	-	-	-	-	-	N/A
GF_Hall W	-	-	-	-	1.8	-	-	-	-	-	N/A
1F_staff WC	-	-	-	0.8	-	-	-	-	-	-	N/A
GF_Cafe corridor	-	-	-	1.5	-	-	-	-	-	-	N/A

General lighting and display lighting

	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
GF_Hall	-	125	-	215
GF_Admin	120	-	-	92
GF_Kit	-	120	-	201
GF_Rec	-	100	22	94
GF_Stairs	-	92	-	21
GF_Store	149	-	-	5

General lighting and display lighting	**Luminous efficacy [lm/W]**			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
GF_Cafe	-	120	-	94
GF_Quiet room	120	-	-	68
GF_Specialist r 1	120	-	-	65
GF_Specialist r 2	120	-	-	70
GF_WC	-	89	-	77
GF_Hall store	149	-	-	11
GF_Circ	-	100	-	12
1F_Activity room W	-	120	-	203
1F_WC	-	89	-	25
1F_Activity room E	-	120	-	145
1F_Admin	120	-	-	89
1F_Store	149	-	-	3
1F_Circ	-	100	-	24
1F_Plant	90	-	-	52
GF_Lounge area N	-	120	-	92
GF_Lounge area S	-	120	-	67
GF_Hall E	-	125	-	239
GF_Hall W	-	125	-	246
1F_stair	-	100	-	17
1F_staff WC	-	89	-	18
1F_Plant 2	90	-	-	15
GF_Plant	90	-	-	39
GF_Cafe corridor	-	120	-	38

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
GF_Hall	NO (-81%)	NO
GF_Admin	NO (-63%)	NO
GF_Rec	NO (-58%)	NO
GF_Cafe	NO (-70%)	NO
GF_Quiet room	NO (-83%)	NO
GF_Specialist r 1	NO (-82%)	NO
GF_Specialist r 2	NO (-86%)	NO
1F_Activity room W	NO (-55%)	NO
1F_Activity room E	NO (-72%)	NO
1F_Admin	NO (-74%)	NO
GF_Lounge area N	NO (-80%)	NO
GF_Lounge area S	NO (-69%)	NO
GF_Hall E	NO (-56%)	NO
GF_Hall W	NO (-67%)	NO
GF_Cafe corridor	NO (-89%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	500	500
External area [m^2]	1188	1188
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	3	3
Average conductance [W/K]	291	379
Average U-value [W/m^2K]	0.24	0.32
Alpha value* [%]	18.24	18.24

* 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
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
100	**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	4.75	2.14
Cooling	0	0
Auxiliary	7.28	6.02
Lighting	8.13	15.01
Hot water	8.07	10.58
Equipment*	27.56	27.56
TOTAL**	**28.24**	**33.74**

* 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]	61.06	19.69
Primary energy* [kWh/m^2]	85.82	100.99
Total emissions [kg/m^2]	14.5	17.1

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

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Central heating using water: floor heating, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	19.1	0	1.6	0	5	3.39	0	3.57	0
	Notional	17.6	0	2	0	8.9	2.43	0	----	----
[ST] Central heating using water: floor heating, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	51.9	0	4.3	0	9.1	3.39	0	3.57	0
	Notional	11	0	1.3	0	7.9	2.43	0	----	----
[ST] Central heating using water: floor heating, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	100.1	0	8.2	0	8.8	3.39	0	3.57	0
	Notional	14.2	0	1.6	0	6.5	2.43	0	----	----
[ST] No Heating or Cooling										
	Actual	2.7	0	0.2	0	9.3	3.39	0	3.57	0
	Notional	0	0	0	0	6.1	0	0	----	----
[ST] Central heating using water: radiators, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	40.1	0	3.3	0	1.2	3.39	0	3.57	0
	Notional	34.3	0	3.9	0	1.1	2.43	0	----	----
[ST] Central heating using water: convectors, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	82.5	0	6.8	0	11.3	3.39	0	3.57	0
	Notional	34.5	0	3.9	0	9.2	2.43	0	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U_{i-Typ}	U_{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.18	External Wall
Floor	0.2	0.13	Ground Floor
Roof	0.15	0.13	Roof
Windows, roof windows, and rooflights	1.5	1.19	rooflights (Kit)
Personnel doors	1.5	1.29	W_GF_5 (door)
Vehicle access & similar large doors	1.5	-	No vehicle doors in project
High usage entrance doors	1.5	-	No high usage entrance doors in project
U_{i-Typ} = Typical individual element U-values [W/(m²K)]			U_{i-Min} = Minimum individual element U-values [W/(m²K)]
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
$m^3/(h.m^2)$ at 50 Pa	5	3

Appendix A - BRUKL outputs

Be Green

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Elleray Hall

As designed

Date: Thu May 20 12:30:12 2021

Administrative information

Building Details

Address: Elleray Road, Teddington,

Certification tool

Calculation engine: TAS

Calculation engine version: "v9.5.0"

Interface to calculation engine: TAS

Interface to calculation engine version: v9.5.0

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

Owner Details

Name: Elleray Community Hall

Telephone number:

Address: North Lane Depot and East Car Park, North Lane, Teddington, London Borough of Richmond upon Thames, London, TW11

Certifier details

Name: Claudia Cioli

Telephone number: 020 7786 7900

Address: 26 Finsbury Square, London, EC2A 1DS

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	17.1
Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	17.1
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	11
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	0.18	0.25	passive louvre-frame
Floor	0.25	0.13	0.13	Ground Floor
Roof	0.25	0.13	0.13	Roof
Windows***, roof windows, and rooflights	2.2	1.26	1.39	W_GF_10
Personnel doors	2.2	1.33	1.36	Ext door
Vehicle access & similar large doors	1.5	-	-	No vehicle doors in project
High usage entrance doors	3.5	-	-	No high usage entrance doors in project

$U_{a\text{-}Limit}$ = 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	3

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	0.9 to 0.95

1- MVHR 3-WCs

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.57	-	-	-	0.83
Standard value	2.5*	N/A	N/A	N/A	0.65
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system	YES				

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

2- MVHR 2-First floor

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.57	-	-	1.55	0.83
Standard value	2.5*	N/A	N/A	1.5^	0.65
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system	YES				

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

3- MVHR 1-Ground floor

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.57	-	-	1.49	0.8
Standard value	2.5*	N/A	N/A	1.5^	0.65
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system	YES				

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

4- AHU02-Kitchen (GF_Kit)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.57	-	-	1.71	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system	YES				

5- Circ

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.57	-	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system	YES				

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

6- AHU04-Hall

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.57	-	-	1.76	0.75
Standard value	2.5*	N/A	N/A	1.5^	0.65
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system	YES				

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

1- New HWS Circuit

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	3.57	0
Standard value	N/A	N/A

"No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

General lighting and display lighting	**Luminous efficacy [lm/W]**			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
GF_Hall	-	125	-	215
GF_Admin	120	-	-	92
GF_Kit	-	120	-	201
GF_Rec	-	100	22	94
GF_Stairs	-	92	-	21
GF_Store	149	-	-	5
GF_Cafe	-	120	-	94
GF_Quiet room	120	-	-	68
GF_Specialist r 1	120	-	-	65
GF_Specialist r 2	120	-	-	70
GF_WC	-	89	-	77
GF_Hall store	149	-	-	11
GF_Circ	-	100	-	12
1F_Activity room W	-	120	-	203
1F_WC	-	89	-	25
1F_Activity room E	-	120	-	145
1F_Admin	120	-	-	89
1F_Store	149	-	-	3
1F_Circ	-	100	-	24
1F_Plant	90	-	-	52
GF_Lounge area N	-	120	-	92
GF_Lounge area S	-	120	-	67
GF_Hall E	-	125	-	239
GF_Hall W	-	125	-	246
1F_stair	-	100	-	17
1F_staff WC	-	89	-	18
1F_Plant 2	90	-	-	15
GF_Plant	90	-	-	39
GF_Cafe corridor	-	120	-	38

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
GF_Hall	NO (-81%)	NO
GF_Admin	NO (-63%)	NO
GF_Rec	NO (-58%)	NO
GF_Cafe	NO (-70%)	NO
GF_Quiet room	NO (-83%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
GF_Specialist r 1	NO (-82%)	NO
GF_Specialist r 2	NO (-86%)	NO
1F_Activity room W	NO (-55%)	NO
1F_Activity room E	NO (-72%)	NO
1F_Admin	NO (-74%)	NO
GF_Lounge area N	NO (-80%)	NO
GF_Lounge area S	NO (-69%)	NO
GF_Hall E	NO (-56%)	NO
GF_Hall W	NO (-67%)	NO
GF_Cafe corridor	NO (-89%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	500	500
External area [m^2]	1188	1188
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	3	3
Average conductance [W/K]	291	379
Average U-value [W/m^{2}K]	0.24	0.32
Alpha value* [%]	18.24	18.24

* 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
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
100	**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	4.75	2.14
Cooling	0	0
Auxiliary	7.28	6.02
Lighting	8.13	15.01
Hot water	8.07	10.58
Equipment*	27.56	27.56
TOTAL**	**28.24**	**33.74**

* 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	6.81	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]	61.06	19.69
Primary energy* [kWh/m^2]	85.82	100.99
Total emissions [kg/m^2]	11	17.1

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

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Central heating using water: floor heating, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	19.1	0	1.6	0	5	3.39	0	3.57	0
	Notional	17.6	0	2	0	8.9	2.43	0	----	----
[ST] Central heating using water: floor heating, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	51.9	0	4.3	0	9.1	3.39	0	3.57	0
	Notional	11	0	1.3	0	7.9	2.43	0	----	----
[ST] Central heating using water: floor heating, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	100.1	0	8.2	0	8.8	3.39	0	3.57	0
	Notional	14.2	0	1.6	0	6.5	2.43	0	----	----
[ST] No Heating or Cooling										
	Actual	2.7	0	0.2	0	9.3	3.39	0	3.57	0
	Notional	0	0	0	0	6.1	0	0	----	----
[ST] Central heating using water: radiators, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	40.1	0	3.3	0	1.2	3.39	0	3.57	0
	Notional	34.3	0	3.9	0	1.1	2.43	0	----	----
[ST] Central heating using water: convectors, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	82.5	0	6.8	0	11.3	3.39	0	3.57	0
	Notional	34.5	0	3.9	0	9.2	2.43	0	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	**U_{i-Typ}**	**U_{i-Min}**	**Surface where the minimum value occurs***
Wall	0.23	0.18	External Wall
Floor	0.2	0.13	Ground Floor
Roof	0.15	0.13	Roof
Windows, roof windows, and rooflights	1.5	1.19	rooflights (Kit)
Personnel doors	1.5	1.29	W_GF_5 (door)
Vehicle access & similar large doors	1.5	-	No vehicle doors in project
High usage entrance doors	1.5	-	No high usage entrance doors in project

U_{i-Typ} = Typical individual element U-values [W/(m²K)]

U_{i-Min} = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	**Typical value**	**This building**
$m^3/(h.m^2)$ at 50 Pa	5	3

Appendix B - TM52 Assessment report

Document

TM52 Overheating Assessment Report

Project

Elleray Hall

Client

Richmond Upon Thames

Date

May 2021

Contact

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DOCUMENT REFERENCE								STATUS	
61301	EHR	MBC	XX	ZZ	RP	V	0002	D5	P3
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DOCUMENT LOCATION

Ensure that this document is current. Printed documents and locally copied files may become obsolete due to changes to the master document.

The source of the master document can be found on the following:

T:\61301 Elleray Hall & Residential Scheme\01_WIP\V_Sustainability\RP_Reports\Stage 3

REVISION HISTORY

Suitability	Revision	Version Date	Summary of Changes	Changes marked
D5	P1	12/05/21	Issue for information	
D5	P2	17/05/21	Rooflight dimension and aperture changed	
D5	P3	20/05/21	Issue for Planning submission	

DISTRIBUTION

This document has been distributed to:

Name	Company
Andrew Gilbert	CCA

APPROVALS

This document requires the following approvals.

Name	Title
Rolfe Jackson	Director

CONTENTS

1.0 INTRODUCTION

McBains have been appointed to provide advice on the M&E strategy and optimum energy strategy of the Elleray Hall. This document will detail the assumptions used in the CIBSE TM52 overheating assessment and the results of the analysis.
CIBSE has published TM52 'The limits of thermal comfort: avoiding overheating in European buildings' (2013) to provide designers with a robust yet balanced assessment of the risk of overheating of buildings in the UK and Europe.
This report describes the results for the South-wing building only which has been designed to be a naturally ventilated building. The Hall space (North-wing) will be served by cooled tempered air via AHU DX coil, hence it has been disregarded by this analysis. Secondary spaces, occupied only for less than 30 minutes, such as bathrooms, storage rooms, plantrooms and circulation areas are outside the scope of this comfort study.

Please note that minor changes would be needed in the design to ensure all rooms pass CIBSE TM52. These have been described and marked-up within this report.

It should also be noted that any changes in the assumptions and the design measures described in this document would have an effect in the outputs and might result in some rooms to fail.

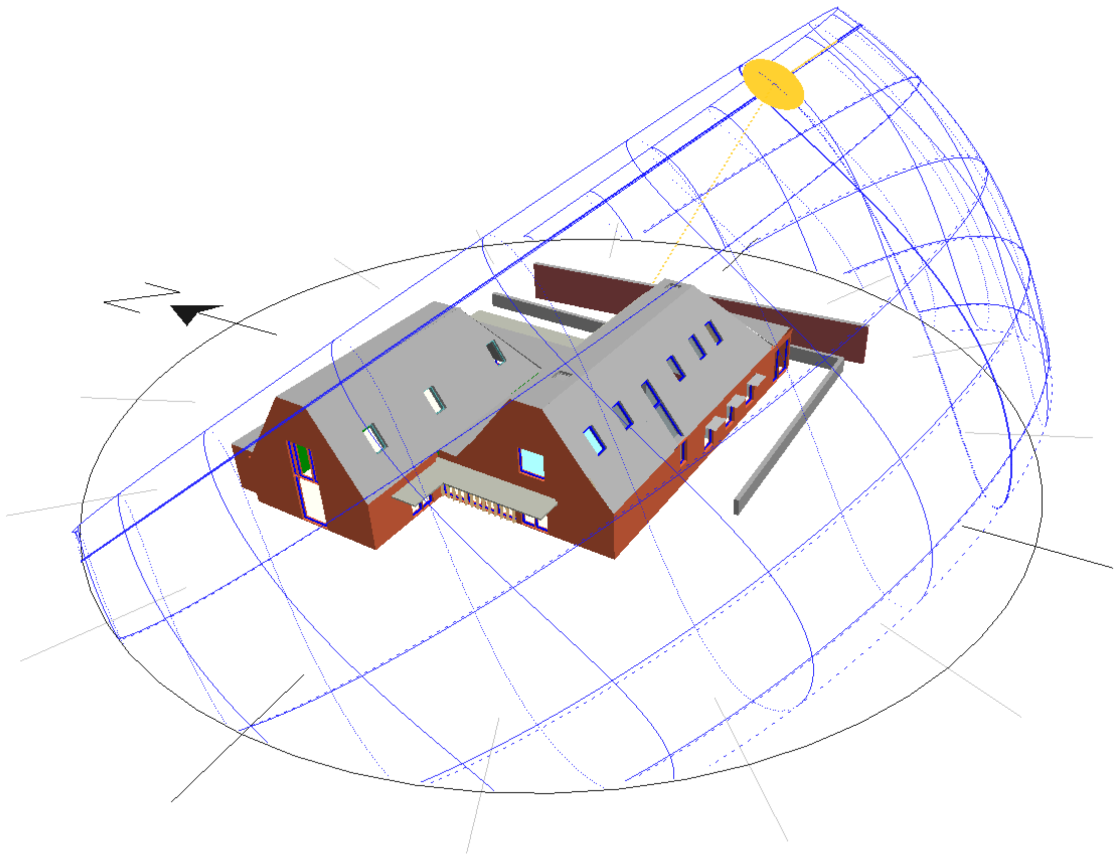


Figure 1: TAS 3D view

2.0 ASSESSMENT OF SUMMER OVERHEATING

2.1 TM52 Methodology

The CIBSE TM52 assessment follows the methodology and recommendations of BS EN 15251 (BSI, 2007) to determine whether an existing occupied building can be classed as overheating or a proposed building is in danger of becoming overheated.

Thermal comfort is not just dictated by the air temperature but by other environmental factors such as the average temperature of the surfaces, relative humidity, occupant behaviour (such as clothing level) and air velocity. To take these factors into account, the advanced method of assessing thermal comfort has been developed.

The following three criteria, taken together, provide a robust yet balanced assessment of the risk of overheating of buildings in the UK and Europe. A room or building that fails any two of the three criteria is classed as overheating.

Criterion 1: Hours of exceedance (He)

Sets a limit for the number of hours that the operative temperature can exceed the threshold comfort temperature (upper limit of the range of comfort temperature) by 1 K or more during the occupied hours of a typical non-heating season (1 May to 30 September).

Criterion 2: Daily weighted exceedance (We)

This criterion deals with the severity of overheating within any one day, which can be as important as its frequency, the level of which is a function of both temperature rise and its duration. This criterion sets a daily limit for acceptability.

Criterion 3: Upper limit temperature (Tupp)

Sets an absolute maximum daily temperature for a room, beyond which the level of overheating is unacceptable.

It is recommended that TM52 is read in conjunction with this report for calculation methodology and further clarification.

A TM52 analysis must be performed using the CIBSE Design Summer Year weather data. the London Heathrow weather file was used in this assessment (**London_LHR_DSY1_2020High_50**). The period of assessment is from 1st May to 30th September.

2.2 Software

A dynamic thermal model of the building has been created using Tas software, which has been used to assess the dynamic response of the building. The simulation uses hourly time steps and can cover the whole year.

EDSL TAS is AM11 compliant.

2.3 Inputs Data and assumptions

2.3.1 General

Building location: Teddington, Richmond upon Thames

Latitude: 51.48° N

Longitude: -0.45° E

Building orientation: 357° (angle from North)

CIBSE Weather file: London_LHR_DSY1_2020High50

2.3.2 Fabric assumptions

FABRIC ELEMENT PERFORMANCE		
Parameter	Unit	Elleray Hall
Ground floor U-value	W/m2K	0.13
External wall U-value	W/m2K	0.18
Roof U-value	W/m2K	0.13
Windows U-value (pane)	W/m2K	1.1
g-value	-	0.35
frame U-value	W/m2K	1.9
Rooflights U-value (pane)	W/m2K	1.1
g-value	-	0.3
frame U-value	W/m2K	1.3
Frame thickness	mm	89
Air permeability	m3/m2h@50Pa	3.0

2.4 Internal Conditions

The usage figures for this building are difficult to predict at this stage. The number of people and times it could be used any given hour is currently unknown because it has not been any confirmed steer from the client/users. Average figures and times have then been assumed to carry out this study at this design stage.

Alteration to the default National Calculation Methodology (NCM) figures have been made for the internal gains and their schedules. All input figures have been summarised in table below:

	Internal gains	Unit	Lounge area	Admin offices	Activity room (East)		Activity room (West)	Specialist /Quiet rooms
Occupancy	Activity type[1]	-	*seated, light work*	*moderate work/office*	*moderate activity*	*moderate dancing*	*moderate activity*	*seated, light work*
	Sensible gains[1]	*W/person*	72	80	74	105	74	72
	Latent gains[1]	*W/person*	54	60	56	160	56	54
	Design Density	*max No. people*	40	2	14		21	4
		average occupancy levels (No. people) [2]	8 [3]	2	6		10	2
	Occupancy schedule	-	50% 9am-12pm 100% 12pm-3pm 50% 3pm-6pm 100% 6pm-8pm 50% 8pm-21pm	8am-1pm 2pm-5pm	50% 10am-12pm 10% 12pm-2pm 100% 2pm-4pm 50% 4pm-7pm 100% 7pm-9pm 10% 9pm-11pm		100% 10am-1pm (high activity) 10% 1pm-3pm 50% 3pm-7pm 100% 7pm-9pm 10% 9pm-11pm	9am-22pm
	General occupancy schedule	-	9am-10pm Mon-Sat 10am-3.30pm Sun					
Lighting	Lighting Gain	*W/m²*	8					
	Time	-						3pm-5pm
Equip	Gain	*W*		36 (No.1 laptop per person)				

No heating has been included in the summertime assessment.

[1] Refers to CIBSE Guide A 2017 Table 6.3 (24° dry bulb temperature).
[2] Figures used in the TM52 simulations and agreed with the architects in order to predict the average occupancy schedule for the building.
[3] Considering people will more likely use the outdoor space during the summer period, with less people indoor.

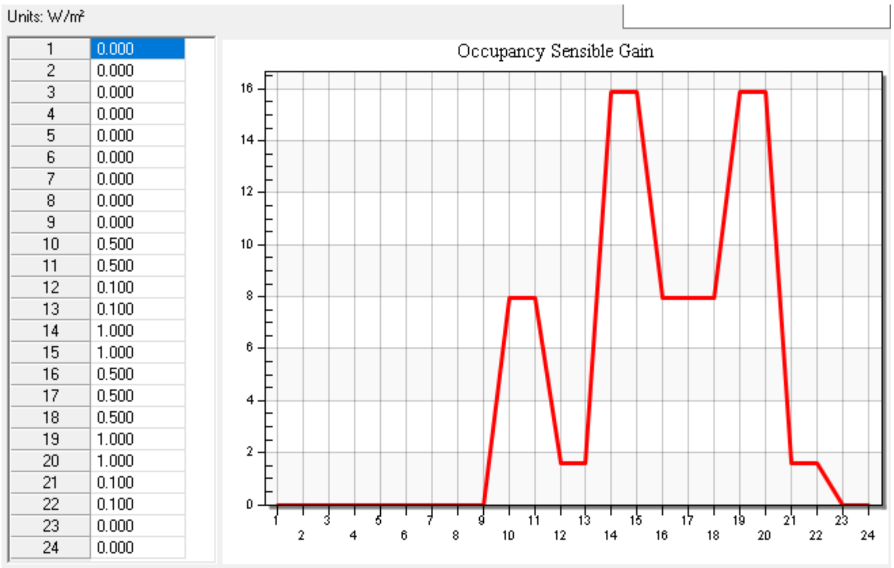


Figure 2: occupancy schedule applied to the Activity room (East)

2.5 Natural Ventilation

The main ventilation strategy for the South-wing building of the Elleray Hall is through natural ventilation through openable windows.

Openings are set to the following opening profile:

- Windows have been assumed to be openable 09:00 to 22:00 on weekdays; 10:00 to 16:00 on Sundays and Bank holidays, since the building will be used for events.
- Rooflights can be opened 24hours/day, seven days a week including holidays;
- Louvres (above specialist rooms and quiet room) can be opened 24hours/day, seven days a week including holidays;
- Windows and rooflights start opening when internal temperature reaches 18°and fully open by 19°.

The centre-pivot rooflights above the Activity rooms at 1st floor have been modelled as openable up to 45° (maximum openable area of 1.0 m^2). Night ventilation has been allowed for. That would require restrictors to be installed to keep the rooflights open at 100mm preventing any security issues during unoccupied hours (0.0942m^2 openable area).

These figures will need to be reviewed at next stage when the design dimensions and specifications will be defined.

External ventilator louvres have been allowed for at ground floor to enable nigh ventilation to the Specialist rooms and Quiet room (refer to paragraph 2.6).

Entrance doors have not been modelled as openable but those can be used to purge hot air when needed.

Internal doors have been modelled as left open during unoccupied hours.

Circulation area are not included in TM52 analysis, but it has been highlighted that the large glazing area in the stairwell increase significantly the internal temperature of that space. A reduction of the windows is highly recommended in order to reduce the discomfort in that space during summer season.

The dimensions of the windows refer to the latest architectural drawings dated 16/04/21 and have been summarised in Appendix B.

2.6 Design changes required

The following minor changes should be applied to the current design in order to allow all the occupied space to pass TM52:

- Dimensions of the window in the Activity room (West) should be reduced to 1600x1600mm;
- One rooflight above the (East) Activity room should be moved to the East slope. In that location the rooflight would be more sloped towards a vertical position and east facing instead of south facing. This design change would reduce the amount of solar gains getting into the room and it would enable the the room to pass Criteria 1 (Figure 5);
- Furthermore, the corner window in the south entrance to the Lounge area should be removed (Figure 3);
- External canopy above South entrance to Lounge area as stated in paragraph 2.8.

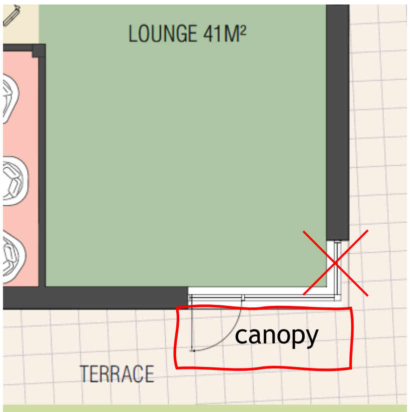


Figure 3: Lounge entrance side window to be removed

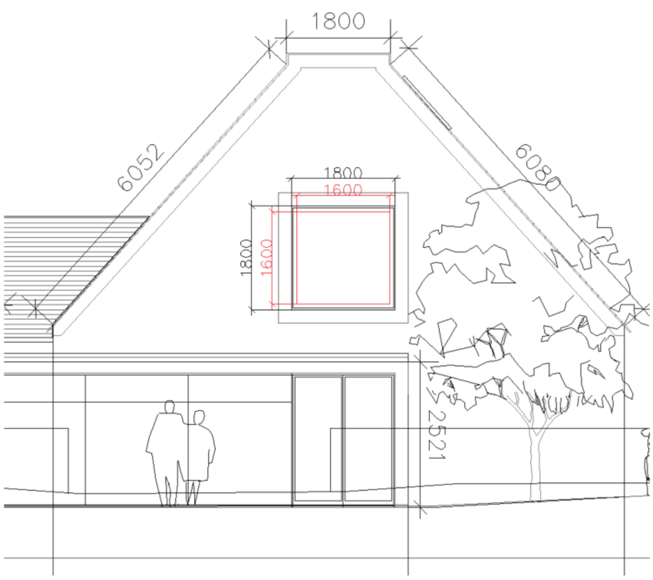


Figure 4: West Activity room window reduced

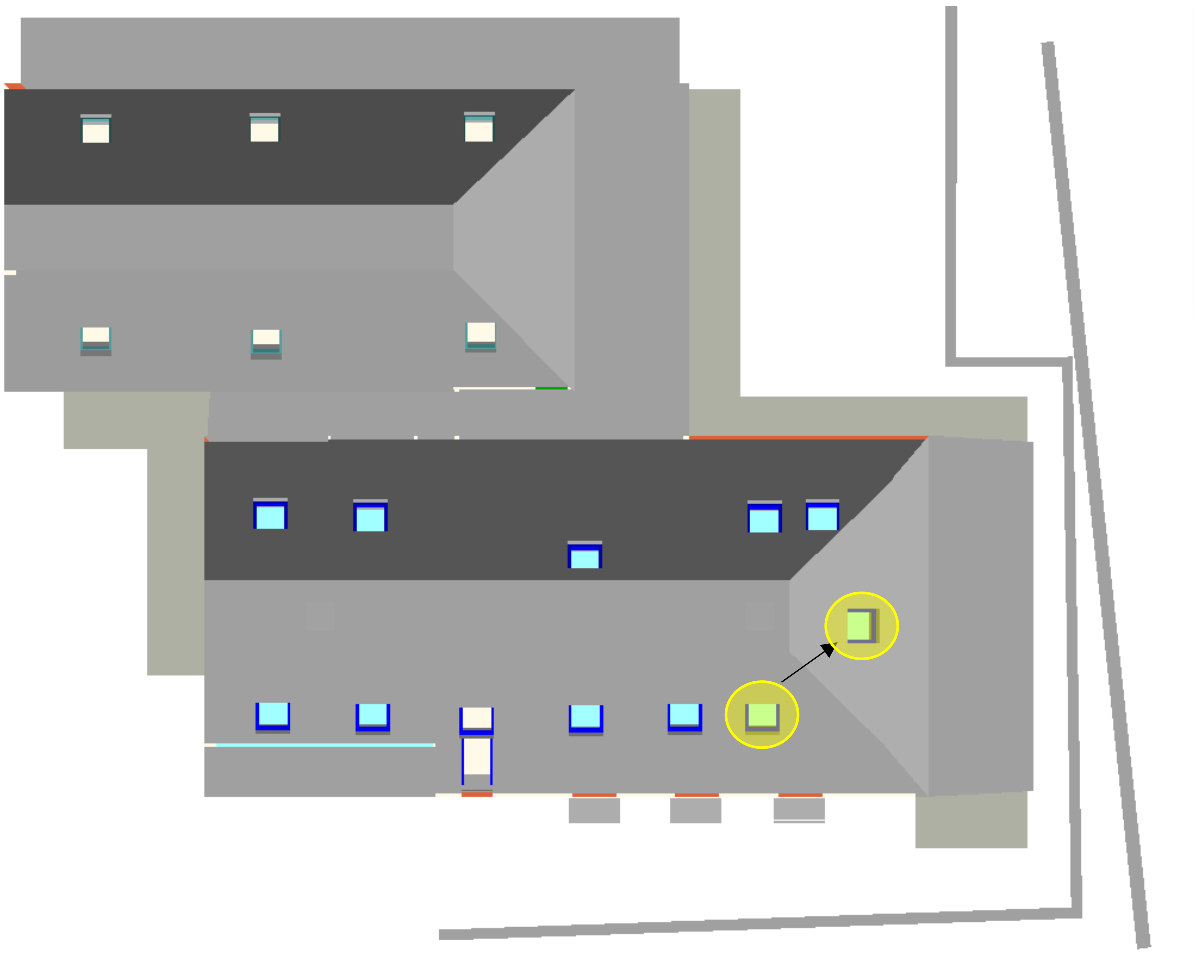


Figure 5: relocation of one rooflight above activity room to reduce solar gains

2.7 Mechanical Ventilation

The most critical spaces in terms of overheating are the Lounge area and Activity rooms. Mechanical ventilation has been allowed for throughout all day and night to purge warm air and reduce the internal temperature during unoccupied hours.

In order to minimise the energy consumption, the peak/boost mode should used during peak summer days only. 10 l/s/person have been allowed for in the Lounge area; 12 l/s/p in the Activity rooms. Please refer to the mechanical specification report for further information.

2.8 External shadings

External shadings have been accounted for in order to reduce the solar gains therefore minimising the risk of overheating.

600mm deep overhangs have been introduced above the South facing windows in Specialit rooms, Quiet room at GF. A 1400mm deep canopy has been included in the therma l model above the South-facing entrance to the Lounge area (Figure 6).

Vertical fins in front of the GF Admin office have been modelled as 200mm deep at 400mm distance (Figure 8). It is advised to install the fins at 20° in order to be more effective in preventing direct solar gains in the afternoon (Figure 9).

The design of the shadings can be modified to suit architectural requirements and costs keeping same dimensions and orientation.

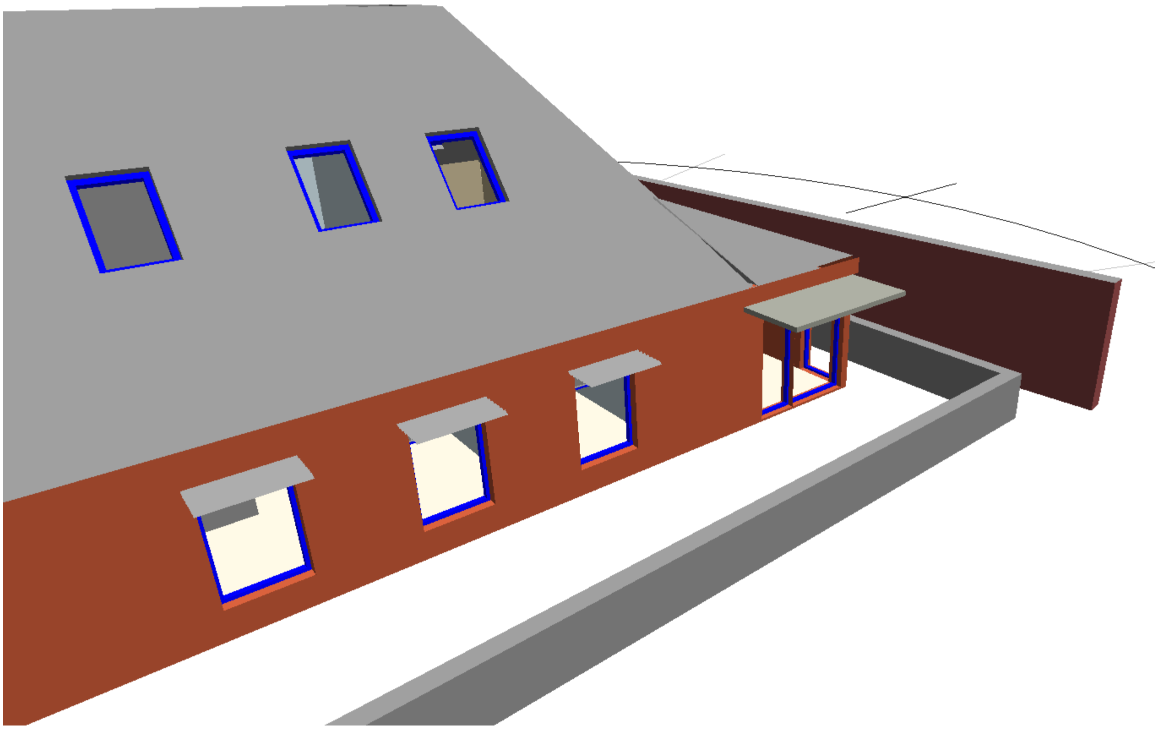


Figure 6: Horizontal overhangs above south facing windows

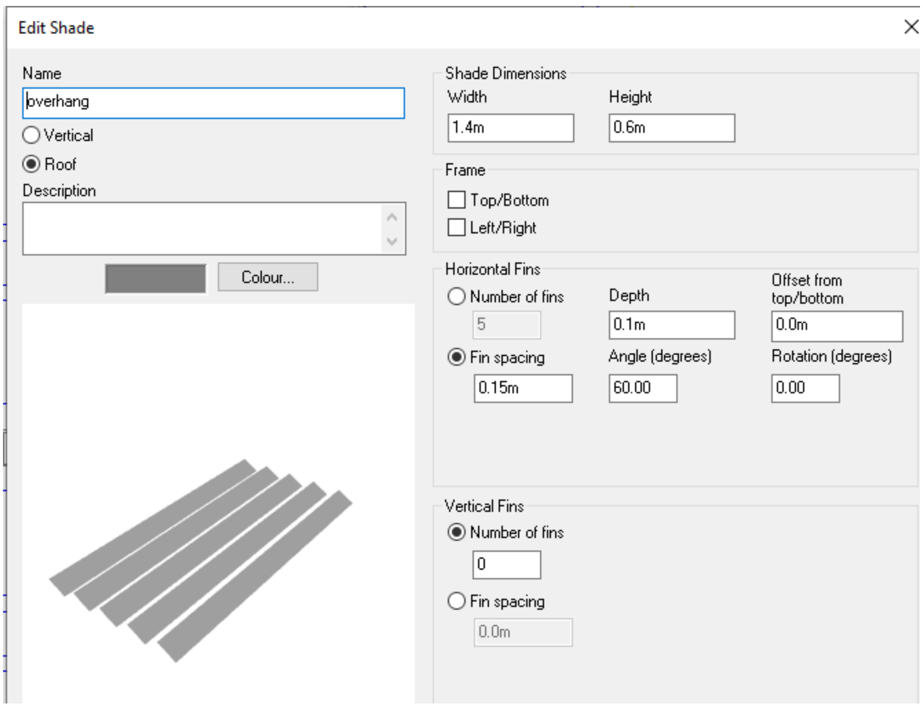


Figure 7: Overhangs dimension input

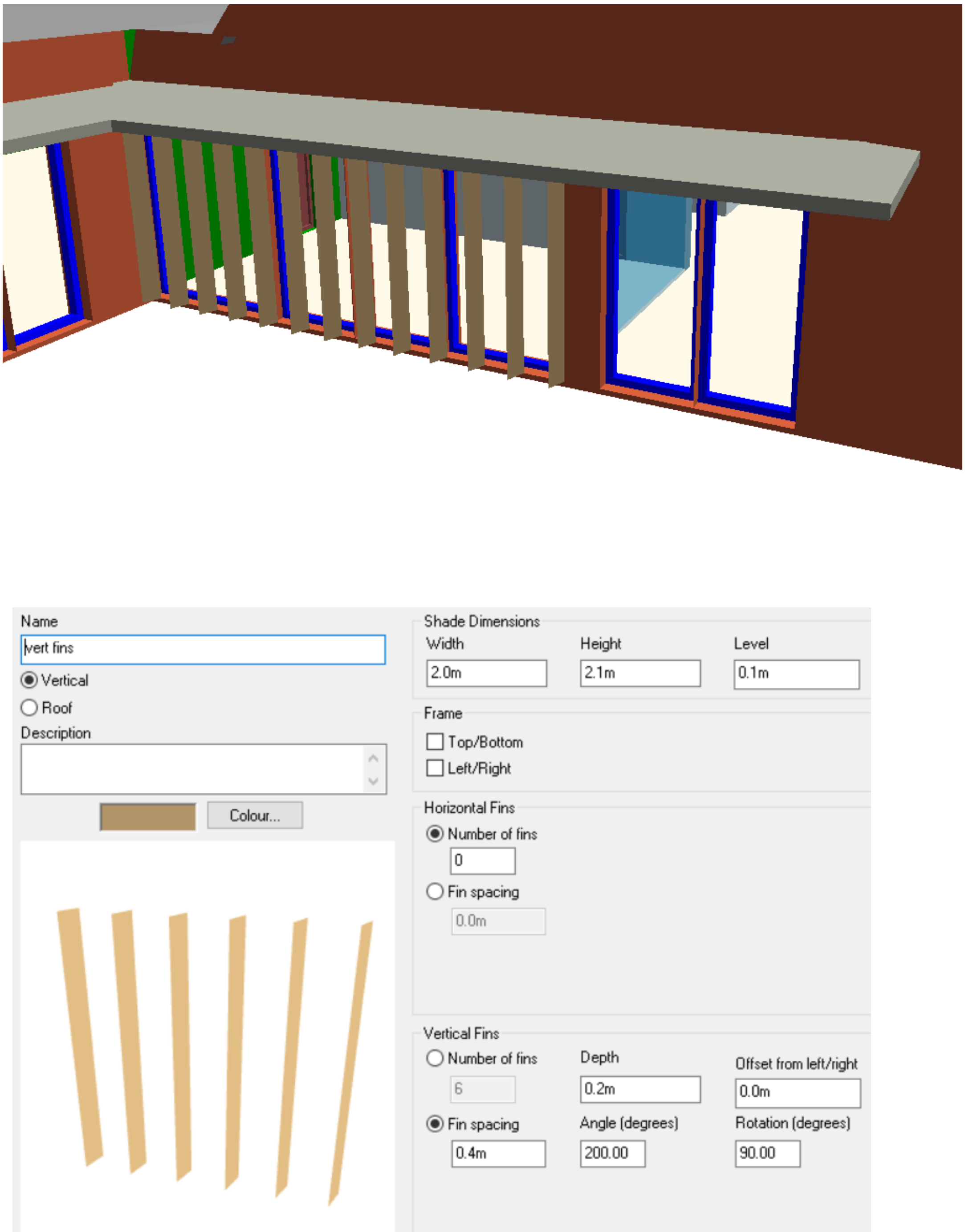


Figure 8: Vertical fins

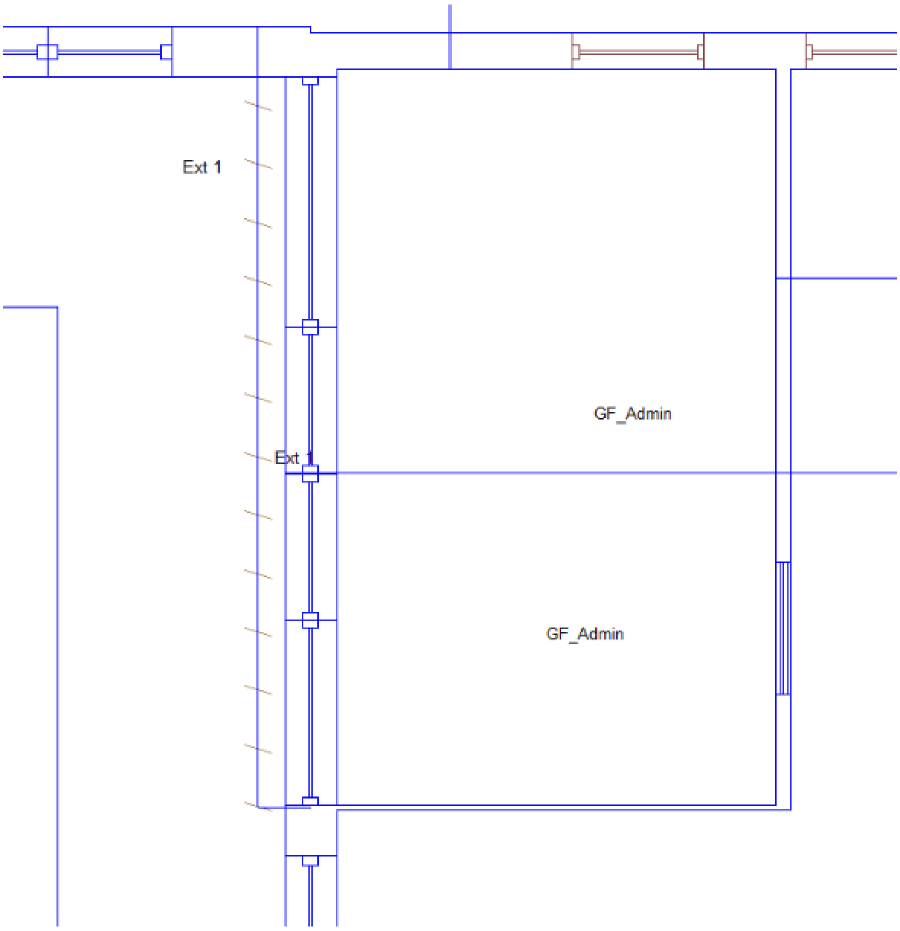


Figure 9: vertical fins at 20degrees to provide better shading during summer days

2.9 Blinds

Internal blinds have been allowed for in all the windows and rooflights in the South-wing building, except in the Lounge area and Entrance doors. It should be noted that any shading devices, such as blinds, should be designed to have little or no impact on air flow.

2.10 Thermal mass

22mm Versapanel lining internal walls in the 1st floor Activity rooms has been allowed for to increase the thermal mass and to cool the space at night.

Considering the lightweight timber structure proposed for this building, incorporating this passive design measure is key to mitigate the risk of overheating in these spaces increasing the thermal mass within the space. Thermal mass located in a space which can be cooled at night, absorbs heat and provides cool indoor surfaces and temperatures the following day. The more surface area of mass in a space, the more stable the indoor temperature.

The dimension and number of boards will need to be reviewed after the cost analysis has been defined.

The internal walls with Versapanel lining have been modelled as follow:

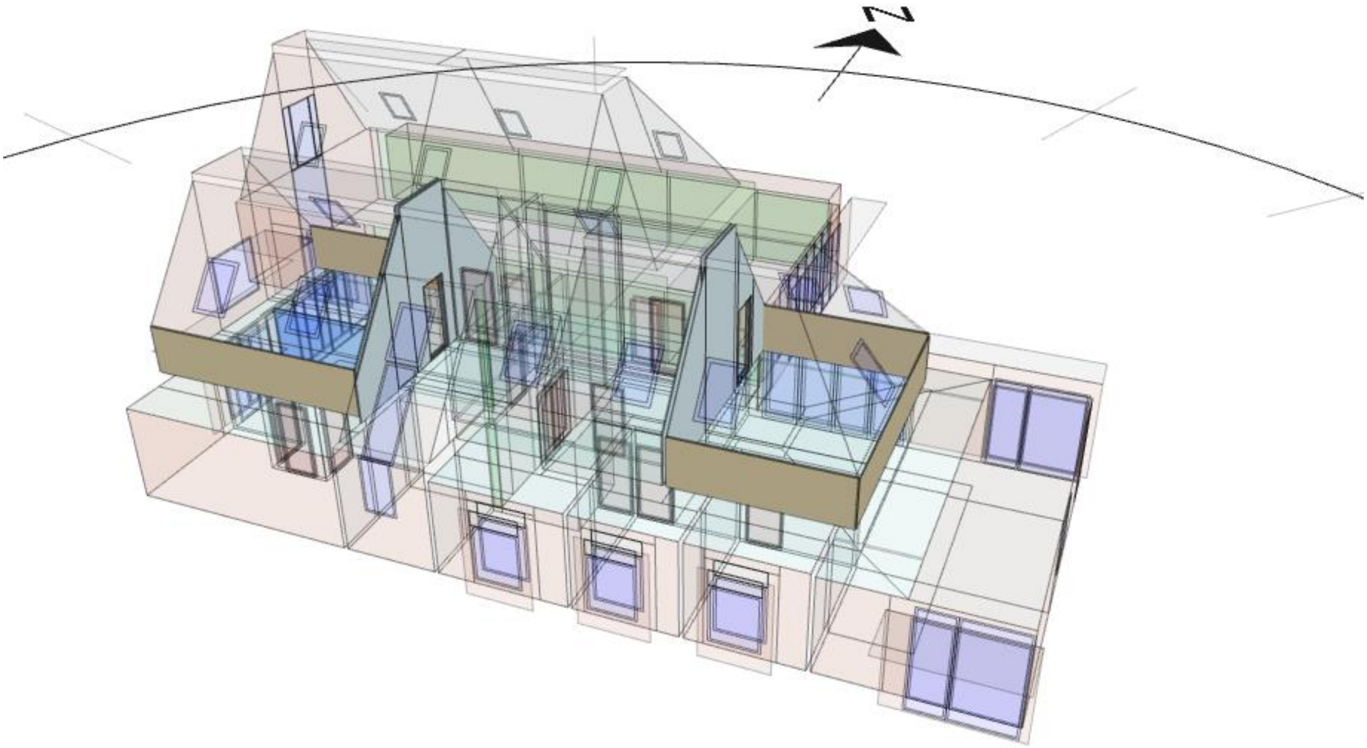


Figure 10: Versapanel lining internal walls in Activity rooms

2.11 External louvres

External ventilation louvres have been included above windows in Specialist rooms and Quiet room in order to allow for night ventilation.

Louvres have been modelled as openable at all times with 25% equivalent area[4]. These begin to open when the adjacent space reaches 18°C and are fully open when it reaches 19°C.

[4] Information provided by Passivent for the Wall Aircool unit at 1200(w) x 500(h) mm

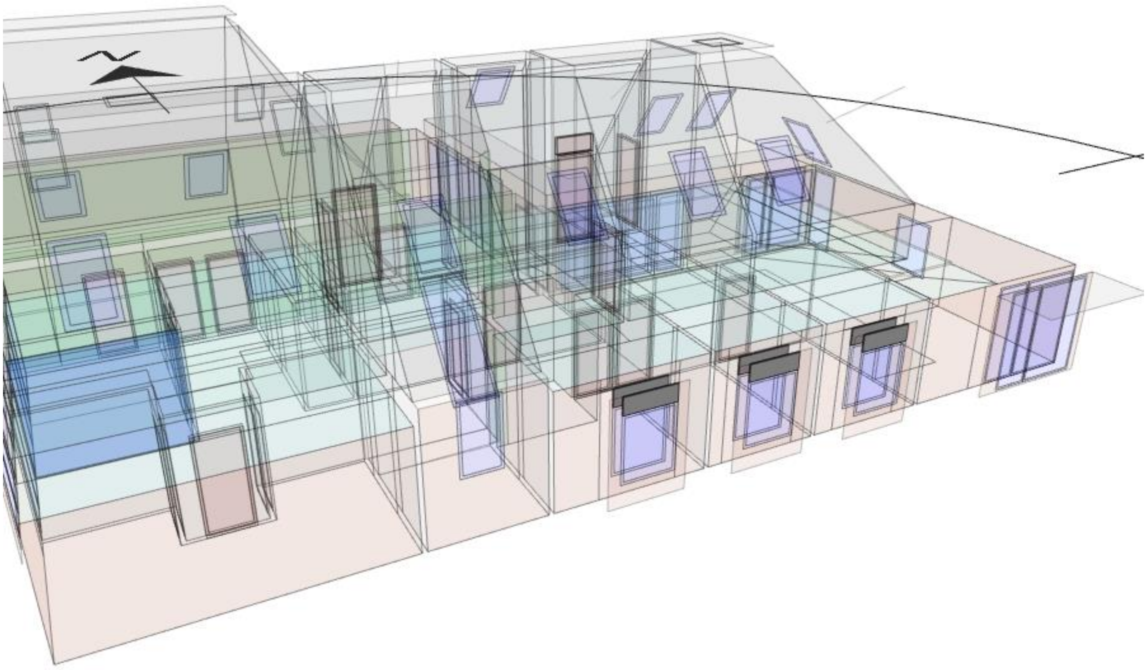


Figure 11: Wireframe 3D showing louvres highlighted in grey

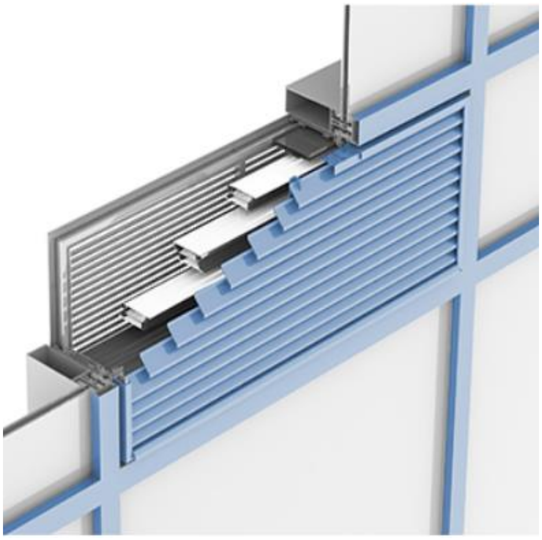


Figure 12: Aircool Wall from Passivent

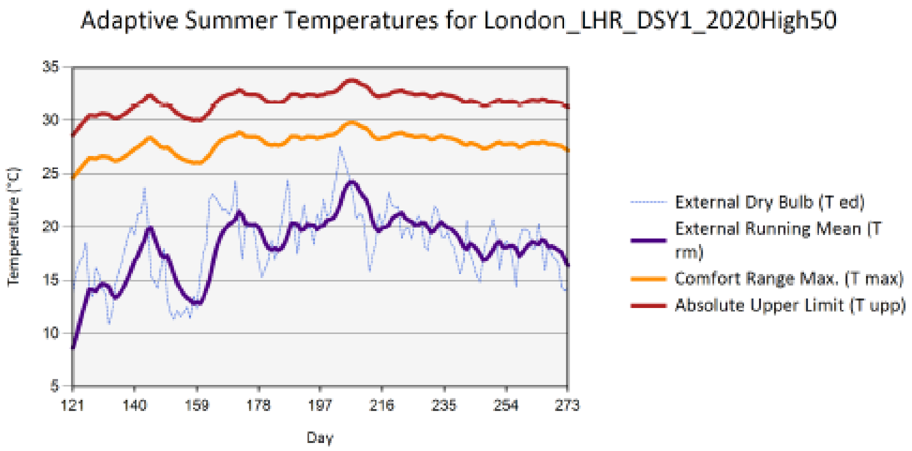
3.0 RESULTS

The results for the TM52 analysis are provided below for both the current design and after the proposed measures are applied. Any change on the design of the building or on the assumed internal heat gains, occupancy levels and schedule would affect the outputs below.

A review of the TM52 analysis is recommended at next design stage.

TM52 Results current design

Adaptive Overheating Report (CIBSE TM52)



The adaptive overheating assessment tests rooms against three criteria. If a room fails any two of the three criteria then it is said to overheat.

1. The first criterion sets a limit for the number of hours that the operative temperature exceeds the comfort temperature by 1°C or more during the occupied hours over the summer period (1st May to 30th September).
2. The second criterion deals with the severity of the overheating within any one day. This sets a daily limit for acceptability.
3. The third criterion sets an absolute maximum daily temperature for the room.

Project Details

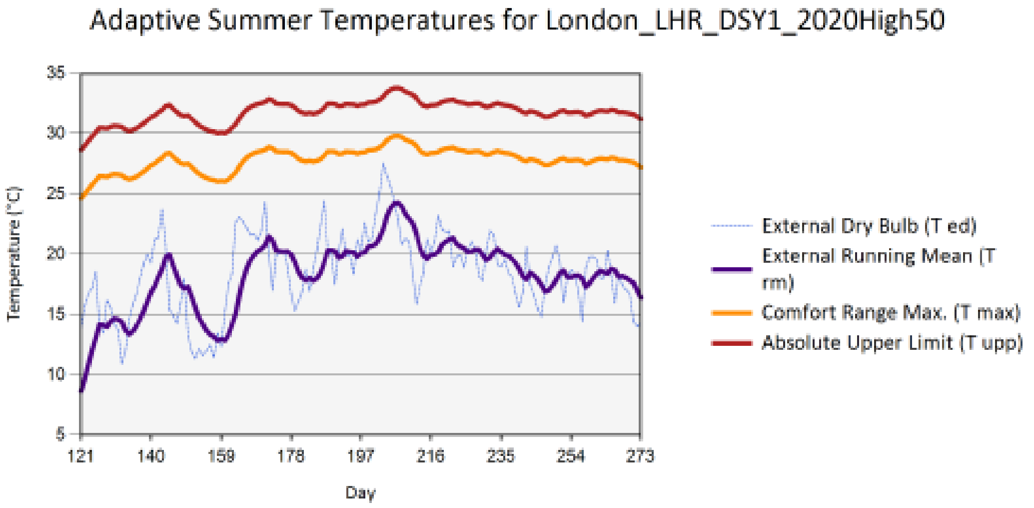
Building Designer File (.tbd): Elleray Hall_TM52_current design.tbd
Simulation Results File (.tsd): Elleray Hall_TM52_current design.tsd
Date: 17 May 2021
Building Category: Category II
Report Criteria: TM52

Results

Zone Name	Occupied Summer Hours	Max. Exceedable Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit	Result
GF_Admin	818	24	23	5.0	0	Pass
GF_Cafe	1814	54	22	8.0	0	Pass
GF_Quiet room	1814	54	31	11.0	0	Pass
GF_Specialist r 1	1814	54	30	11.0	0	Pass
GF_Specialist r 2	1814	54	8	5.0	0	Pass
GF_Lounge area N	1814	54	29	12.0	1	Fail
GF_Lounge area S	1814	54	70	17.0	2	Fail
1F_Activity room W	1814	54	50	15.0	1	Fail
1F_Activity room E	1814	54	50	14.0	1	Fail
1F_Admin	893	26	17	5.0	0	Pass

TM52 Results including proposed design changes

Adaptive Overheating Report (CIBSE TM52)



The adaptive overheating assessment tests rooms against three criteria. If a room fails any two of the three criteria then it is said to overheat.

1. The first criterion sets a limit for the number of hours that the operative temperature exceeds the comfort temperature by 1°C or more during the occupied hours over the summer period (1st May to 30th September).
2. The second criterion deals with the severity of the overheating within any one day. This sets a daily limit for acceptability.
3. The third criterion sets an absolute maximum daily temperature for the room.

Project Details

Building Designer File (.tbd): Elleray Hall_TM52_v66.tbd
Simulation Results File (.tsd): Elleray Hall_TM52_v66.tsd
Date: 15 May 2021
Building Category: Category II
Report Criteria: TM52

Results

Zone Name	Occupied Summer Hours	Max. Exceedable Hours	Criterion 1: #Hours Exceeding Comfort Range	Criterion 2: Peak Daily Weighted Exceedance	Criterion 3: #Hours Exceeding Absolute Limit	Result
GF_Admin	818	24	28	5.0	0	Pass
GF_Cafe	1814	54	21	8.0	0	Pass
GF_Quiet room	1814	54	25	11.0	0	Pass
GF_Specialist r 1	1814	54	28	11.0	0	Pass
GF_Specialist r 2	1814	54	10	5.0	0	Pass
GF_Lounge area N	1814	54	22	9.0	0	Pass
GF_Lounge area S	1814	54	28	10.0	0	Pass
1F_Activity room W	1814	54	46	15.0	0	Pass
1F_Activity room E	1814	54	40	12.0	0	Pass
1F_Admin	893	26	14	4.0	0	Pass

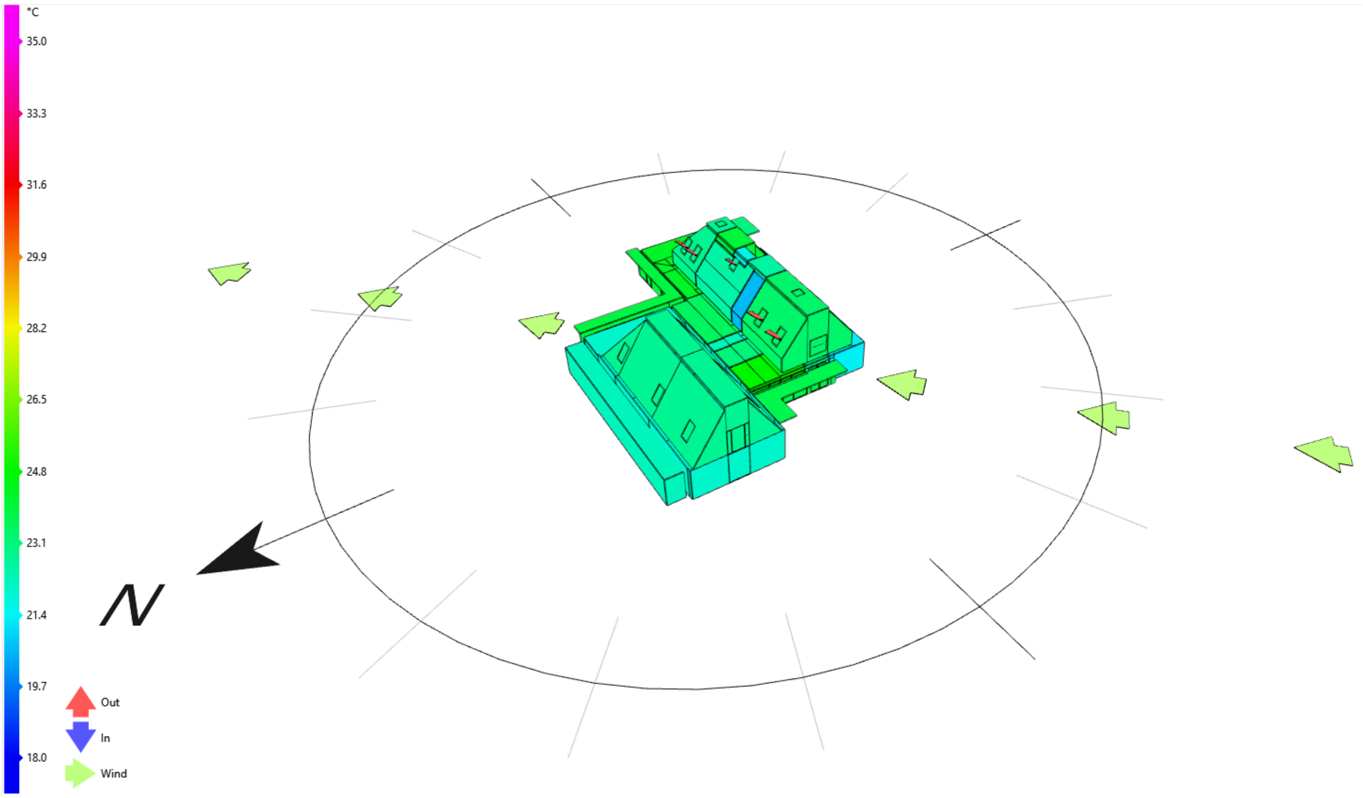


Figure 13: TAS 3D view_July 17th at 11am

4.0 APPENDIX A

Plans from TAS software

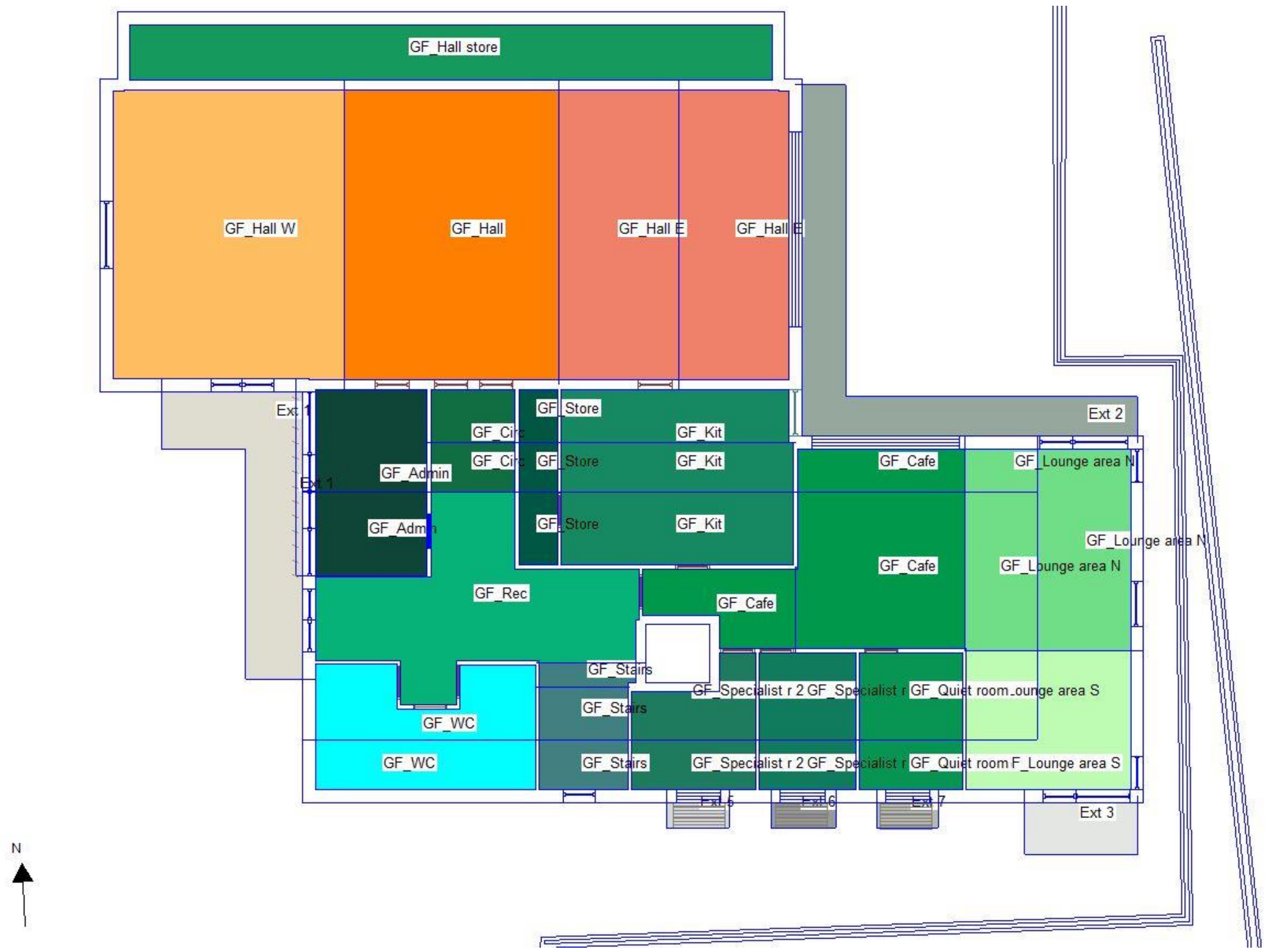


Figure 14: Ground floor plan

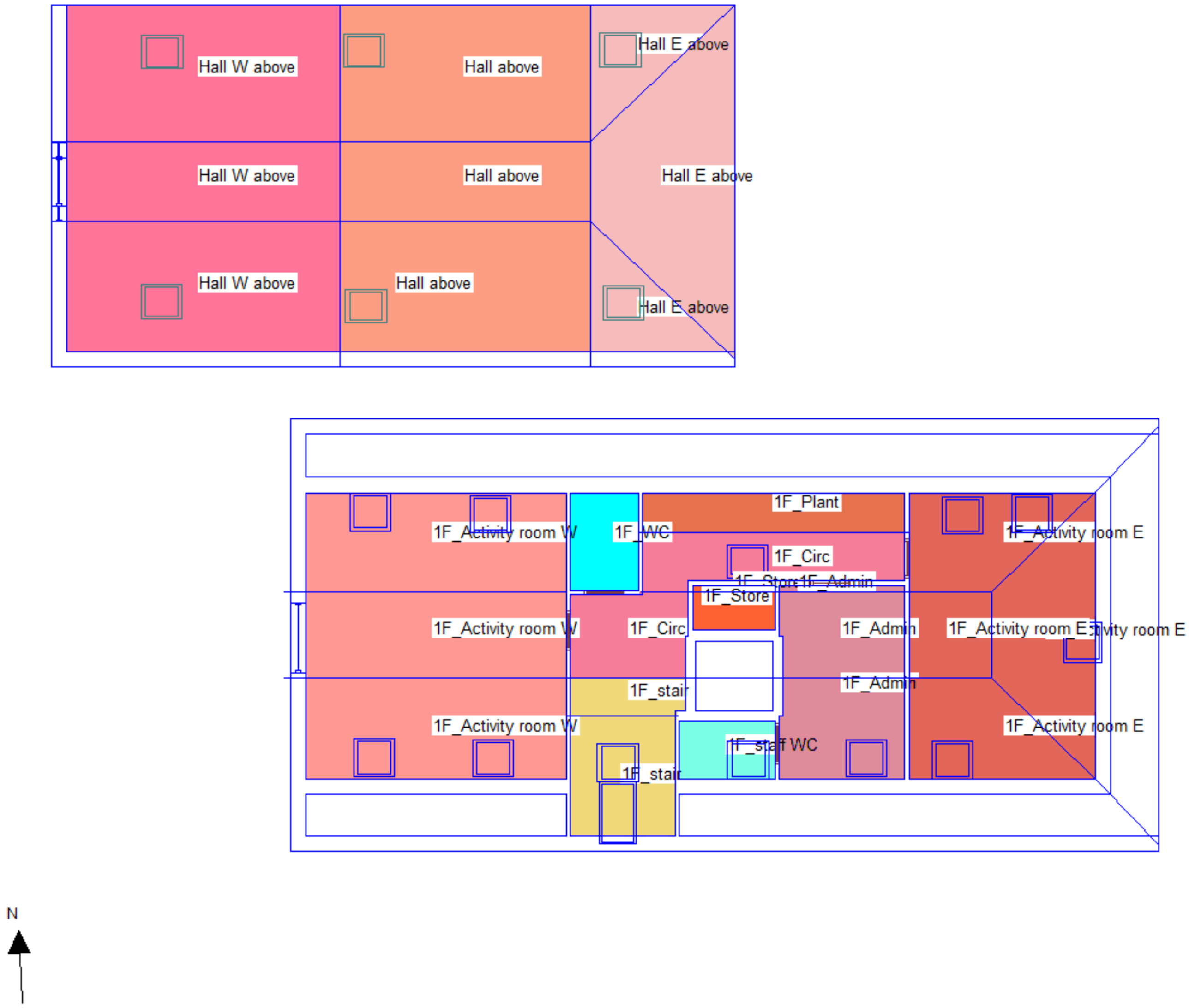


Figure 15: First floor plan

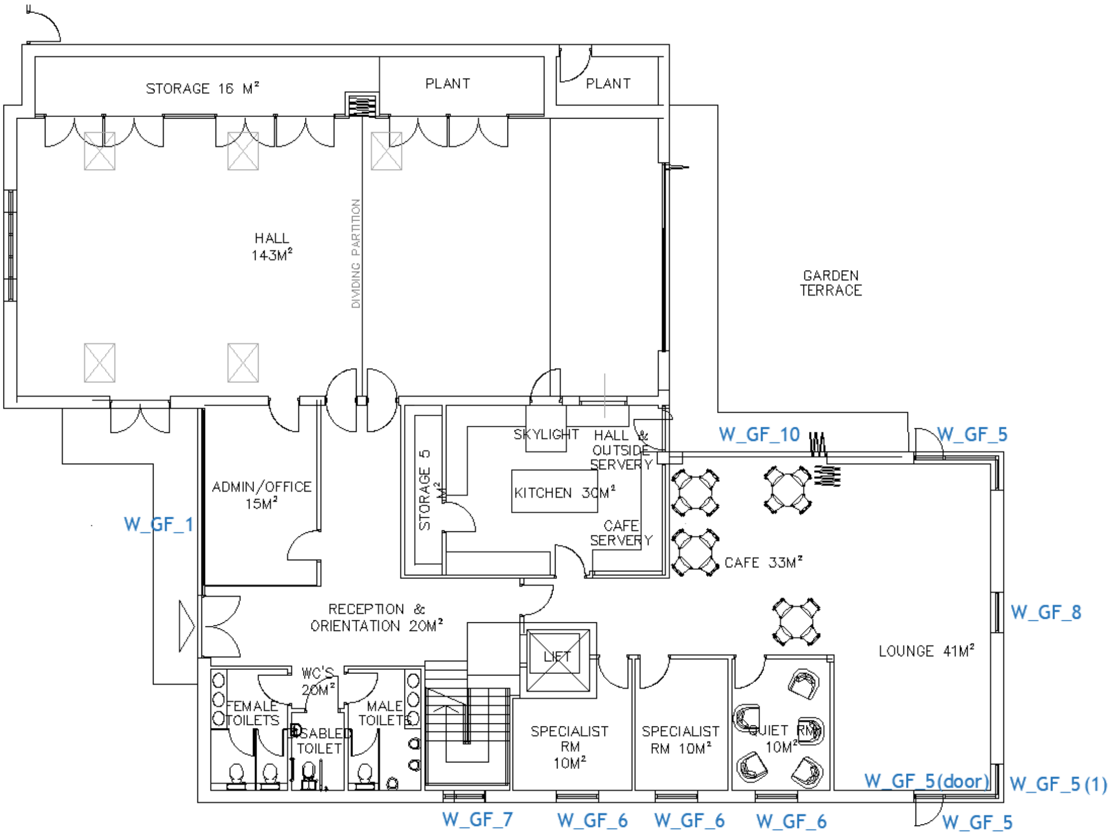
5.0 APPENDIX B – WINDOWS ASSUMPTIONS

Window Ref.	Description	Width (mm)	Height (mm)	Openable factor[5]
W_GF_1	Top/bottom hung window	All room depth	2260	30%
W_GF_5	fixed	1480	2400	0%
W_GF_5 (1)	fixed	1480	2400	0%
W_GF_5 (door)	fixed	1480	2400	0%
W_GF_6	Side hung window	1200	1500	100%
W_GF_7	fixed	1200	1500	0%
W_GF_8	Side hung window	1200	1518	50%
W_GF_10	Sliding doors fully openable	4000	2400	100%
W_1F_1	fixed	1200	2200	0%
W_1F_2	Top/side hung (TBC)	1800	1800	50%
RF_1	Centre pivot	942	1398	100% (day) 1% (night)

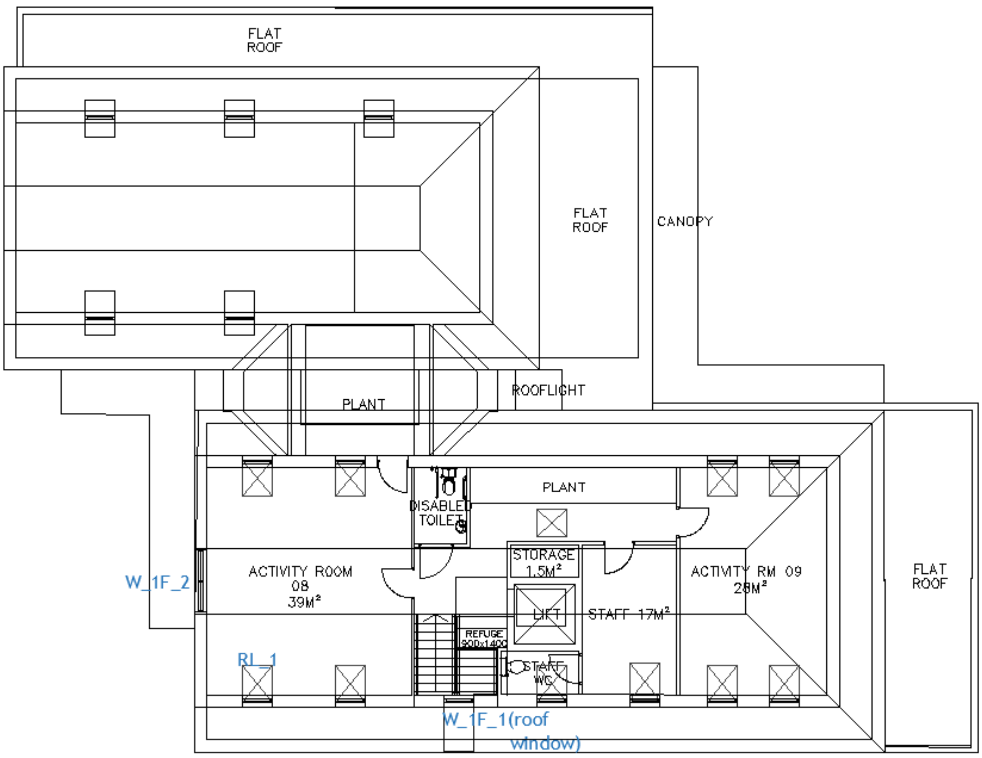
Reference floor plans provided in the next page.

[5] Percentage of the rooflights pane area which can be openable.

Ground floor plan



First floor plan



END OF REPORT

McBains