SKELLY & COUCH

REPORT TITLE:

Energy Report & Sustainability Statement

PROJECT NUMBER:
1640

DATE:
03/05/2025

PROJECT NAME
Lighthouse London, Holy Trinity Swiss Cottage

REVISION:
3.0

Rev	Date of Issue	Status	Issued by	Checked by	Summary of changes
1.0	27/03/2025	Information	NJ	SW	Issue for planning
2.0	03/04/2025	Information	NJ	SW	Updated following comments
3.0	**03/04/2025**	**Planning**	**NJ**	**SW**	**Additional reports appended**

Contents

1 Introduction

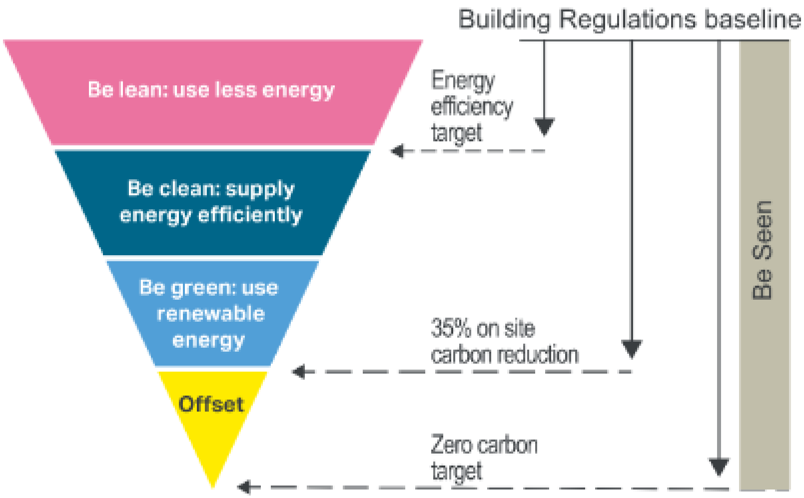
Skelly and Couch Ltd have been appointed to work alongside Reed Watts Architects, to undertake the Mechanical, Electrical and Environmental Design aspects for the extension and refurbishment of The Lighthouse London, Holy Trinity Swiss Cottage.

The following statements summarise the proposed sustainable design strategy for the church building, appropriate to the nature of the refurbishment, in line with Camden's 'Draft Local Plan 2024; v1', as published by Camden Council.

It is understood that, since the total area of the development is less than 1000m^2, the planning submission is for a minor scheme application.

2 Planning policy requirements

The London Plan energy and sustainability strategy is built around the concept of the Energy Hierarchy, a basic tenet of good sustainable design. This sets out a system by which buildings should be designed to consume as little energy as possible, before then addressing the remainder by ensuring that it uses “clean” energy, and only considering renewable energy once these earlier objectives have been rigorously covered.



Camden’s Draft Local Plan Policy CC5 addresses how energy reduction measures should be targeted through adaptations and improvements to existing buildings.

The expectation is that all refurbished developments shall demonstrate:

i) how energy efficient improvements shall be implemented within the alterations and extensions proposed, appropriate to the scale and nature of the proposal.

ii) How the energy demand in the part of the building being altered/extended is primarily to be reduced through improvements to the building fabric. U-values are set out in Table 6 below.

Table 6 – Building material fabric U Value specifications

Residential **Fabric U-values (W/m2 .K)**	**Non-residential** Fabric U-values (W/m2 .K)
Walls 0.13 - 0.15 Floor 0.08 - 0.10 Roof 0.10 - 0.12 Exposed ceilings/floors 0.13 - 0.18 Windows 0.80 – 1.0 (triple glazing) Doors 1.00 Include openable windows, cross ventilation, and include external shading	Walls 0.12 - 0.15 Floor 0.10 - 0.12 Roof 0.10 - 0.12 Windows 1.0 (triple glazing) - 1.2 (double glazing) Doors 1.2

The development is largely refurbishing an existing building and is not considered to require substantial demolition to allow for the extension. It is understood that there is no requirement to submit a whole life carbon assessment, as per Camden’s Draft Local Plan Policy CC4.

3 Energy and Sustainability strategy

The energy efficiency strategy for the scheme follows an energy hierarchy approach which can be summarised by the following points in order of priority:

- Utilising passive design measures where possible to reduce energy demand
- Adopting efficient services to use the required energy efficiently
- Implementing low and zero carbon technologies to further reduce the energy consumption and reduce carbon emissions

3.1 Passive design measures

The passive design and energy efficiency measures to be considered in the scheme are summarised below:

3.1.1 Optimise Building Envelope

The building envelope will:

- Have an efficient average wall to floor ratio.
- Have highly insulated wall and roof constructions
- Use efficient glazing systems and frames, with high light to solar transmission ratios.
- Make use of passive solar heat in the winter months.
- Be airtight in its construction.

The following U-values shall be targeted for the building:

NEW BUILD THERMAL ELEMENTS

Building Element	Part L Baseline Values	Notional Building Values	Target Values
U-Values (W/m^{2}K)			
New Roof	0.18	0.15 / 0.18	0.12
New Walls	0.26	0.18 / 0.26	0.12
New Floors	0.18	0.15 / 0.22	0.12
New Windows and Doors	1.6	1.4	1.1
New Rooflights	2.2	2.1	1.2

REFURBISHED THERMAL ELEMENTS

Building Element	Building Regs Threshold U-Values.	Building Regs Improved U- Values	Target U-Values
U-Values (W/m²K)			
Flat Roof	0.35	0.18	0.15
Walls (externally insulated)	0.7	0.3	0.3
Floors	0.7	0.25	No upgrade proposed
Windows	1.6	1.4	1.3
Rooflights (flat roof)	2.2	1.4	1.3

3.1.2 Maximise Daylighting

The use of daylight shall be maximised by:

- Careful consideration of façade glazing and solar shading design, to maintain the quality of the spaces.
- Aiming to locate spaces that will benefit from daylight in parts of the building that get the most light.
- Using rooflights to introduce natural light into the centre of the spaces, where appropriate.

A separate daylighting study has been conducted, to allow the building design to be developed to ensure good levels of daylight are maximised to he major spaces across the building.

3.1.3 Limit Overheating

The proposed building contains areas with potentially high internal and solar heat gains; therefore, care must be taken to limit the risk of summertime overheating and to reduce/eliminate the need for cooling.

The strategy for limiting overheating follow the principles of the cooling hierarchy and adopts numerous passive design measures.

The following strategies should been adopted where feasible:

- Provide thermal mass where possible.
- Utilising mechanical ventilation and necessary controls
- Provide the option of secure night-time ventilation
- Use shading and overhangs to limit solar gains
- Provide generous floor to ceiling heights
- Utilise efficient glazing specifications to highly glazed facades

A separate overheating study has been conducted, to ensure all occupied spaces are designed to meet the3 requirements of CIBSE TM52.

3.1.4 Utilise Energy Efficiency Measures

The following systems will be adopted as a minimum in the new buildings, where feasible:

- Air source heat pumps for all building services heat required
- Compensated and optimise control of heating system
- Thermostatic control of all heated spaces
- Variable speed pumping and fans
- Demand controlled mechanical ventilation (where provided), either by carbon dioxide, humidity or temperature monitoring
- Simple and non-intrusive automatic controls
- Energy submetering and monitoring
- Low energy LED limited technology
- Daylight dimming and Occupancy switching

3.2 Efficient Building Services

Heat Sources
Skelly and Couch propose to meet the heating demand of the building by using high quality Air Source Heat Pump technology.

Care will need to be taken to select heat pumps that are not oversized, as these may cause an excessive power draw. This will need to be limited through controlling the capacity of each heat pump through the BMS to limit the heating that can be supplied to match the power available.

Ventilation
Generally, due to the noise and pollution from Finchley Road, as well as an aim to ensure that space perform in as energy efficient a manner as possible, mechanical ventilation with heat recovery shall be favoured throughout.

The site is not naturally suited to natural ventilation. A more efficient building, in this situation, can be provided where mechanical solutions are favoured. Openable windows could still be provided to allow user choice and to provide greater levels of ventilation in the summer months. Where these are open, the associated spaces may not be able to be kept warm, however.

Active cooling is not included, largely from the perspective of ensuring sustainability and also because of the electrical supply limitations. This will result in care being required to manage the chances of overheating. Dynamic thermal simulation modelling has been carried out to assess the building and advise on design measures required to ensure comfortable temperatures are achieved.

Allowing the ventilation systems to run slowly and quietly overnight will be a primary way of managing heat buildup, but where the internal spaces are limited by the external spaces and the amount that the church is used, the resulting temperature will need to be explained and managed to the building users.

3.3 Low and Zero Carbon Technologies

A feasibility study has been undertaken to undertaken to evaluate range of LZC technologies in terms of their carbon saving potential and suitability for the scheme, with particular consideration of the restricted nature of the site.

Photovoltaic panels have been deemed best suited to the scheme, located to the rear flat roof where the largest portion of solar energy can be harvested throughout the year. The site is significantly overshadowed by the building to the south, and this is a major obstacle to the generation of renewable energy through photovoltaic panels.

The London Plan will consider these to be of value, and they will generate some electricity and thus offset some carbon dioxide.

The Planning process requires that as much renewable energy is generated as possible on site, but the value of these southern facing PV's needs to be made explicit. As these panels would only generate ¾ of the maximum power that they might otherwise, the payback is likely to be longer, but the panels can still be justified as viable at this stage of the design.

3.4 Metering Strategy

Metering in the building will be installed in accordance with CIBSE TM39.

Energy consumed will be metered or sub-metered to allow 90% of the energy delivered by each fuel to be identified. Energy generated from renewables on site in the future, such as solar photovoltaic panels, shall be sub-metered.

Heat provided by the air source heat pump will be sub-metered to allow the proportion delivered from this source to be established.

Cold water consumed on site shall be metered and logged.

3.5 Water Efficiency Measures

The following water saving strategies are proposed as a minimum to minimise the water use across the building:

- Low Flush WCs (4.5 litres)
- Auto Shut Off Spray Taps in public toilets
- PIR spray taps on all sinks and basins with timed flow and auto-shut off
- Flow limiting valves to all outlets
- Low flow showers (under 8 l/min)
- Water leak detection

Water leak Detection Equipment
Water leak detection equipment should be considered to the incoming supply.

Sanitary Supply and Shut Off
The PIR sensors in the WC areas that control the lighting in the WCs will also be used to provide a sanitary shut off to the cold-water supply to the room. This will help prevent water loss from leaky cistern drop valves and washers.

3.6 Materials

Materials should ideally have a low embodied energy and be sourced from sustainably managed and local sources to mitigate transportation- related impacts.

Material selection has formed a key aspect in the process of reducing both embodied energy and operational energy of the proposed development.

Certified Schemes
The Design Team will specify that the building contractor source their materials from a responsibly sourced supplier and encourage them to provide EMS and timber certification certificates for the main building components.

Low VOC Content
The design team will consider the specification of internal finishes and fittings with low emissions of volatile organic compounds (VOCs).

Low GWP
Consideration will also be given to avoid the specification for materials that make use of substances with a global warming potential of five or more in either manufacture or composition.

3.7 Waste

The contractor will be asked to reduce waste during the construction by sorting waste on site. They will be asked to come up with a Site Waste Management Plan prior to commencing on Site, which will outline the proposed reuse, recovery and best practice waste management practices to minimise waste going to landfill.

The project will target the following the waste hierarchy:

- *Prevention*: using material in design and manufacture, keeping products for longer, reuse, using less hazardous materials.
- *Preparing for reuse*: checking, cleaning, repairing, refurbishment, whole items or spare parts
- *Recycling*: turning waste into a new substance or produce. It includes composting if it meets quality protocols
- *Other recovery*: includes anaerobic digestions, incineration with energy recovery, gasification and pyrolysis, which produce energy (fuels, heat and power) and materials from waste.
  Disposal landfill and incineration without energy recovery.

Recycled and Sustainably Sourced Aggregates
Secondary and recycled aggregate shall be used where possible, in higher value situations. If primary aggregates are used, these will locally sourced, sustainably transported and from a region where that aggregate type is abundant.

3.8 Decentralised Energy Networks/District Heating and Combined Heat and Power

3.8.1 District Heating

At present, there is no known district heat network in the area.

3.8.2 Combined Heat and Power

In recent years the national carbon factor for electricity has reportedly almost halved from 0.519 kgCO2/kWh to 0.233 kgCO2/kWh (SAP 2019 figures).

Due to its inefficiency, electricity generated in a CHP from heat is more carbon intensive than electricity from the grid. As a result, a CHP is the less favoured renewable option, since it is no longer low carbon. This technology is not recommended for the project.

The key factors in the decision to install CHP include:

- Running time: in order to be cost effective the system ideally needs to run for a minimum of 4,650 hours/year.
- Total capital costs.
- The total running costs and life cycle costs.
- The ability to use the heat generated by the CHP system.

Appendix I – Overheating Study

SKELLY & COUCH

REPORT TITLE:
1640-SAC-RP-Overheating Study

PROJECT NUMBER:
1640

DATE:
14/03/2025

PROJECT NAME
The Lighthouse

REVISION:
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1.0	21/02/2025	Information	CC	NJ	First draft issue for comment
2.0	**14/03/2025**	**Information**	**CC**	**NJ**	**Updated with final results**

Contents

1 Introduction

This report presents a thermal comfort analysis of the proposed Lighthouse London Church building.

IES VE 2023 has been used to create a model with geometry, weather files, opening characteristics, operating profiles, and room specific internal gains. This model has been used to calculate the thermal response of each space with respect to time and thus used to determine compliance with CIBSE TM52 Overheating Guidelines thermal comfort in buildings.

The IES Virtual Environment (VE) is a suite of building performance analysis applications that can be used to test different options, identify passive solutions, compare low-carbon & renewable technologies, and draw conclusions on energy use, CO2 emissions, and occupant comfort.

Different solutions and design measures have been tested, to mitigate overheating across the key spaces within the building.

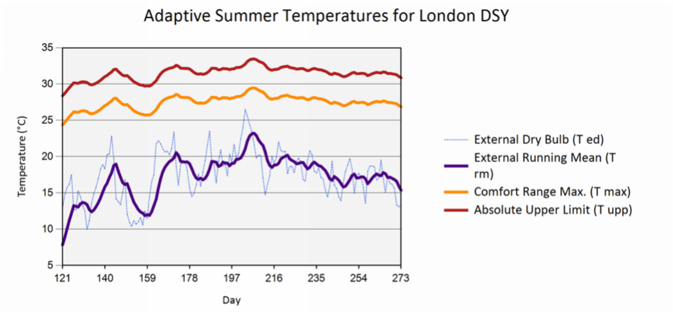
2 Assessment Criteria

The methodology set out in CIBSE TM52 has been used to assess the relative likelihood of occupants overheating in the occupied spaced of the building. This analysis uses three criteria for assessing thermal comfort, which indicate when overheating is likely to be problematic.

- **Criterion 1 (Hours of Exceedance)** sets a limit for the number of hours that the operative temperature can exceed the threshold comfort temperature by 1°C or more during the occupied hours of a typical non-heating season (1st of May to 30th September). This criterion should be 3% or less to pass.
- **Criterion 2 (Daily Weighted Exceedance)** considers the severity of the overheating within each day (which can be as important as its frequency), the level of which is a function of both temperature rise and duration. This criterion should be 6 degree-hours or less in any one day to pass.
- **Criterion 3 (Upper Limit Temperature)** sets an absolute maximum daily indoor operating temperature for a room, beyond which the level of overheating is unacceptable. This criterion should be 4 or less to pass.

A room is considered to overheat when it fails at least two of the three criteria.

It is important to note that passing TM52 does not necessarily imply that occupied spaces will not feel hot on occasion through the summer months; however, it does suggest that the frequency and intensity of these occasions will be low enough to be considered acceptable by most occupants.



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.

3 Modelling

IES VE 2023 has been used to prepare the model geometry, run thermal simulations, and analyse the results. The geometry has been modelled based on the following Reed Watts Architects Stage 3 plan, section and elevation drawings:

- 2401(0)100
- 2401(0)101
- 2401(0)102
- 2401(0)103
- 2401(0)200
- 2401(0)201
- 2401(0)202
- 2401(0)300
- 2401(0)301

3.1 Weather Data

As per TM52 guidance, the weather file 'London_LHR_DSY1' has been used for the thermal comfort assessment.

The DSY (Design Summer Year) weather file consists of a single continuous year of hourly data, selected from the 20-year data sets (1983 to 2004) to represent a year with a hot, but not extreme, summer. The selection is based on the daily mean dry-bulb temperatures during the period April - September, with the third hottest year being selected. This enables designers to simulate building performance during a year with a hot, but not extreme, summer.

Since the Worship Space is a double height space, it has been split into 2 vertical spaces, in order to obtain a more accurate idea of the temperature in the (lower) occupied zone.

3.2 Fabric Assumptions

Construction elements have been created to match the assumed U-values for the building's retained and new fabric elements. Within the model it has been assumed that double glazing will be used for the rooflights and for the windows.

Fabric u-values and g-values used are shown in *Table 1* below.

Element	U-Value (W/m²K)	G-Value
External Window (New)	1.3 (1.1 - glass only)	0.4
Rooflight	1.4 (1.14 - glass only)	0.4
External Wall	0.12	
Internal Partition Wall	1.3	
Intermediate Floor	1.6	
Ground Floor (Retained)	1.6	
Ground Floor (New)	0.18	
Roof (Refurbished – Worship Space)	0.35	
Roof (New - Extension)	0.13	

Table 1 – Fabric U-values

The following wall, floor, and ceiling build-ups have been used in the model:

Type	Build-up, internal to external
Retained External Wall	• 25mm external rendering • 220mm brickwork • 270mm mineral fibre insulation • 12.5mm gypsum plasterboard
New External Wall	• 3mm rainscreen/cladding • 50mm cavity • 150mm insulation • 12mm cement bonded particleboard • 50mm cavity • 30mm gypsum plasterboard
New Curtain Wall	• 6mm outer pane, 16mm argon filled cavity, 6mm inner frame • G-value 0.4 • U-value: 1.1 (glass only) or 1.3 (including the frame)
Internal Wall (partitions)	• 5 mm plaster • 15 mm plasterboard, 50 mm cavity • 15 mm plasterboard • 5 mm plaster

Internal Wall (brick)	• 5 mm plaster • 25 mm plasterboard • 110 mm brick • 25 mm plasterboard • 5 mm plaster
Ceiling/internal floor	• 30 mm plaster • 100 mm timber • 20 mm screed • 20mm timber flooring
Retained Ground Floor	• 150mm concrete • 15mm timber flooring
New Ground Floor (Café only)	• 10mm clay tile • 65mm screed • 165mm mineral fibre slab • 50mm cavity • 150mm reinforced concrete
Refurbished Roof	• 5mm felt/bitumen layer • 25mm plywood sheathing • 100mm mineral fibre slab • 25mm gypsum plasterboard
New Roof	• 5mm felt/bitumen layer • 25mm plywood sheathing • 260mm mineral fibre slab • 25mm gypsum plasterboard
New Rooflights	• 6mm outer pane, 16mm argon filled cavity, 6mm inner pane • 6 x 1.5m x 1.5m, rooflights mounted north at 30 degrees to the horizontal • No blinds, mesh or local shade • Non-openable

Table 2 – Construction build-ups

The following solar shading to the front façade has been modelled:

- A 200mm overhang has been modelled over the main glass façade, at ground floor level.
- The stone columns have been initially modelled with a depth of 200mm beyond the curtain wall

Adjacent buildings, as currently in place, have also been modelled.

3.3 Occupancy & internal gain assumptions

The following assumptions have been made to the number and frequency of occupancies to each of the spaces. These have been based on client feedback on how the building shall be used:

Worship Space
The following occupancy patterns have been applied:

- 150 people for a school assembly every week on Tuesday 12:00-12:30
- 40 people for an evening class on Thursday 18:00-20:00
- 160 people for two, 3-hour Sunday services which may increase to 250 people (various timings of these services have been modelled to understand the impact of the internal gains. Refer to the results & discussion for further details/clarity)

The following internal gains have been applied:

- Maximum sensible gain: 65 W/person
- Maximum latent gain: 35 W/person
- Equipment gain: 10 W/m2
- Lighting gain: 15 W/m2

Café
The following occupancy patterns have been applied:

- Monday to Saturday: 20 people between 09:00-17:00
- Sunday:
  - 30 people 08:45-09:00
  - 6 people 09:00-12:00
  - 30 people 12:00-12:30
  - 6 people 12:30-15:30
  - 10 people 15:30-17:30 (6 people during services, 30 people before and between services, 10 people after the last service)

The following internal gains have been applied:

- Maximum sensible gain: 75 W/person
- Maximum latent gain: 55 W/person
- Lighting gain: 10 W/m^2

Multi-purpose space
The following occupancy patterns have been applied:

- Monday to Saturday: 40 people for 2x 2hour periods occurring between 09:00 and 17:00.

The following internal gains have been applied:

- Maximum sensible gain: 75 W/person
- Maximum latent gain: 55 W/person
- Lighting gain: 10 W/m^2

3.4 Ventilation assumptions

The following assumptions have been applied to the simulation, to replicate how the ventilation systems could be run at an optimum, to minimise overheating:

Worship Space Mechanical ventilation

- 13 l/s/person
- Runs at 50% capacity overnight 17:00-09:00 and runs at 100% capacity during the day, 09:00-17:00

Café Mechanical ventilation

- 10 l/s/person
- Runs at 50% capacity overnight 17:00-09:00 and 100% capacity during the day 09:00-17:00

Multi-purpose space ventilation:

- 10 l/s/person
- Runs at 50% capacity overnight 17:00-09:00 and runs at 100% capacity during the day, 09:00-17:00

5 Results & Discussion

The initial TM52 assessment results are shown in the Table directly below.

Space Name	Criteria 1	Criteria 2	Criteria 3	Result
Worship space (160-person occupancy)	1.8	13	4	Pass
Worship space (250-person occupancy)	2.3	17	5	Fail
Cafe	9.3	27	6	Fail
Multi-purpose space	13.5	12	5	Fail

5.1 Worship space

Following an initial simulation, under the assumptions set out above (assuming that the services are running back-to-back; 09:00-12:00 and 12:30-15:30), the worship space achieves compliance for 160-person occupancy.

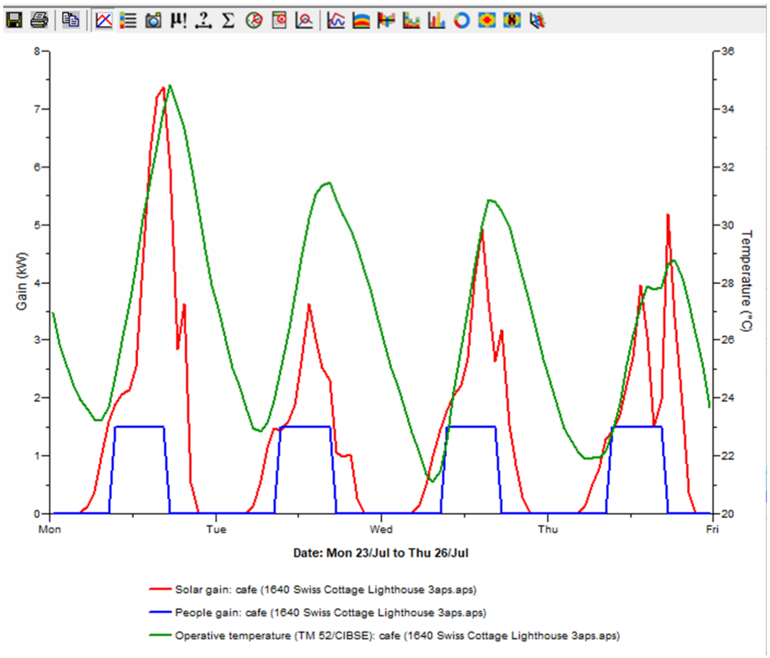
The following measures, however, are required to achieve compliance for 250-person occupancy:

1. Changing the ventilation profile such that at runs at 100% capacity between 08:00 and19:00 and at 50% capacity overnight between 19:00 and 08:00.

It should be noted that the timetable of the day makes a significant difference to the risk of the space overheating. It was found that back-to-back services 09:00-12:00 and 12:30-15:30 are less likely to overheat than services of the same occupancy for 09:00-12:00 and 17:00-20:00. This occupancy scenario doesn't comply with the criteria set out in TM52 for either 160 person or 250-person occupancy unless further measures are taken.

5.2 Café

For the conditions set out above, the space initially fails the TM52 analysis. As demonstrated by the graph below, this is largely caused by solar gains from the south facing windows as opposed to internal gains from people.



It is therefore suggested that, in order to achieve compliance with TM52, measures should be taken to limit solar gains.

The following measures could be applied, to achieve compliance:

1. Replacing the gypsum plasterboard lining the walls around the café (to both internal and external walls) with the equivalent thickness of fermacell
   and
2. Replacing the plasterboard lining to the ceiling with the equivalent thickness of fermacell - providing sufficient thermal mass to stop the space from overheating.
   and
3. Increasing the ventilation profile so that it operates at 100% between 08:00-19:00 (during the day), and at 50% overnight, between 19:00 and 08:00.
   and either
4. A blind included to the top 3rd of the curtain wall glazing, with a solar shading factor of 0.4 and short-wave radiance fraction of 0.3 (as suggested by table 8 in the IES user manual for a cream holland linen blind)
   or
5. Extending the horizontal solar shading element to a 300mm depth of overhang

5.4 Multi-purpose Space

The first-floor multi-purpose space is shown not to overheat, based on the following additional design measures:

1. The gypsum plasterboard lining to the ceiling is replaced with 45mm of fermacell.
   and
2. And changing the ventilation profile so that it operates at 100% between 08:00-19:00 and at 50% overnight, between 19:00 and 08:00.

As a result of the above measures, the overheating results are as follows:

Space Name	Criteria 1	Criteria 2	Criteria 3	Result
Worship space (160-person occupancy)	1.8	12	4	Pass
Worship space (250-person occupancy)	2.3	15	4	Pass
Cafe (modelled with 300mm overhang)	2.8	15	4	Pass
Cafe (modelled with a 1/3 blind)	2.4	14	4	Pass
Multi-purpose space	3.1	4	3	Pass

7 Conclusion

Whilst the initial modelling indicated that overheating may be problematic within the building, following the application of a few passive design measures it is anticipated that overheating could be mitigated.

Since there is relatively little exposed thermal mass within the spaces via the building structure, introducing fermacell lining to the internal partitions becomes effective, providing a means of absorbing the gains throughout the day so they don't build-up and cause overheating later in the day.

It has been suggested that 30mm of fermacell to all walls (within the key spaces modelled) should be used, to gain the most effective use of thermal mass.

A greater depth of fermacell to the ceiling of the multi-purpose space is suggested, within the multi-purpose space at first floor level.

Reducing solar gains to the café is vital so it is recommended that a horizontal overhang is incorporated to the glazed front façade, and that the stone columns protrude forwards a minimum of 200mm.

Ventilation controls have generally been kept as simple as possible and instead thermal mass solutions have been favoured to make the building as easy to maintain as possible. Additionally, ventilation has been capped at a maximum capacity of 50% between the hours of 11pm-6am to adhere to noise restrictions.

Appendix II – Daylighting Study

SKELLY & COUCH

REPORT TITLE:

1640-SAC-RP-Daylighting report

PROJECT NUMBER:
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The Lighthouse Church, Swiss Cottage

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1.0	14/03/2025	Information	CH	NJ	First draft issue for comment

Contents

1 Introduction

This report has been produced to assess the provision of daylight within the refurbished Lighthouse Church, and allow the building fabric and form to develop, optimising the use of daylight for good visual comfort.

The provision of artificial light in a building can account for a significant proportion of a typical building's primary energy consumption. Maximising daylight within a building design can reduce this energy demand significantly whilst also creating a more pleasant internal environment. CIBSE Guide A gives the following quantitative guidance with regards to recommended daylight factor benchmarks:

"If the average daylight factor exceeds 5% on the horizontal plane, an interior will look cheerfully day lit, even in the absence of sunlight. If the average daylight factor is less than 2% the interior will not be perceived as well day lit and electric lighting may need to be in constant use."

2 Assessment Criteria

Historically, when designing for a well daylit building, the aim is to achieve a minimum daylight factor as well as also a good level of daylight uniformity to each space.

The latest BREEAM Technical Manual (HEA 01) sets out good practice standards to facilitate good visual comfort through daylighting. There is no requirement for a BREEAM rating for the Lighthouse Building, but the daylighting guidance is deemed a good target to meet best practice levels of daylight to key spaces.

To achieve the full BREEAM credits for HEA 01, the following criteria must be met:

a) 80% of the occupied spaces within a building must achieve a daylight factor of 2% or more
b) A daylight uniformity ratio of 0.3 (normally lit spaces) or 0.7 (top lit spaces) or minimum point daylight factor of at least 0.3 times the average daylight factor value must be achieved.
c) If item (2) cannot be achieved, a further assessment can be made to ensure that 80% of the space has a sky view as desk level, as well as the space achieving a particular room depth criterion.

3 Modelling

A daylighting analysis has been undertaken for the key occupied spaces across the building. Daylight analysis was carried out using the 'RadienceIES' module of the IES VE software. This analysis calculates the Average Daylight Factor (ADF), a measure of the proportion of daylight that reaches into a room. This analysis has been undertaken on the following spaces:

- Café
- First Floor multi-purpose space
- Worship space.

The average daylight factor of the room is calculated based off the average daylight factor in the useable areas, therefore corners and the edges of the walls have been excluded, additionally the daylight factor has been assessed as 0.8m off the floor level.

Internal daylighting calculations will assume the following internal surface colours based off the architectural images “2401_RWA_Internal Images.pdf”:

Internal Surface	Surface Colour
Worship space internal walls (café)	White
Worship space internal walls (flexible hall)	Dark brown
Worship space upper internal walls (roof extension)	Light brown
Worship space floor	Dark brown
Worship space roof	Dark brown
Café external wall	White
Café internal partition (worship space)	Light brown to grey
Café internal partition (meeting room)	Light brown
Café floor	Red to brown
Café internal ceiling	White
Multi-purpose space internal walls	Dark green
Multi-purpose space floors	Light brown
Multi-purpose space internal ceiling	White
Doors	White

Figure 1: *Architect images depicting the internal finishes of the café (left) and multi-purpose space (right)*

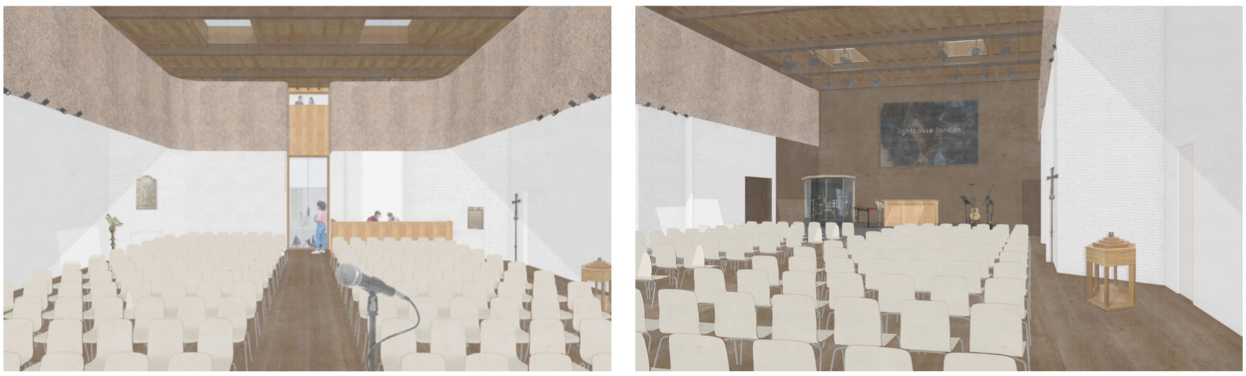

Figure 2: *Architect images depicting the internal finishes of the worship space*

3.1 Weather Data

For the daylighting model, the "CIE Overcast Sky" has been selected to present a standard level of overcast skylight distribution for the simulation.

3.2 Shading

The following elements of shading have been accounted for within the modelling assessment:

- Adjacent buildings (as currently built) have been modelled.
- Local shading has been added to the café; the stone columns have been modelled as extending 200mm while an overhang of both 200mm and 300mm have been modelled.
- Blinds and curtains are not accounted for in shading calculations
- The shading assigned to the model doesn't account for any foliage or trees.

4 Results

The following table outlines the results of the daylighting modelling, undertaken to date:

Name of space	Daylight factor	Uniformity	Minium daylight factor
Worship space (clerestory windows)	1.20	0.05	0.07
Worship space (rooflights)	2.00	0.16	0.31
Café (incl. 300mm overhang)	5.32	0.17	0.86
Multi-purpose space	3.51	0.002 (0.03 when corridor is excluded)	0.1 (when corridor is excluded)

4.1 Worship space

The existing worship space achieves very good levels of daylighting, due to a large rooflight which floods the space with natural daylight.

The initial design of the Worship space included 1m high clerestory windows along the length of the space, at high level. Since this design fell below good practice levels of daylighting, a roof design incorporating skylights was subsequently explored, to aim to improve the daylighting to the space.

4.1.1 Clerestory windows

The initial Stage 2/3 design featured two clerestory windows which ran along the lengths of the new roof of the worship space, each 1m in height. Despite the large amount of glazing, this design achieved a low daylight intensity, which is partially due to shading from Lief house and The Quarters.

Additionally, as the wings of the worship space sat below the windows, they were poorly lit, decreasing the average daylight factor and the uniformity.

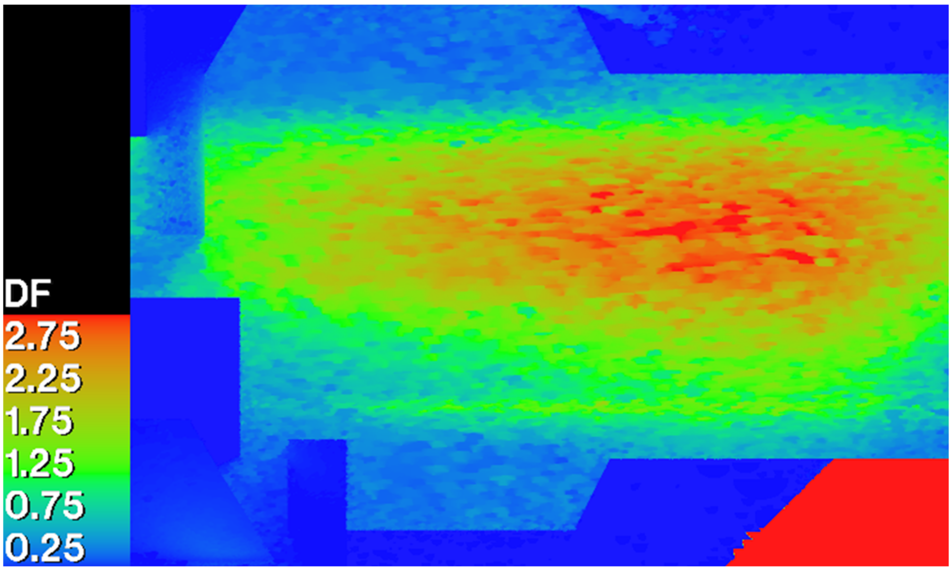

Figure 3: *Image showing the average daylight factor for the initial worship space design*

4.1.2 Rooflights (angled 30 degrees to the north)

It has been suggested that 6No. evenly spaced 1.5m x 1.5m rooflights could be used, in place of the clerestory windows, to allow daylight into the space. They have been angled 30 degrees to north-west to reduce the amount of direct sunlight (therefore reducing the risk of overheating).

They collect more light, as the effects of shading from the adjacent buildings is reduced. Greater uniformity is also achieved, as they are better able to light the wings.

This scenario achieves a greater daylight factor however the layout and size of the rooflights are restricted by cost, structural beams supporting the roof and plant equipment mounted on the roof. It should also be considered that there is a greater risk of overheating for rooflights.

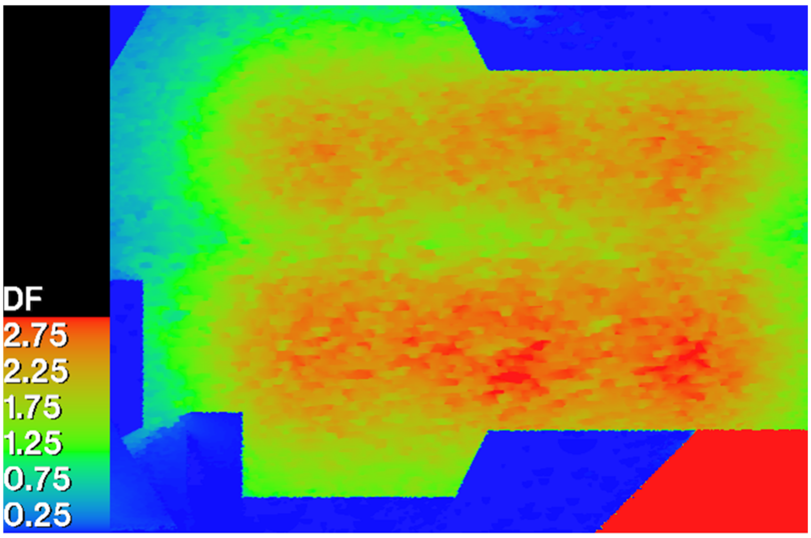

Figure 4: *Image showing the average daylight factor for the worship space with rooflights*

4.2 Café

The café is lit by a large, south-east facing glazed façade. As with the worship space, efforts have been made to reduce overheating without compromising the daylighting. In this case it has been achieved through modelling the windows as recessed to the back of the stone-faced columns, and introducing an overhang of protruding past the columns.

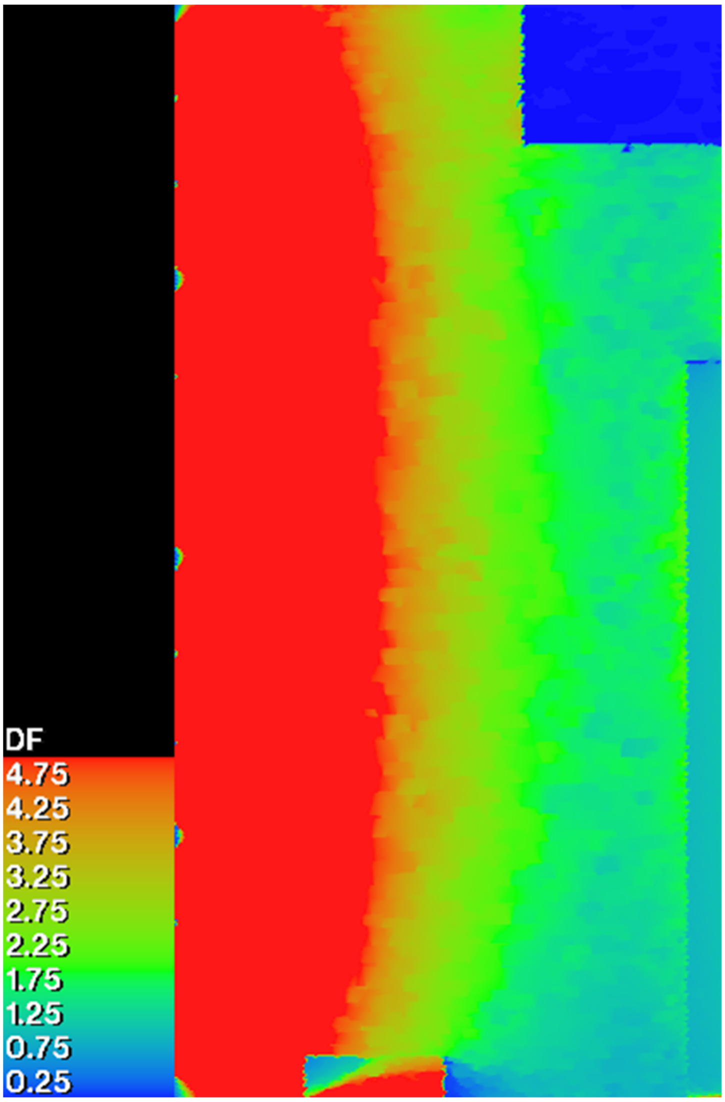

Figure 5: *Image showing the average daylight factor for the café with 300mm overhang modelled*

4.4 Multi-purpose space

This space achieves a high daylight factor as a large proportion of the fabric of the room is glazed however, as the room is quite low and features an unlit corridor, the uniformity of the space is very low. The uniformity increases when the useable area restricts the corridor however the change to the daylight factor is negligible.

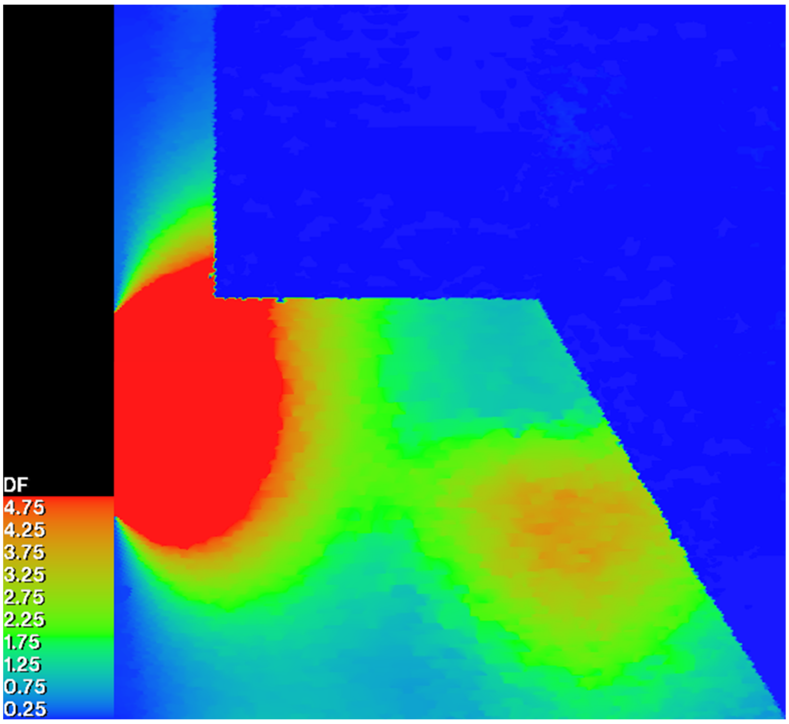

Figure 6: *Image showing the average daylight factor for the multi-purpose space*

To further improve the uniformity, the large window could be centred within the space and the bottom third of the window removed.

5 Conclusion

The daylighting modelling and analysis carried out shows that, following some minor tweaks to the building form, the key occupied spaces achieve a daylight factor of 2.

Some of the spaces, however, see a lower uniformity than would ideally be desirable. This is partly due to unideal height/depth proportions of the spaces, meaning getting daylight into the spaces is hard to achieve without significant (and costly) design changes.

It has been deemed appropriate to focus on achieving a good daylight factor to the spaces, with as best uniformity as achievable without introducing more glazing. It is important to consider that as more glazing is introduced, the risk of overheating to the spaces becomes greater. This is particularly prominent within this building, due to the building orientation, lightweight structure, and site constraints.