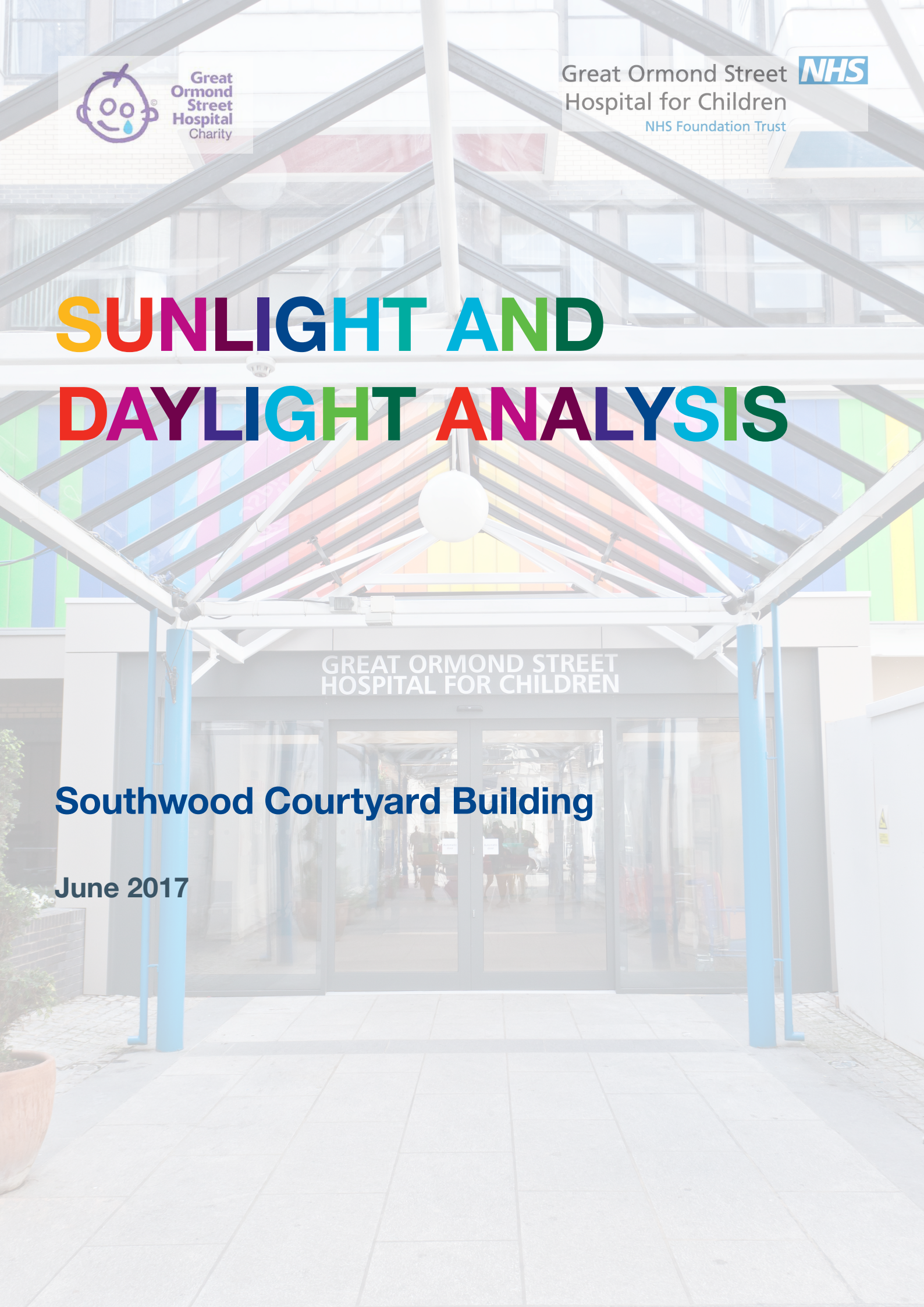
Great Ormond Street Hospital Charity

Great Ormond Street Hospital for Children NHS Foundation Trust

SUNLIGHT AND DAYLIGHT ANALYSIS



Southwood Courtyard Building

June 2017

Sunlight and Daylight Statement

Delva Patman Redler LLP

The Development for the Southwood Courtyard Building – Desk Top Daylight Report

This study has been carried out in accordance with the recommendations of the Building Research Establishment Report "Site Layout Planning for Daylight & Sunlight 2011" (BRE209).

The Proposal

The proposals include the construction of a three storey building centrally located within the courtyard adjacent to the Chapel building. The intention is to use a Kalwall product which can emit light to provide an alternative source of light to natural daylight levels to adjacent rooms surrounding the development site.

Policy / Guidelines

This study has been carried out in accordance with the recommendations of the Building Research Establishment report "Site Layout Planning for Daylight & Sunlight 2011". This is the recognised standard against which daylight and sunlight should be assessed.

The BRE guide is intended for building designers and their clients, consultants and planning officials. The advice given is not mandatory and the report should not be seen as a part of planning policy. Its aim is to help rather than constrain the designer. Although it gives numerical guidelines, these should be interpreted flexibly because natural lighting is only one of the many factors in site layout design. In certain circumstances the developer or planning authority may wish to use alternative target values.

Whilst technical analysis can be carried out in accordance with numerical guidelines and reported factually by comparison with those guidelines, the final assessment as to whether affected dwellings are left with acceptable amounts of daylight and sunlight in an inner-city context where the findings are to be interpreted in a flexible manner is a matter of subjective opinion.

Methodology

The Daylight assessments have been undertaken by reference to the Building Research Establishment (BRE) guidelines "Site Layout Planning for Daylight & Sunlight. A Guide to Good Practice".

The BRE Report advises that daylight levels should be assessed for the main habitable rooms of neighbouring residential properties. Habitable rooms in residential properties are defined as kitchens, living rooms and dining

rooms. Bedrooms are less important as they are mainly occupied at night time. The report also makes reference to other property types, which may be regarded as 'sensitive receptors' such as schools, hospitals, hotels and hostels, small workshops and most offices

Daylight

The BRE Guide states that:

> *"If, for any part of the new development, the angle from the centre of the lowest affected window to the head of the new development is more than 25^{o}, then a more detailed check is needed to find the loss of skylight to the existing buildings."*

The BRE guidelines propose several methods for calculating daylight. The two main methods predominantly used are those involving the measurement of the total amount of skylight available (the vertical sky component (VSC)) and its distribution within the building (the No-Sky line).

The VSC calculation is a general test of potential for daylight to a building, measuring the light available on the outside plane of windows.

The No-Sky Line divides those areas of the working plane which can receive direct skylight, from those which cannot. It provides an indication of how good the daylight distribution is within a room.

The third recognised method of assessment for daylight is the Average Daylight Factor (ADF) calculation which assesses the quality and distribution of light within a room served by a window and takes into account the VSC value, the size and number of the windows and room and the use to which the room is put. ADF assesses actual light distribution within a defined room area whereas the VSC considers potential light. British Standard 8206, Code of Practice for Daylighting recommends ADF values of 1% in bedrooms, 1.5% in living rooms and 2% in kitchens. There is no general requirement within the BRE guidelines to assess ADF values, other than for neighbouring residential buildings.

Sunlight

The BRE have produced sunlight templates for London, Manchester and Edinburgh indicating the Annual Probable Sunlight Hours (APSH) for these regions. The London template has been selected for this study as the London indicator template is the closest of the three available from BRE in terms of latitude.

Sunlight analysis is undertaken by measuring annual probable sunlight hours (APSH) for the main windows of rooms which face within 90^{o} of due south. The maximum number of annual probable sunlight hours for the London orientation is 1,486 hours. The BRE guidelines propose that the appropriate date for undertaking a sunlight assessment is on 21st March, being the spring equinox. Calculations of both summer and winter availability are made with the winter analysis covering the period from the 21st September to 21st March. For residential accommodation, the main requirement for sunlight is in living rooms and it is regarded as less important in bedrooms and kitchens.

Buildings surrounding the site including the Chapel building, the Southwood building and the Variety Club Building have been considered for assessment.

At this stage only the primary VSC assessment has been considered for the purposes of this preliminary report.

Source Data

The studies have been undertaken by calculating the daylight based on the template drawings provided within the BRE guidelines. The studies have been undertaken with plan drawings derived from:

- Existing & Surrounding buildings:

ZMapping 3D contextual massing model:

Southwood Building: Dwg's received via GOSH: 25/01/2017; Dwg no's: C2, C3, C4, C5, CX(CP2134)001 - 020

The Chapel & VCB: Dwg no's: B2

Ansell Bailey Architects: Dwg no's: 16021(09)002

- Proposed scheme:

Proposed Scheme: Ansell Bailey Architects: Dwg No's: 16021(03)003, 16021(03)002, 16021(02)011, 16021(02)010, 16021(02)009, 16021(02)008, 16021(01)005, 16021(01)004, 16021(01)003, 16021(01)002.

The daylight assessments have been undertaken using the primary VSC, No Sky Line and ADF calculation methods in accordance with BRE Guidance. All relevant windows/rooms considered to be serving habitable rooms have been assessed for this assessment.

Significance Criteria

The guidance given by BRE has been used as a basis for the criteria to assess the Development's potential effects. The BRE guidance specifies:

> *"…In special circumstances the developer or planning authority may wish to use different target values. For example, in an historic city centre a higher degree of obstruction may be unavoidable…"*

The report adds:

> *"…Different criteria may be used, based on the requirements for daylighting in an area viewed against other site layout constraints."*

In consideration of the above, it is important to note that the Site is located in a dense urban centre that, in parts, currently experiences adverse daylight and sunlight levels. This is discussed within the 'Baseline Conditions' section of this report. Thus, in these instances the BRE guidance states that the:

> *"…guidelines should be applied sensibly and flexibly".*

Under these circumstances, the less stringent, higher BRE target percentage loss values and significance criteria may be justifiable.

In describing the significance criteria as set out below, it should be noted that they have been developed to protect residential properties, which are the most sensitive receptors.
The BRE guidance is summarised in Table 1 and this has been used as the basis for the criteria used in the assessment of daylight and sunlight impacts.

Table 1: BRE Daylight Guidance used in the Assessment

Issue	Criteria
Neighbouring Daylight	A window may be affected if the vertical sky component **(VSC)** measured at the centre of the window is less than 27% and less than 0.8 times its former value.
	A room may be affected if the area of the working plane in a room which can receive direct skylight (No Sky Line) is reduced to less than 0.8 times its former value
	A room may be adversely affected if the average daylight factor **(ADF)** is less than 1% for a bedroom, 1.5% for a living room or 2% for a kitchen.
Neighbouring Sunlight	A window may be adversely affected if a point at the centre of the window receives in the year less than 25% of the annual probable sunlight hours including at least 5% of the annual probable sunlight hours (APSH) during the winter months (21 September to 21 March) and less than 0.8 times its former sunlight hours during either period.

It is of note that for daylight calculations, total reliance upon numerical values and particularly percentage changes may be misleading particularly where baseline values are already comparatively low, as is often the case in dense

urban locations such as this. A percentage change of more than 20% may well represent only a very small difference in actual light value.

Additionally, it should be borne in mind that Page 1 of the BRE guidance suggests that circumstances will exist where an alternative criteria value may be used, for example, in a city centre:

> *"…where a higher degree of obstruction may be unavoidable if new developments are to match the height and proportions of existing buildings".*

In such instances, the BRE guidance advises that the numerical guidelines should be interpreted flexibly, and alternative numerical values may be used. The Site's dense urban location justifies this flexible interpretation of the BRE guidance.

Baseline Conditions

An analysis of the impact of the existing buildings (the baseline conditions) against which to compare any potential impact arising from the development has been undertaken based on Drawing 17028/SPT/800 in appendix A.

The site is in very close proximity to the adjacent buildings which are not in residential occupation. Therefore, the sensitivity of the neighbouring building in terms of natural light is generally of lower significance than if they were principle habitable rooms.

The existing light levels in the Southwood building are also principally affected by a combination of the relatively tight enclosed courtyard space as well as the presence of the external balconies/fire escape walk ways which substantially inhibit the access of natural light into the rooms of this building.

The restriction to the access of natural light in the current condition is such that in many cases the current light levels are virtually zero and when in use the rooms are constantly lit by electrical lighting rather than reliance on natural light levels.

This can be seen in the attached table illustrating the existing VSC levels which are all well below 10% and in many cases are below 1% or are in fact zero currently.

Results - Proposed Condition

It is quite clear that the proposed building will reduce the access to natural light to the neighbouring windows/rooms where there is access to daylight and as the existing baseline figures are so low any reduction no matter how small could represent a reduction in excess of the 20% recommended limit by the BRE Guidance.

In reality therefore whist a comparison of percentage reductions is likely to illustrate a reduction beyond BRE Guidance levels the actual quantum of change is very small and barely noticeable in many instances.

The attached table illustrates that the actual real change is 2.45 percentage VSC points which may well be barely noticeable in many instances.

Moreover, as the healthcare and medical use of the rooms currently is dependent on the use of electrical light rather than natural light it is considered unlikely that the actual beneficial use of the rooms will experience any material effect and their intended uses will remain unchanged.

Added to this the anticipated beneficial effects that the Kalwall product is purported to produce it may well be that some of those very poorly lit rooms in the current condition will have the perception of better light levels as a result of the diffuse transmitted light emitting from the iMRI building when lit from the inside.

At this point we are unable to comment directly on the effects or benefit that the Kalwall product will have as we are yet to receive confirmation of the specification and light emitting benefits that this material will actually generate.

Conclusions

The site is in very close proximity to the adjacent buildings which are not in residential occupation. Therefore, the sensitivity of the neighbouring building in terms of natural light is generally of lower significance than if they were principle habitable rooms.

To assess the development's potential daylight impact on neighbouring properties a baseline assessment was undertaken. The main methods of assessment include the Vertical Sky Component (VSC), No Sky Line (daylight distribution) and Average Daylight Factor (ADF) for daylight analysis and the Annual Probable Sunlight Hours (APSH) using the waldram diagram template drawings provided by the Building Research Establishment.

All relevant neighbouring buildings adjacent to the development site that are likely to be affected have been considered in this assessment.

The existing daylight analysis demonstrates that all neighbouring existing windows/rooms currently experience very low levels of existing light principally due to the proximity of the courtyard itself along with the presence of deep external balconies/fire escape walk ways which substantially inhibit the access of natural light into the rooms of this building.

The restriction to the access of natural light in the current condition is such that in many cases the current light levels are virtually zero and when in use the rooms are constantly lit by electrical lighting rather than reliance on natural light levels.

This can be seen in the attached table illustrating the existing VSC levels which are all well below 10% and in many cases are below 1% or are in fact zero currently.

Whist it is recognised that the proposed building will block the access of natural light further it is anticipated that the actual quantum of change will be so low in the majority of instances that the differences will be barely noticeable particularly given that the use of the rooms in question currently is dependent on the use of electrical light rather than natural light it is considered unlikely that the actual beneficial use of the rooms will experience any material effect and their intended uses will remain unchanged.

Added to this the anticipated beneficial effects that the Kalwall product is purported to produce it may well be that some of those very poorly lit rooms in the current condition will have the perception of better light levels as a result of the diffuse transmitted light emitting from the iMRI building when lit from the inside.

Interior Lighting Analysis

The Richard Stephens Partnership

1.0 INTRODUCTION

The Richard Stephens Partnership have been commissioned to undertake a visual and measured survey of the lighting levels in St Christopher's Chapel, located on Level 02 at Great Ormond Street Hospital and report the findings.

This survey accompanies a full Planning Application dated June 2017. The Planning Application is submitted on behalf of Great Ormond Street Hospital for Children – NHS Foundation Trust, known as GOSH and is referred to as the Trust, hereafter. Redevelopment is part of the Trust's ongoing commitment to updating the Hospital's existing facilities and deliver an improved model of care into the 21st Century.

Redevelopment of the wider campus is now substantially underway, with a number of buildings and associated public realm already completed, occupied or under construction. This includes: the Morgan Stanley Clinical Building, which opened in 2012; the Premier Inn Clinical Building, due to be completed mid-late 2017; and the Zayed Centre for Rare Disease in Children, which commenced construction in 2016 and is due for completion in 2018.

Development of the Southwood Courtyard Building comes forward as part of the Trust's next phase of works in relation to the Frontage Building, which is described in more detail in the Design and Access Statement.

The Southwood Courtyard Building occupies a central location in the western half of the GOSH campus site. It is adjacent to the Southwood Building, the Variety Club Building to the north, east, south and west, and to a lesser extent the Paul O'Gorman Building to the south. In addition the building will be immediately adjacent to the grade II* listed Chapel of St. Christopher (Hospital Chapel). Powis Place, a privately owned road lies to the west of the site.

The location of the Southwood Courtyard Building and the Planning Application submission boundary are shown on the submitted drawings for approval.

St Christopher's Chapel has a series of stained glass windows on the east-facing facade. These windows overlook the external courtyard and therefore benefit from a limited amount of natural light that filters into the courtyard past multi-storey buildings on all four sides.

The proposal to construct a single building comprising three floors for hospital use within an external courtyard. The impact of development is likely to reduce the amount of natural light penetrating into the Chapel windows.

2.0 SURVEY RESULTS

The full list of survey conditions and results are included in a separate report in **Appendix A** of this document. The main points to note are:

a) The survey was carried out on a sunny day in April 2017.

b) The light meter readings taken vary between 5.0 lux and 98.2 lux.

c) The one high reading was caused by the sun reflecting off windows and other permanent structures attached to the building on the opposite side of the courtyard.

d) It should be possible to maintain or improve the illumination levels measured, with a target for improvement up to a level of 50 lux, without causing sky glow and/or light trespass and/or glare or an unnatural appearance inside the Chapel.

3.0 DESIGN PROPOSALS

To offset the perceived loss of light on the stained glass windows, the design team are proposing to introduce three new elements of artificial lighting that will raise the illumination levels outside the Chapel and therefore give the appearance of bright external space when viewed from inside.

The three new elements of the proposed lighting design are:

a) Using the internal corridor lighting on Levels 02 and 03 of the new building to shine through an opaque wall-cladding system (Kalwall) so that the nearest new wall facing the Chapel will have a bright and even surface.

This lighting element will be controlled via a timeswitch to ensure that it is energised at all times when the Chapel is available for occupation. In normal circumstances, this will be for at least 15 hours per day due to the expected use of the building.

b) To further enhance the bright surface of the Kalwall, a continuous strip of linear LED luminaires will be installed at high level and at low level to shine down and up along the length of wall facing the Chapel. This will have two benefits because, apart from contributing to the Chapel “light box” effect, the light will also spill through the Kalwall into the internal corridor areas.

These LED luminaires will also be timeswitch controlled, but on a different timer.

c) The final new lighting element will be some in-ground mini-LED spotlights that will be aimed up onto the back of each stained glass panel so that some light will be directed through the glass and into the Chapel to "lift" the eastern end in the same way that natural daylight would.

These spotlights will also be controlled via a timeswitch but, again, on a different timer.

The main advantage of using the "Kalwall" as a major component of the backdrop, is that the energy used will be "free". The light that passes through the wall surfaces will be designed in accordance with the Trust's requirements for the internal lighting scheme (200 lux) and the energy needed to maintain these lights will be expended to illuminate the corridors irrespective of whether or not the Chapel interior levels need to be improved. In this sense, the "borrowed" light produced will be utilised at no additional cost to GOSH. It is expected that the natural hours of occupation will be from 6:00 a.m. to 9:00 p.m.

By using three different lighting elements, there will be a potential for varying the illumination levels in a simple way to replicate the natural rise and fall of light during a 24-hour cycle of the day. By switching on, say, the corridor lights first in the morning, then the up/down linear LED's one hour later, then the floodlights, say, one hour later again, the natural rhythm of the day can be followed by having the brightest appearance in the middle of the day. During the evening, a similar shutdown sequence could be followed. Other timing sequences could also be explored if they were considered to be a positive influence on the end result.

It has been suggested that a better solution would be to install light boxes close to the outer surface of the stained glass. This would ensure uniform illumination across the glass and a glare-free result. Unfortunately, this would be a really poor solution for St Christopher's Chapel, because the light boxes would be visible from outside the Chapel and the effect of the stained glass outside the building would be lost forever. It is hard to believe that such a radical change in the appearance of a listed building would be acceptable to the Planning Department of the London Borough of Camden.

4.0 TECHNICAL OBJECTIVES

CIBSE design guidance stresses the importance of good colour rendering in this type of installation. The luminaires used will therefore have a CRI greater than 90.

Where daylight needs to be replicated, luminaires with a colour temperature greater than 4000K should be used. The internal corridor will be illuminated using LED's at 4000K, in accordance with CIBSE Guide LG2. To raise the overall colour temperature, the up and down linear fittings will be specified at 5000K and the ground mounted spotlights at 5000K. Higher colour temperatures close to the stained glass should be avoided as the higher colours start to look more "blue" and this could have a detrimental effect on some of the reds and yellows in the stained glass panels. The optimum blend of colour temperatures is likely to be in the region of 4700K.

Some of these issues are recognised in CIBSE Guide LG10 - Lighting for Places of Worship. Section 5.9.7 deals specifically with stained glass windows and this text includes the recommendation: "It is almost always necessary to experiment on site to achieve successful results, but in spite of the difficulties, lighting stained-glass windows can, with care and patience, produce some striking effects".

Therefore, whatever design proposal is adopted, there will need to be some flexibility in the scheme to add or remove some elements for the design objectives to be achieved. It is our intention to work with the London Borough of Camden and Historic England to achieve the best results possible.

5.0 POSSIBLE ADDITONAL BENEFIT

During the course of the site survey, it was noted that there are two existing stained glass windows inside the Chapel, (on the south side) that are permanently dark. This is because the Variety Club Building stands directly against the south wall of the Chapel, blocking all sources of natural light to the windows. It would appear that the beauty of the Clayton & Bell stained glass has been permanently lost to observers. However, by looking at the existing Level 02 plans (submitted as part of the Drawings Package), it can be seen that two shallow cupboards have been created in the corridor of the Variety Club Building that line up closely to the rear of both window openings.

On further investigation, the design team have found that the cupboards contain light boxes with fluorescent lamps that must have illuminated the stained glass windows for a period of time after the Variety Club Building was constructed. The light boxes are likely to be 20 years old so a full replacement will be proposed using LED technology, with dimming and colour rendering to suit the overall design intent of the Chapel lighting scheme. In this way, the "lost" images on the stained glass will be brought back to life, creating a spectacular betterment to the interior of the Chapel. This would arguably be more beneficial than works to the remaining windows where we are aiming for a small gain in brightness on windows that are currently inadequately illuminated by daylight alone.

6.0 CONCLUSIONS

With the methods described above, we believe that there will be no detriment to the internal appearance of the Chapel at GOSH. It may even be possible to enhance a fairly gloomy space by raising the illumination levels by a small degree. The ultimate objective would be to perceive a sunny day outside the Chapel and this can be achieved by using artificial sources of light.

If the two existing "dark" windows could also be brought back to life, there will be some tangible benefits for the Chapel users as a result of the iMRI building project.

7.0 REFERENCE DRAWINGS

The following RSP drawing should be read in conjunction with this report.

1717ESK20 – Existing Plan of St Christopher's Chapel with RSP Survey Notes

APPENDIX A

RECORD OF LIGHT METER READINGS TAKEN BY RSP IN ST CHRISTOPHER'S CHAPEL

Date: 7th April 2017

Time: 4:15 p.m.

Weather Conditions: Bright sunshine, clear blue sky

Appearance inside Chapel with lights off: Dull, sad, dreary. Not at all representative of the bright conditions outside.

Light Meter Type: CEM DT-1300
Serial Number: 08049793

Method:

With the Chapel empty and all artificial lighting sources switched off, the light meter sensor was placed to lie flat at the centre of each windowsill so that similar readings can be taken at a later date.

Schedule of readings taken:
(For window references refer to the attached sketch drawing)

WINDOW	LIGHT METER READING (Lux)
1	38.2
2	98.2
3	24.8
4	38.9
5	49.2
6	27.5
7	16.5
8	5.0
9	7.8
10	34.2

Window Details:

For tall windows (1, 2 and 10)

Dimensions (approx.): 2000mm high x 800mm wide

Sill height: 1780mm

For shorter windows (3 to 9)

Dimensions (approx.): 1500mm high x 500mm wide

Sill height: 1960mm

Note: there are two 120mm high steps into the apse that make the sills of the shorter windows more easily accessible than the figures above suggest.

Observations:

The one high reading on window 2 was investigated in more detail and, by finding the right viewing angle, it was determined that the sun was creating a bright beam of light on one of the surfaces (a wall or window) on the building opposite the Chapel. This beam of light was obviously shining onto window 2 and is likely to be a temporary phenomenon that would pass as the sun moved across the sky.

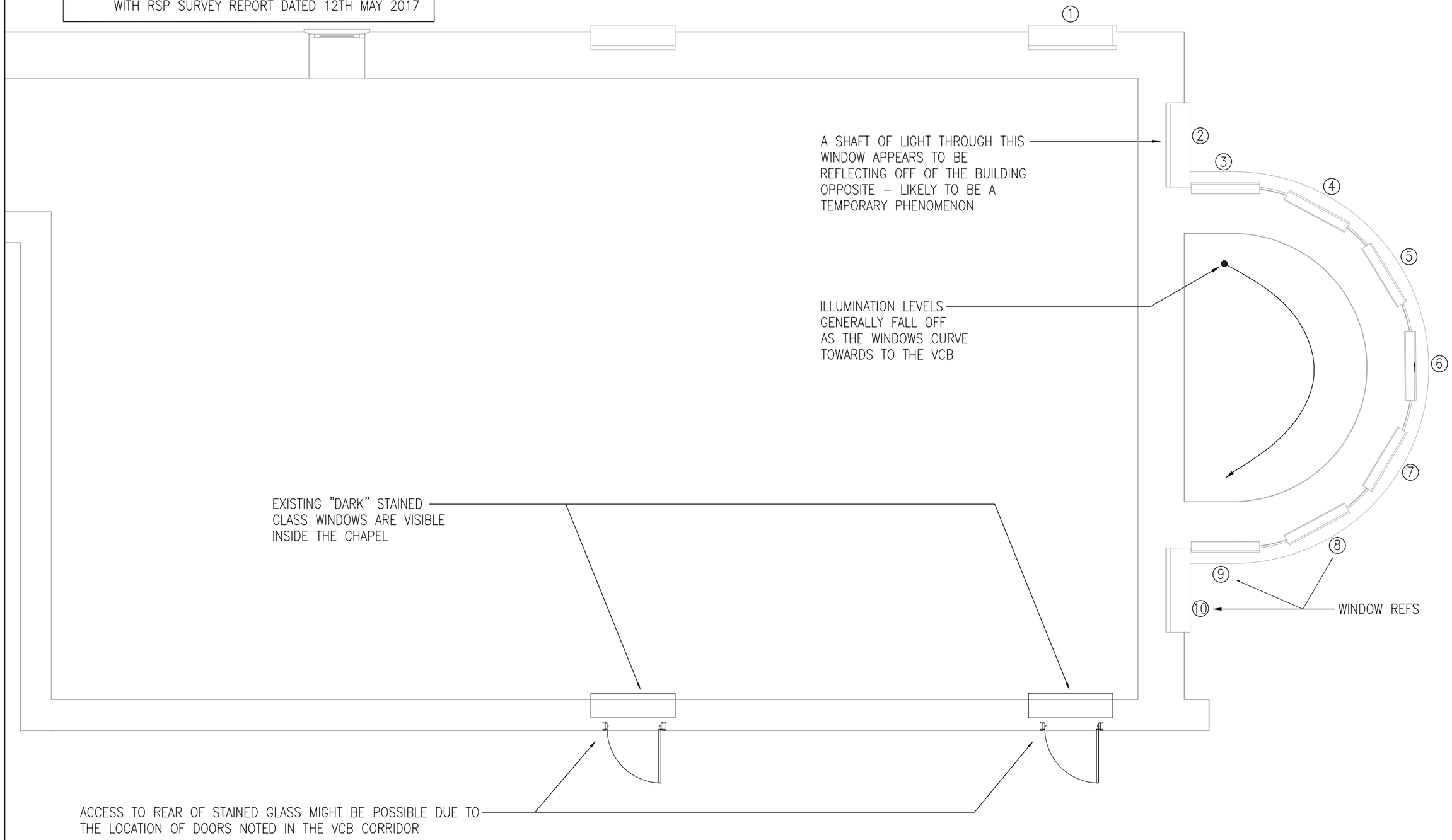
As expected, the windows that curve closest to and face towards the nearest existing building (VCB) gradually decrease in brightness.

If we can ignore window 2 as being the abnormally high reading, the average level of the other nine windows is 26.9 lux. If we use window 5 as the optimum value – around 50 lux - this would almost double the average amount of light passing trough the existing stained glass from outside and this would seem to be a reasonable target to aim for in the new scheme.

Survey notes and observations by:

David Baulcombe
RSP
12th May 2017

NOTE: THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH RSP SURVEY REPORT DATED 12TH MAY 2017



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GREAT ORMOND STREET HOSPITAL iMRI PROJECT

title
LEVEL 02
EXISTING PLAN OF ST CHRISTOPHER'S CHAPEL WITH RSP SURVEY NOTES

date	MAY 2017	scale	1:50 @ A3
designed	DB	cad	VY
checked	DB	approved	

drawing no. 1717ESK20

rev P1