

STATION HILL NORTH

READING

DAYLIGHT & SUNLIGHT DESIGN GUIDE

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1 EXECUTIVE SUMMARY

This document provides illustrations and design guidance in relation to the daylight and sunlight potential of the Station Hill Phase 2 and 3 residential elements being submitted in outline. Residential Plots (A, B and C) are being submitted in outline and are identified on page 3 of this report.

This report also discusses the provision of sunlit open spaces including the public realm within Phases 2 and 3, and any communal open spaces within the Phase 3 residential elements.

The purpose of this report is twofold:

- firstly, it aims to ascertain the potential of the outline elements of the scheme to offer acceptable daylight and sunlight amenity for the enjoyment of future occupants;
- secondly, it provides guidance to be used by the plot architects at the detailed stages to ensure they make the most of the daylight and sunlight available.

The approach contained within this report is based upon design guidance central to the BRE recommendations upon the availability of daylight and sunlight. The studies presented are based on the three Illustrative Scheme models (Options 1, 2 and 3) which provide realistic propositions of how the scheme could be built-out within the maximum parameters. Further and more detailed assessments should be provided in due course and in accordance to the level of planning application sought.

The daylight potential assessments have shown that the Vertical Sky Component (VSC) levels seen on the residential façades is generally good, with lower levels on the façades that overlook the courtyard between Plots A, B, C and D. In areas with lower daylight potential, care will need to be taken in relation to the design of fenestration, room depths and balconies. Recommendations and examples from Station Hill Phase 1 have been provided to aid the detailed design within challenging areas.

The sunlight potential assessments have shown that the Annual Probable Sunlight Hours (APSH) seen on the residential façades is generally in line with expectation given the site's density and urban location. Lower levels of APSH are mostly located within the lower floors facing into the courtyard but are also found on the lower levels overlooking Garrard Street, which is obstructed by Phase 1 to the south.

However, the upper floors within the courtyard and outer façades see good levels of sunlight potential.

The recommendations contained within this document will enable the design team to maximise the levels of daylight and sunlight within the residential elements of the proposed illustrative schemes, but it is expected that there will be habitable rooms with levels of daylight and sunlight lower than recommended by BRE. This is to be expected within any high-density mixed-use development. The levels of light reaching the façades are in line with Phase 1 which has been successfully designed in detail to offer adequate and acceptable levels of light.

In terms of overshadowing, the assessments have been undertaken on all proposed public and communal open spaces within the site both on 21st March and 21st June. The results have shown the proposed development will offer the potential future residents access to well sunlit communal outdoor amenity. The illustrative schemes, and parameter plans, have been designed to ensure the public realm performs as well as possible in the summer months when sunlit outdoor areas are most valued.

In conclusion, the proposed development has the potential to provide residential accommodation considered acceptable in terms of daylight, sunlight and overshadowing provided care is taken in certain areas where façades are situated in close proximity to one another.

2 SITE OVERVIEW

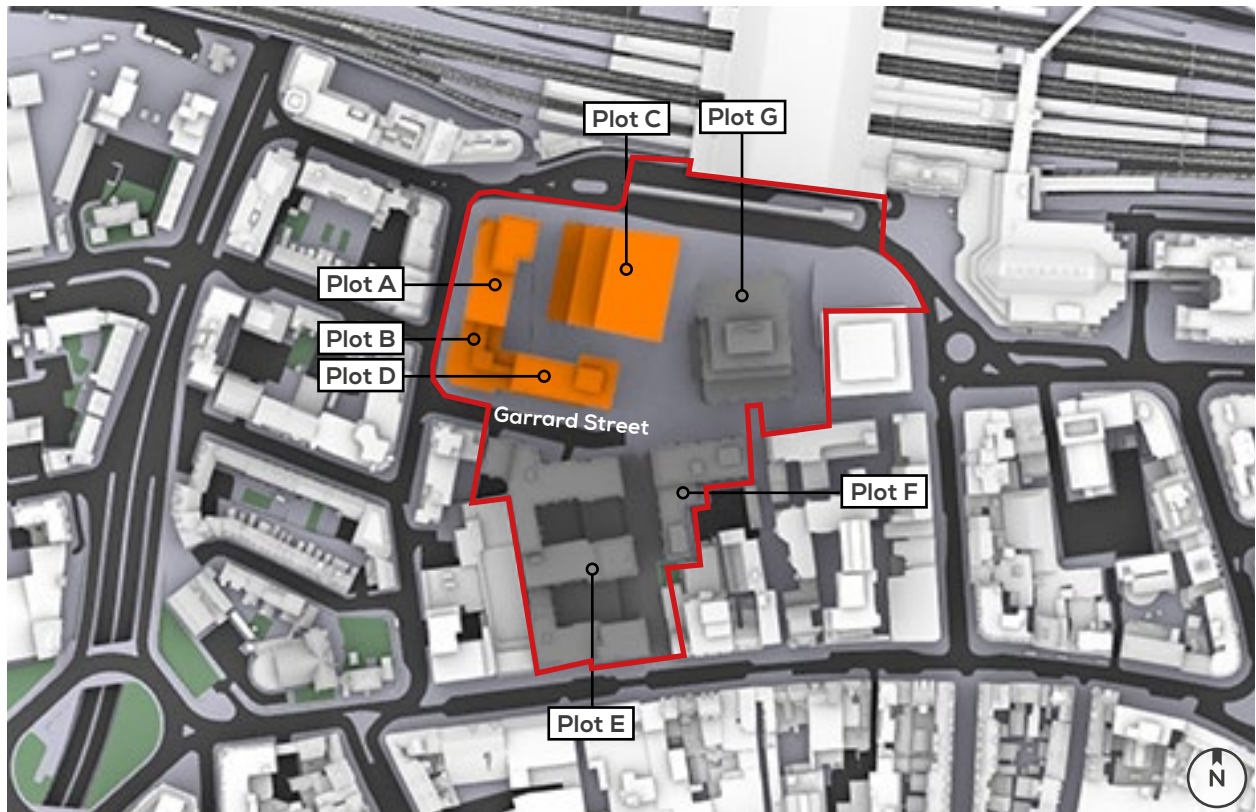


Fig. 02: Site Overview - Top view

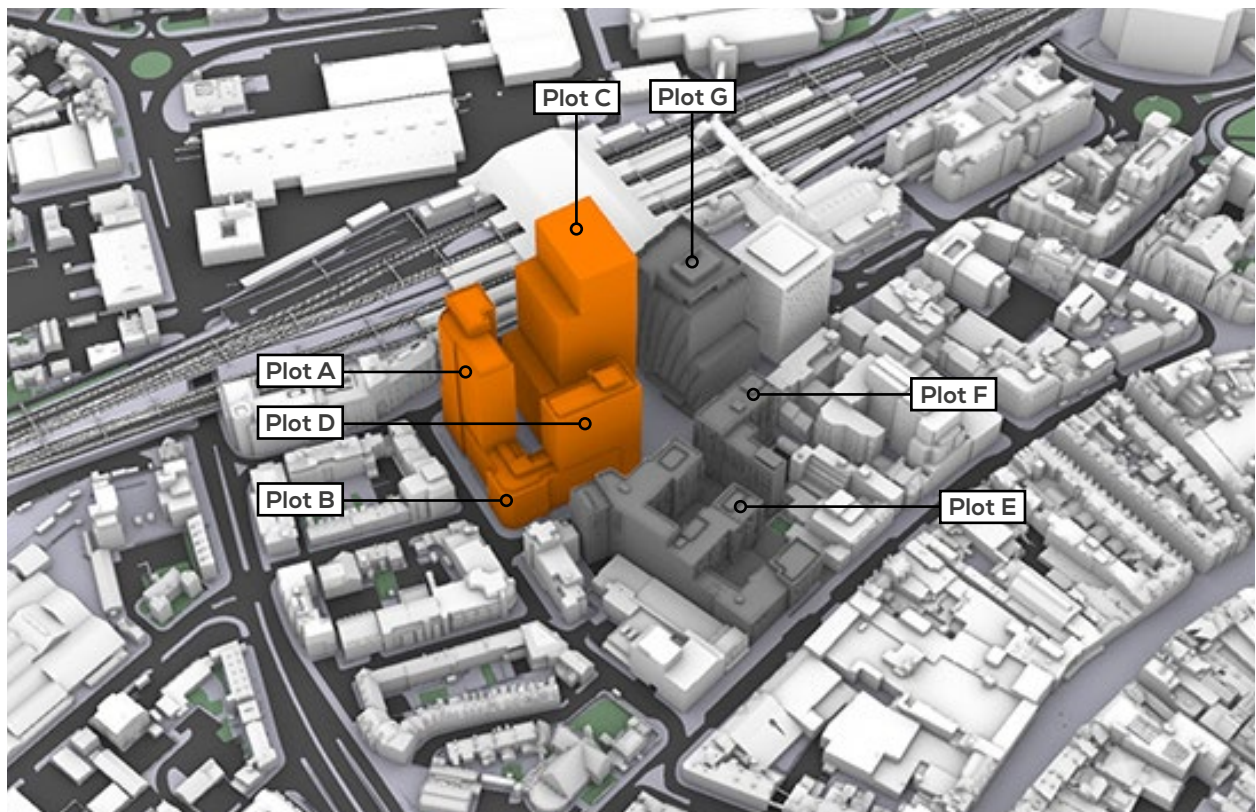


Fig. 01: Site Overview - Birds-eye view

3 BRE GUIDELINES

The Building Research Establishment (BRE) have set out in their handbook 'Site Layout Planning for Daylight and Sunlight a Guide to Good Practice (2011)', guidelines and methodology for the measurement and assessment of daylight and sunlight within proposed buildings.

The guide also provides advice on site layout planning to determine the quality of daylight and sunlight within open spaces between buildings.

It is important to note, however, that this document is a guide and states that its aim *"is to help rather than constrain the designer"*.

The document provides advice, but also clearly states that it *"is not mandatory and this document should not be seen as an instrument of planning policy."* The report also acknowledges in its introduction that *"in special circumstances the developer or planning authority may wish to use different target values. For example, in a historic city centre a higher degree of obstruction may be unavoidable if new developments are to match the height and proportions of existing buildings."*

It is an inevitable consequence of the built up urban environment that daylight and sunlight will be more limited in these areas. It is well acknowledged that in such situations there may be many other conflicting and potentially more important planning and urban design matters to consider other than just the provision of ideal levels of daylight and sunlight.

3.1 DAYLIGHT

The BRE set out various methods for assessing the daylight within a proposed building within section 2.1 and Appendix C of the handbook. These are summarised below.

Vertical Sky Component (VSC)

This method of assessment can be undertaken using a skylight indicator or a Waldram diagram. It measures from a single point, at the centre of the window (if known at the early design stage), the quantum of sky visible taking into account all external obstructions. Whilst these obstructions can be either other buildings or the general landscape, trees are usually ignored unless they form a continuous or dense belt of obstruction.

The VSC method is a useful 'rule of thumb' but has some significant limitations in determining the true quality of daylight within a proposed building. It does not take into account the size of the window, any reflected light off external obstructions, any reflected light within the room, or the use to which that room is put. Appendix C of the guide goes into more detail on these matters and sets forward alternative methods for assessment to overcome these limitations.

Appendix C of the BRE guide: Interior Daylighting Recommendations, states:

"The British Standard for daylighting, and the CIBSE Applications manual: window design, contain advice and guidance on interior daylighting. This guide to good practice is intended to be used in conjunction with them, and its guidance is intended to fit in with their recommendations."

For skylight, the British Standard and the CIBSE manual put forward three main criteria, based on the average daylight factor, room depth, and the position of the no skyline."

These assessments are set out below.

Average Daylight Factor (ADF)

"If a predominantly daylight appearance is required, then DF should be 5% or more if there is no supplementary electric lighting, or 2% or more if supplementary electric lighting is provided. There are additional recommendations for dwellings, of 2% for kitchens, 1.5% for living rooms and 1%

for bedrooms. These last are minimum values of Average Daylight Factor, and should be attained even if a predominantly daylight appearance is not required."

This method of assessment takes into account the total glazed area to the room, the transmittance quality of the glazing proposed, the total area of the room surfaces including ceilings and floors, and the internal average reflectance for the room being assessed. The method also takes into account the Vertical Sky Component and the quantum of reflected light off external surfaces.

This is, therefore, a significantly more detailed method of assessment than the Vertical Sky Component method set out above.

Room Depth Criterion (RDC)

Where it has access to daylight from windows in one wall only, the depth of a room can become a factor in determining the quantity of light within it. The BRE guidance provides a simple method for examining the ratio of room depth to window area. However, whilst it does take into account internal surface reflections, this method also has significant limitations in that it does not take into account any obstructions outside the window and therefore draws no input from the quantity of light entering the room.

No Sky Line (NSL)

This third method of assessment is a simple test to establish where within the proposed room the sky will be visible through the windows, taking into account external obstructions. The assessment is undertaken at working plane height (850mm above floor level) and the method of calculation is set out in Appendix D of the BRE handbook.

Appendix C of the BRE handbook states *"if a significant area of the working plane lies beyond the no skyline (i.e., it receives no direct skylight), then the distribution of daylight in the room will look poor and supplementary electric lighting will be required."* To guarantee a satisfactory daylight uniformity, the area which does not receive direct skylight should not exceed 20% of the floor area.

Summary

The Average Daylight Factor gives a more detailed assessment of the daylight within a room and takes into account the highest number of factors in establishing a quantitative output.

However, the conclusion of Appendix C of the BRE guide states:

"All three of the criteria need to be satisfied if the whole of the room is to look adequately daylight. Even if the amount of daylight in a room (given by the Average Daylight Factor) is sufficient, the overall daylight appearance will be impaired if its distribution is poor."

In most urban areas it is important to recognise that the distribution of daylight within a room may be difficult to achieve, given the built up nature of the environment. Consequently, most local authorities seek to ensure that there is sufficient daylight within the room as determined by the Average Daylight Factor calculation. However, the additional recommendations of the BRE for residential accommodation, set out above, ought not to be overlooked.

3.2 FURTHER RELEVANT INFORMATION

Further information can be found in The Daylight in Urban Areas Design Guide (Energy Saving Trust CE257, 2007) which provides the following recommendation with regards to VSC levels in urban areas:

"If 'theta' (Visible sky angle) is greater than 65° (obstruction angle less than 25° or VSC at least 27 percent) conventional window design will usually give reasonable results.

If 'theta' is between 45° and 65° (obstruction angle between 25° and 45°, VSC between 15 and 27 percent), special measures such as larger windows and changes to room layout are usually needed to provide adequate daylight.

If 'theta' is between 25° and 45° (obstruction angle between 45° and 65°, VSC from 5 to 15 percent), it is very difficult to provide adequate daylight unless very large windows are used.

If 'theta' is less than 25° (obstruction angle more than 65°, VSC less than 5 percent) it is often impossible to achieve reasonable daylight, even if the whole window wall is glazed."

3.3 SUNLIGHT

The BRE provide guidance in respect of sunlight quality for new developments within section 3.1 of the handbook. It is generally acknowledged that the presence of sunlight is more significant in residential accommodation than it is in commercial properties, and this is reflected in the BRE document.

It states, "in housing, the main requirement for sunlight is in living rooms, where it is valued at any time of the day, but especially in the afternoon. Sunlight is also required in conservatories. It is viewed as less important in bedrooms and in kitchens where people prefer it in the morning rather than the afternoon."

The BRE guide considers the critical aspects of orientation and overshadowing in determining the availability of sunlight at a proposed development site.

The guide proposes minimizing the number of dwellings whose living room face solely north unless there is some compensating factor such as an appealing view to the north, and it suggests a number of techniques to do so. Further more, it discusses massing solutions with a sensitive approach to overshadowing, so as to maximize access to sunlight.

At the same time it acknowledges that the site's existing urban environment may impose orientation or overshadowing constraints which may not be possible to overcome.

To quantify sunlight access for interiors where sunlight is expected, BRE refers to the Annual Probable Sunlight Hours criterion. APSH is defined as *"the total number of hours in the year that the sun is expected to shine on unobstructed ground, allowing for average levels of cloudiness at the location in question."* In line with the recommendation, APSH is measured from a point on the inside face of the window, should the locations have been decided. If these are unknown, sunlight availability is checked at points 1.6m above the ground or the lowest storey level on each main window wall, and no more than 5m apart. If a room has multiple windows on the same wall or on adjacent walls, the highest value of APSH should be taken into account. If a room has two windows on opposite walls, the APSH for each can be added together.

The summary of section 3.1 of the guide states as follows:

"In general, a dwelling or non-domestic building which has a particular requirement for sunlight, will appear reasonably sunlit provided that:

At least one main window faces within 90 degrees of due south;

and

The centre of at least one window to a main living room can receive 25% of annual probable sunlight hours, including at least 5% of annual probable sunlight hours in the winter months between 21 September and 21 March. "

In paragraph 3.1.11 the BRE guidance suggests that if a room faces significantly North of due East or West it is unlikely to meet the recommended levels. As such, it is clear that only windows facing within 90 degrees of due South can be assessed using this methodology.

3.4 OVERSHADOWING

The BRE guidance in respect of overshadowing of amenity spaces is set out in section 3.3 of the handbook. Here it states as follows:

"Sunlight in the spaces between buildings has an important impact on the overall appearance and ambiance of a development. It is valuable for a number of reasons:

- *To provide attractive sunlit views (all year)*
- *To make outdoor activities, like sitting out and children's play more pleasant (mainly during the warmer months)*
- *To encourage plant growth (mainly in spring and summer)*
- *To dry out the ground, reducing moss and slime (mainly during the colder months)*
- *To melt frost, ice and snow (in winter)*
- *To dry clothes (all year)"*

Again, it must be acknowledged that in urban areas the availability of sunlight on the ground is a factor which is significantly controlled by the existing urban fabric around the site in question and so may have very little to do with the form of the development itself. Likewise there may be many other urban design, planning and site constraints which determine and run contrary to the best form, siting and location of a proposed development in terms of availability of sun on the ground.

The summary of section 3.3 of the guide states as follows:

"3. 3 .17 It is recommended that for it to appear adequately sunlit throughout the year, at least half of a garden or amenity area should receive at least two hours of sunlight on 21 March. If as a result of new development an existing garden or amenity area does not meet the above, and the area which can receive two hours of sun on 21 March is less than 0.8 times its former value, then the loss of sunlight is likely to be noticeable. If a detailed calculation cannot be carried out, it is recommended that the centre of the area should receive at least two hours of sunlight on 21 March.

4 METHODOLOGY

The three dimensional representations of the proposed illustrative schemes have been modelled using the models provided to us by CallisonRTKL & Gensler. These have been placed in the context of the surrounding buildings which have been modelled from survey information, photogrammetry, OS and site photographs. This allows for a precise model, which in turn ensures that analysis accurately represents the amount of daylight and sunlight available to the building façades, internal and external spaces, considering all of the surrounding obstructions and orientation.

In order to portray the most realistic scenario, the assessments presented within this report have been undertaken using the three illustrative massing proposals for the Plots A, B, C and D, and the detailed massing for Plot G and the approved detailed massing for Plots E and F.

Daylight

The 3D computer model above was used to ascertain the Vertical Sky Component (VSC) values that would be enjoyed by the residential façades within the outline elements of the proposed development. This produced a number of VSC façade maps showing the VSC value that a window in that location would enjoy. The façades are split into tiles approximately one metre wide and one storey high, the colour of which represents the VSC value achieved at that location.

The VSC assessments are separated into the brackets outlined in Section 3.2 above which states that:

- with VSC levels above 27% conventional window design will usually give reasonable results;
- with VSC levels from 15–27%, special measures are required;
- with VSC levels from 5–15%, adequate daylight can only be provided with very large windows; and
- with VSC levels below 5%, it is often impossible to achieve reasonable levels of daylight.

However, the VSC studies' principal use should be as a starting point for establishing the potential for good daylighting indoors. As stated in Section 3.1, the VSC is a very simple test and good levels of daylight can still be found in rooms with low levels of VSC. The primary test for assessing daylight within a development proposed in detail is the ADF, therefore the VSC studies should be used to provide advice on how to achieve good levels of ADF at detailed design stage.

The VSC facade maps can be used to highlight pinch-points within the massing where care and attention is suggested to achieve good daylight ingress when these plots are taken forward to detailed design. The strategies outlined in Section 6 are examples drawn from the Phase 1 detailed elements of the Station Hill Masterplan where design features were utilised within challenging areas to improve the daylight conditions within the units. Once initial layouts are available, it is recommended the matrix tables are produced using the VSC facade maps within this study to give guidance on fenestration to achieve the recommended levels of ADF.

Sunlight

The 3D computer model above was also used to ascertain the Annual Probable Sunlight Hours (APSH) values that would be enjoyed by the residential façades within the outline element of the proposed development. As per the VSC assessment, the façades are split in tiles, the colour of which represents the APSH value achieved at that location. Two maps are produced from each viewpoint, one showing the levels of annual PSH and one showing the levels of winter PSH. The BRE's recommendations on APSH (set out in section 3.3) are that windows see 25% APSH total throughout the year with 5% of that being during the winter months.

Overshadowing - Sun Hours on Ground

The 3D computer model was again used to calculate the amount of sun falling onto the proposed communal and public open spaces. This was done both for the equinox (21st March), as recommended by the BRE, but also on the summer solstice (21st June) so as to show how the areas are likely to perform during the summer, when outdoor spaces are most likely to be utilised.

The BRE guidance recommends that at least 50% of each amenity space should receive direct sunlight for two or more hours on the equinox, therefore false-coloured diagrams have been produced to show the areas seeing at least two hours of sunlight on the equinox. In addition to this compliance test, sun exposure gradient diagrams have also been presented to better illustrate the amount of sunlight received by each amenity space on the equinox and summer solstice.

5 OPTION OVERVIEW



Fig. 03: Top view - Option 1

- Plot A - 24 Level of Residential
- Plot B - 8 Levels of Residential
- Plot C - 21 Levels of Offices
- Plot D - 18 Levels of Residential



Fig. 04: Top view - Option 2

- Plot A - 28 Levels of Residential
- Plot B - 8 Levels of Residential
- Plot C - 23 Levels of Offices
- Plot D - 18 Levels of Residential



Fig. 05: Top view - Option 3

- Plot A - 12 Levels of Residential
- 12 Levels of Hotel
- Plot B - 5 Levels of Hotel
- Plot C - 25 Levels of Offices
- Plot D - 8 Levels of Residential
- 10 Levels of Hotel

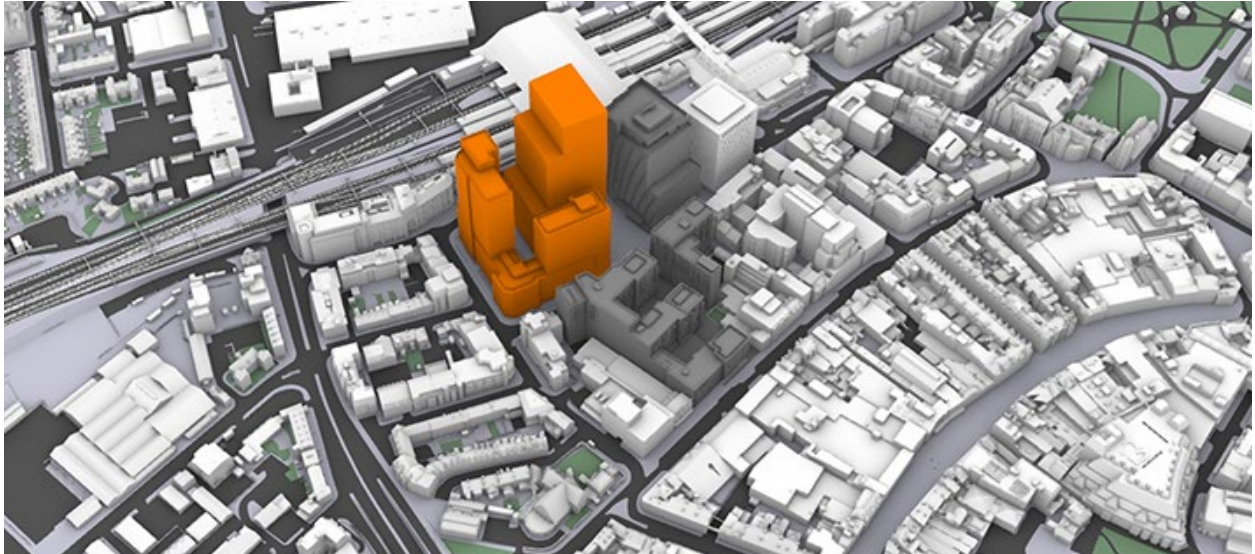


Fig. 06: Perspective view - Option 1

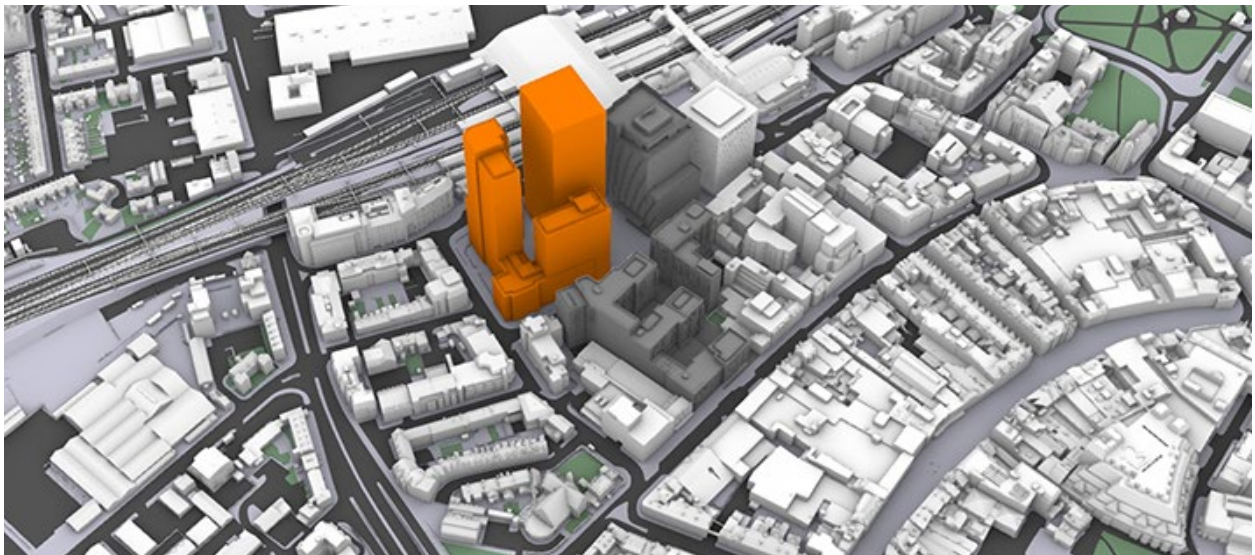


Fig. 07: Perspective view - Option 2

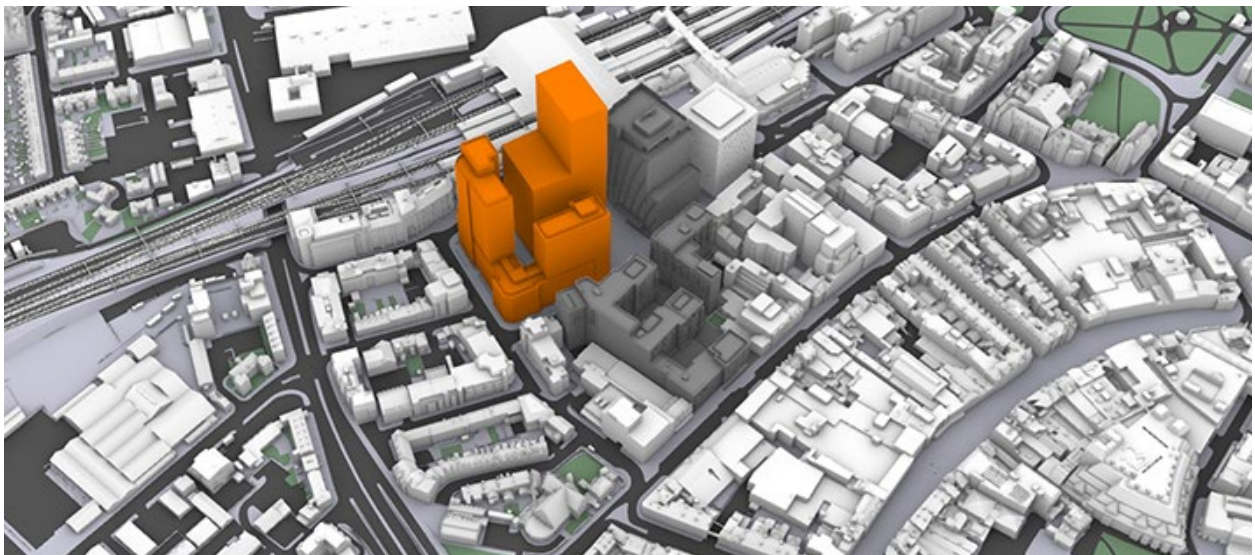


Fig. 08: Perspective view - Option 3

6 DISCUSSION & CONCLUSIONS

6.1 DESIGN EVOLUTION

The Station Hill Masterplan has been progressed alongside GIA, with daylight, sunlight and overshadowing being key drivers for a number of massing decisions.

A comprehensive and iterative design process has been undertaken in the development of the three illustrative schemes to ensure that the schemes offer acceptable daylight and sunlight potential. This in turn also ensures that the scheme can deliver acceptable levels of daylight and sunlight when it comes forward as Reserved Matters Applications (RMAs).

As part of the iterative design process, the following features have been incorporated to optimise the available daylight and sunlight:

- Distances between building façades have been increased to improve daylight;
- The gap between Plots D and G has been enlarged to improve overshadowing within the public realm;
- Stepping back of massing on the upper floors, especially Plot C, to allow great sky-visibility to the courtyard façades;
- Lowering of the south-western corner to increase daylight and sunlight within the courtyard amenity area;
- Setback of the Garrard Street façades to increase daylight reaching the lower floors; and
- Careful consideration given to potential uses such as locating hotel uses within the more constrained areas whilst residential in the areas with greater daylight availability.

It is also worth noting that historically, the Station Hill Masterplan has seen challenges in terms of daylight and overshadowing. This has been documented within the previous Environmental Statements

(application numbers 151426 and 151427) and cited within the most recent RMAs (application numbers 190465/REM and 190466/REM), which highlighted that:

'Within the 2015 ES, the VSC facade studies identified that care would be needed in the detailed design of these plots owing to the density of the scheme and its urban location. This was demonstrated by just 50% of the façades of Plot E and 25% of the façades of Plot F meeting the VSC recommendation of 27%. Furthermore, 34% of the façades of Plot E and 45% of the façades of Plot F were found to experience a VSC of 15% or less, which generally proves a more challenging starting point from which to offer acceptable levels of light indoors.'

Once designed in detail, the approved RMA for Plots E and F (Phase 1) achieved an overall compliance of 79% in terms of Average Daylight Factor (ADF). This demonstrated that with careful detailed design, acceptable levels of light can be achieved within areas that receive a VSC less than 15%.

For comparative purposes, the Phase 1 VSC levels are shown in Table 01.

6.2 DAYLIGHT

In order to understand the potential daylight levels within the residential elements proposed in outline, VSC facade assessments have been undertaken on each residential facade of the three proposed illustrative schemes (Option 1, 2 and 3).

A table summarising the VSC ranges for each of the three illustrative schemes can be seen below, and compares their daylight potential with those of the Phase 1 outline massing. The VSC facade assessments for each of the illustrative schemes

Table 01: Vertical Sky Component (VSC) Illustrative Scheme comparison

	Option 1		Option 2		Option 3		Option 1	
	%	SQM	%	SQM	%	SQM	Plot E	Plot F
0-4.9% VSC	12%	2,951	13%	3,736	6%	876	8%	17%
5-14.9% VSC	22%	5,431	22%	6,026	18%	2,812	26%	28%
15-26.9% VSC	21%	4,962	18%	4,959	16%	2,473	17%	30%
27%+ VSC	45%	10,745	47%	13,031	60%	9,067	50%	25%
Area Weighted Average VSC	23%		23%		27%			

can be found on pages 20 - 31.

In addition to the VSC facade assessments, a selection of strategies for addressing areas of lower daylight potential are provided. These strategies have been drawn from the Phase 1 detailed elements and are provided on pages 18-19 of this report.

Overall, the results of the assessments have shown that good levels of daylight potential are generally seen on the outward façades and upper floors of the development. The courtyard façades see lower daylight availability looking onto Plot C, as is common of courtyard façades.

Options 1 and 2 perform similarly, with comparable levels of VSC throughout, whilst Option 3 sees the residential elements located in the portions of the facade with the greatest daylight availability. Comparatively, the proposed illustrative schemes see levels of VSC similar to those of the Phase 1 outline massing, which when designed in detail, were found to achieve acceptable levels of light, thus acceptable levels of light can be achieved within the three illustrative schemes.

The majority (45-60%) of residential facade area sees levels of VSC greater or equal to 27% and so, as stated in the BRE guidelines, conventional window design will lead to good levels of daylight. A further 16-21% of the facade area sees levels of VSC between 15% and 27%, and so good levels of daylight are easily achievable provided slightly larger windows are specified. As such, between 65% and 76% of the facade area can easily achieve acceptable levels of daylight when designed in detail.

Between 18% and 22% of the facade area sees levels of VSC between 5% and 15%, behind which rooms will achieve acceptable levels of daylight provided large windows are specified and the room depths are kept to a minimum. These areas of lower potential are generally located on façades positioned adjacent larger neighbouring buildings (such as Plot C) or on the lower floors overlooking Garrard Street. Acceptable level of light within the rooms behind these areas of lower potential can be designed and it should be noted that lower levels of VSC are to be expected in certain areas of any high density development.

Between 6% and 13% of the facade area sees levels

of daylight potential lower than 5% VSC, behind which it will be more difficult to achieve the levels recommended by BRE within rooms. These areas are confined to the lower floors facing into the courtyard and Plot D flank wall facing Plot C, which will most likely not contain windows due to overlooking and light pollution constraints. Should habitable rooms be placed behind these areas, however, acceptable levels of daylight are still achievable in bedrooms provided the recommendations contained within this Design Guide are adhered to. Single Aspect living rooms located within these areas are likely to fall short of guidance, similar to those of Phase 1.

Overall, the VSC facade assessments have shown acceptable levels of daylight potential in line with expectations for a large-scale mixed-use development of this nature. In areas of lower VSC, the façades often look out onto well landscaped public realm and are comparable with those of Phase 1. Therefore, the residential façades of Plots A, B and D have the potential to offer acceptable levels of light overall when designed in detail and are expected to be in line with expectation for the high-density nature of the Site.

6.3 SUNLIGHT

In order to understand the potential sunlight levels within the proposed development, Annual Probable Sunlight Hours (Annual PSH) and Winter Probable Sunlight Hours (Winter PSH) facade assessments have been undertaken on each residential facade facing within 90 degrees of due south.

A table summarising the PSH results for each of the three illustrative schemes can be seen on the following page (Table 02), and compares their sunlight potential with those of the Phase 1 outline massing. The PSH facade assessments for each of the illustrative schemes can be found on pages 32 - 47.

The assessments have shown that the levels of annual and winter PSH seen are generally more constrained on lower floors, this is typical of both courtyard schemes and high-density environments where sunlight to the lower floors are obstructed by adjacent buildings. Overall, between 56% and 71% of the facade area complies with the BRE's recommendations both throughout the year and during the winter months. This is similar to that of

Plot F of Phase 1, which has a similar, predominately east/west facing configuration. Predominantly east/west facing configurations are challenging in terms of sunlight as easterly and westerly facing windows only have the potential to capture half of the available sunlight hours.

Areas of lower PSH, where care will be needed to maximise sunlight, are:

- The lower east facing courtyard façades;
- The lower southerly façades overlooking Garrard Street, these facade see lower levels of Winter PSH when the sun is lower in the sky however have good sunlight potential throughout the year; and
- During the winter months on the lower floors of the eastern facade of Plot D.

Whilst little can be done at detailed design stages in order to increase the sunlight availability to the façades, the lower levels of PSH can be mitigated through careful positioning of living rooms in the areas of greatest sunlight potential. Should living rooms be located in areas of lower sunlight potential, we would recommend making them dual aspect to allow for greater access to sunlight. Special consideration is required in the balcony strategy to maximise the amount of sunlight hitting the living windows behind or below them.

6.4 CONCLUSIONS ON OVERSHADOWING

Overshadowing assessments have been undertaken for the areas of public and communal open space provided within the three illustrative schemes. The results from these assessments are shown on pages 48-59 of this report.

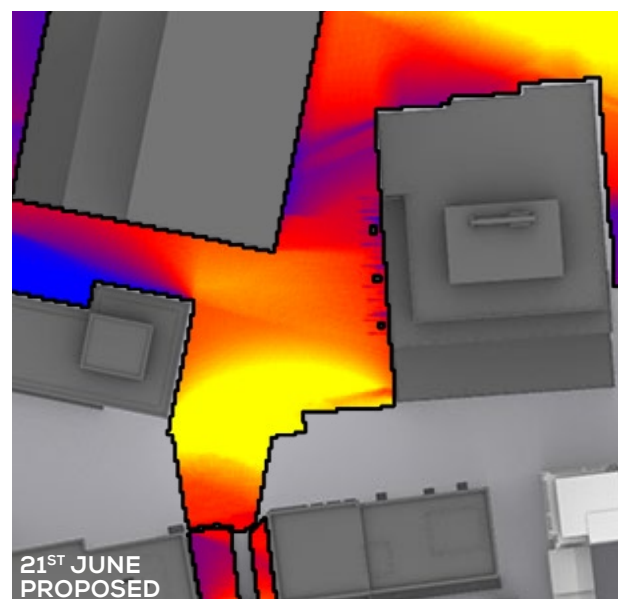
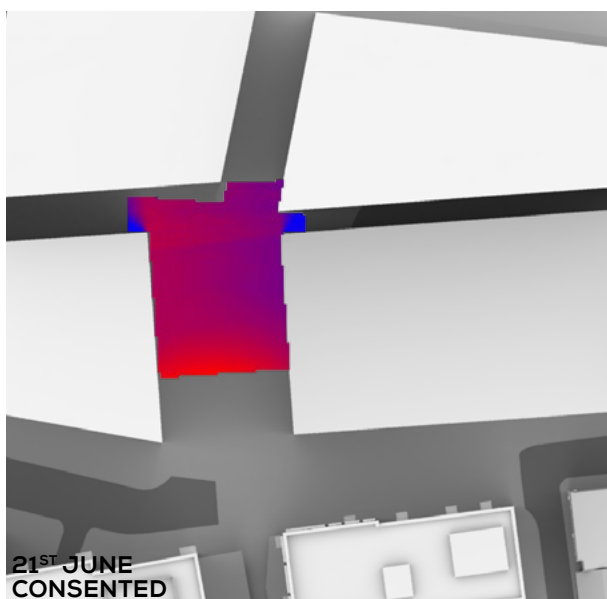
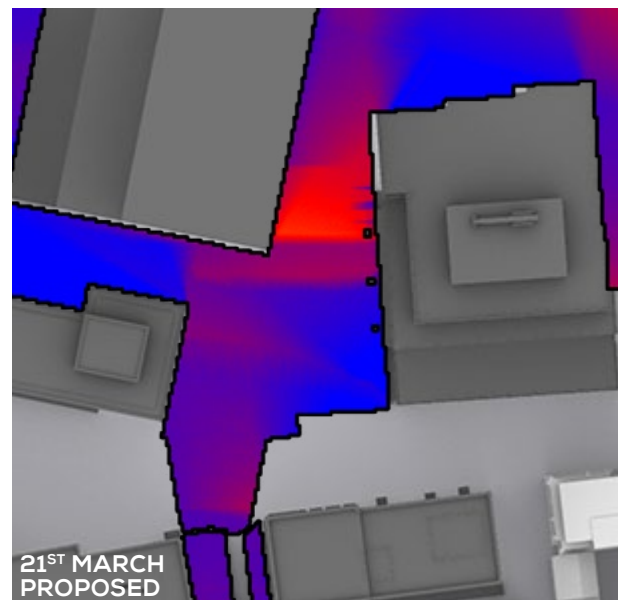
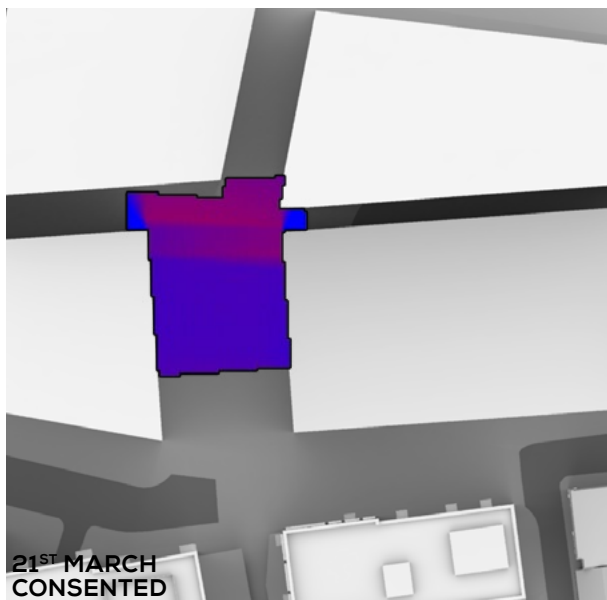
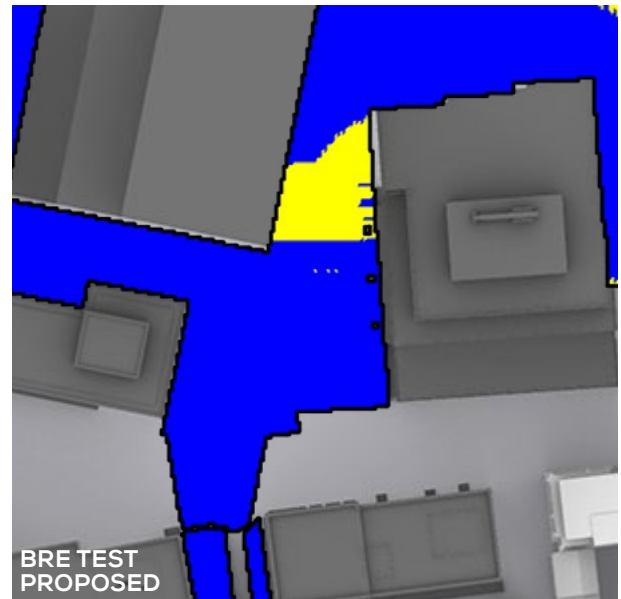
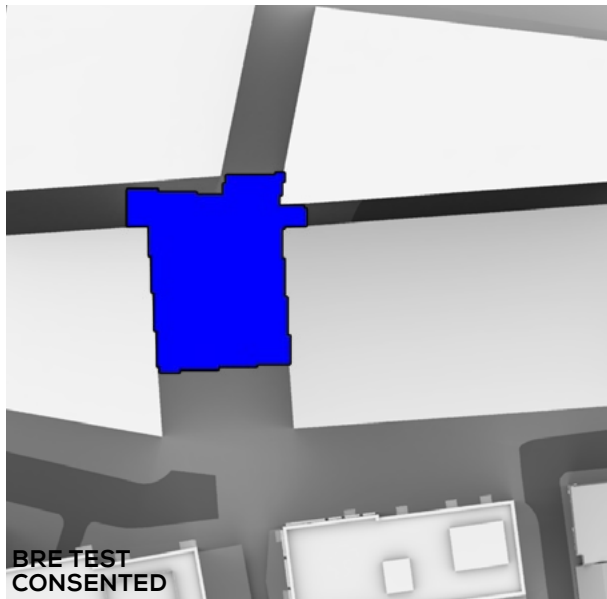
Providing well sunlit public realm was a key consideration of the design team. As is common of high-density mixed use schemes, the sunlight reaching the ground is constrained by larger massing surrounding it. The design team has sought to maximise the amount of sunlight within the public realm by implementing a number of features to improve the overshadowing compared to the earlier Station Hill consents (151426 and 151427), as shown in the images on the following page. This has included increasing the gap between Plots D and G, stepping back the upper floors of Plot G and orienting Plot G so as to open the main area of public realm in the south.

Overall, the schemes offer future residents and visitors to the site a variety of open spaces, where 19% to 20% of the public realm will see two or more hours of direct sunlight on the 21st of March and a roof terrace has been provided for residents within each of the three illustrative schemes where each sees in excess of two hours of sunlight between 83% and 88% of their respective areas.

The BRE sun hours on ground assessment, undertaken on the 21st March shows lower levels than recommended reaching the ground within the Station Hill Plaza, however, the sun exposure images for 21st March, 21st April, 21st May and 21st June show that the sunlight reaching the ground gradually increases from less than two hours for much of the space on the 21st March, to in excess of six hours on 21st June. As such, this space will enjoy good levels of sun on ground in the summer months when people are most likely to seek well sunlit public realm.

Table 02: Annual Probable Sunlight Hours (APSH) Illustrative Scheme comparison

	Option 1		Option 2		Option 3		Phase 1	
	%	SQM	%	SQM	%	SQM	Plot E	Plot F
Total South Facing Facade Area		3,760		4,322		2,249		
Annual PSH	69%	2,595	66%	2,846	72%	1,628	90%	54%
Winter PSH	64%	2,390	63%	2,706	79%	1,784	90%	56%
Annual & Winter PSH	58%	2,177	56%	2,413	71%	1,606	90%	52%



Owing to the massing along the southern and western perimeter, the public realm between Plots A, B, C and D will be largely shaded throughout the year and will serve as visual amenity and circulation rather than a sunlit amenity area. Overshadowing in areas such as this are common of large-scale urban developments and whilst not technically assessed in the earlier applications, the levels of sunlight within this area is in line with that of the consented Masterplan.

As a response to the challenging urban location of the site, a roof terrace is proposed within each of the illustrative schemes for residents to access. The roof terraces offer future residents well sunlit amenity space to enjoy on sunny days throughout the year. The terraces see between 83% and 88% of their respective areas with two or more hours of direct sunlight on 21st March, far in excess of the BRE recommendation. The sun exposure images on pages 48-59 show that the roof terraces will in fact see in excess of six hours of direct sunlight on both 21st March and 21st June.

We therefore conclude that the proposed development seeks to maximise sunlight within the public realm and communal roof terraces. When designed in detail, Phase 3 has the potential to offer future residents access well sunlit communal amenity and the massing has been designed to ensure the public realm performs as well as possible in the summer months when sunlit amenity areas are most valued.

Overall, the overshadowing shows a meaningful improvement on the 2016 consented scheme.

6.5 GENERAL RECOMMENDATIONS

There are a number of recommendations that should be considered when designing residential accommodation in a dense urban development such as the Station Hill Phase 2 & 3 site. The most pertinent of these are outlined below.

In areas of lower daylight potential it is important to increase the window sizes; the best way to do this is to raise the window head height as this will improve both the amount of daylight entering and its distribution within the room. Raising the window head can be particularly effective for lower level windows.

Especially at ground floor and the lower levels it is recommended to use light coloured exterior and interior finishes. This will ensure that indirect light is reflected off the lighter surfaces and distributed more evenly within the rooms.

Balconies and overhangs significantly reduce the light entering windows behind or below them and this is a particular problem if there are large obstructions opposite.

With the combined effect of the overhang and the obstruction, it may be impossible to see the sky from inside the room, and hence to receive any direct skylight or sunlight. Careful design is essential with balcony locations and the size of windows serving rooms behind or beneath balconies.

Depending on the layout of the building, sometimes the facade can be stepped back to allow rooftop access or terraced gardens, without creating an overhang to the windows below. Alternatively balconies may be staggered, so that a living room has its own balcony, but not one directly above it. Bathrooms or, in less obstructed situations, bedrooms could be sited underneath the balcony.

In the areas of lowest daylight potential we would recommend locating connection cores, non-habitable rooms or secondary windows to dual aspect rooms.

One important way to plan for good interior daylight is to reduce building depths (window wall to window wall). Even on a totally unobstructed site there is still a limit to how deep a room can be.

In housing, the main requirement for sunlight is in living rooms, where it is valued at any time of day but especially in the afternoon. It is viewed as less important in bedrooms and in kitchens, where people prefer it in the morning rather than the afternoon.

A south-facing window will, in general, receive most sunlight, while a north-facing one will only receive it on a handful of occasions (early morning and late evening in summer). East and west facing windows will receive sunlight only at certain times of the day.

A dwelling with no main window wall within 90° of due south is likely to be perceived as insufficiently sunlit. This is usually only an issue for flats. Sensitive layout design of flats will attempt to ensure that each

individual dwelling has at least one main living room which can receive a reasonable amount of sunlight. In both flats and houses, a sensible approach is to try to match internal room layout with window wall orientation.

Where possible, living rooms should face the southern or western parts of the sky and kitchens towards the north or east.

6.6 SUMMARY

GIA has worked alongside the design team as the design has been progressed to feedback to the team pinch-points in the scheme's massing. This has seen the design respond to any pinch-points wherever possible through modifications to massing. In particular, the distances between buildings and stepping back of upper floors have been optimised for daylight whilst allowing for the density sought.

In order to understand the potential daylight levels within the massing, VSC facade assessments have been undertaken on each residential facade. The results of the assessments have shown that the daylight potential seen is generally good, with lower levels on the façades that face into the courtyard between Plots A, B, C and D. Generally, the areas of lower VSC look out onto well landscaped public realm which offers very good visual amenity.

In areas with lower daylight potential, care will need to be taken in relation to the design of fenestration, room depths and balconies. These areas are highlighted in section 6.2 and recommendations on how to best address them are contained within section 6.5. Pages 18-19 also contain examples drawn from the Phase 1 detailed elements that can be used to maximise daylight ingress within the scheme.

The results of the sunlight assessments have shown that the levels of Annual Probable Sunlight Hours (APSH) seen are generally in line with expectation given the site's density and urban location. Lower levels of APSH are isolated to within the lower floors facing into the courtyard and on the lower levels overlooking Garrard Street, which is obstructed by Plot E to the south. Upper floor within the courtyard and the outward façades see good sunlight potential.

The recommendations contained within this document will enable the design teams to maximise

the levels of daylight and sunlight within the schemes residential elements, but it is expected that there will be habitable rooms with levels of daylight and sunlight lower than recommended by the BRE. This is to be expected within any high-density development and it is the design team's duty to ensure that the levels of daylight in these areas are maximised.

In terms of overshadowing, Sun Hours on Ground assessments have been undertaken on all proposed public and communal open spaces within the site both on 21st March and 21st June. The results have shown the proposed development offers future residents to access well sunlit communal outdoor amenity and the parameter plans have been designed to ensure the public realm performs as well as possible in the summer months when sunlit amenity areas are most valued.

The illustrative schemes (Option 1, 2 and 3) perform better than the consented parameters plan massing in terms of overshadowing.

In conclusion, the proposed development has the potential to provide residential accommodation considered acceptable in terms of daylight, sunlight and overshadowing provided care is taken in certain areas where façades are situated in close proximity to one another.

7 DESIGN STRATEGIES

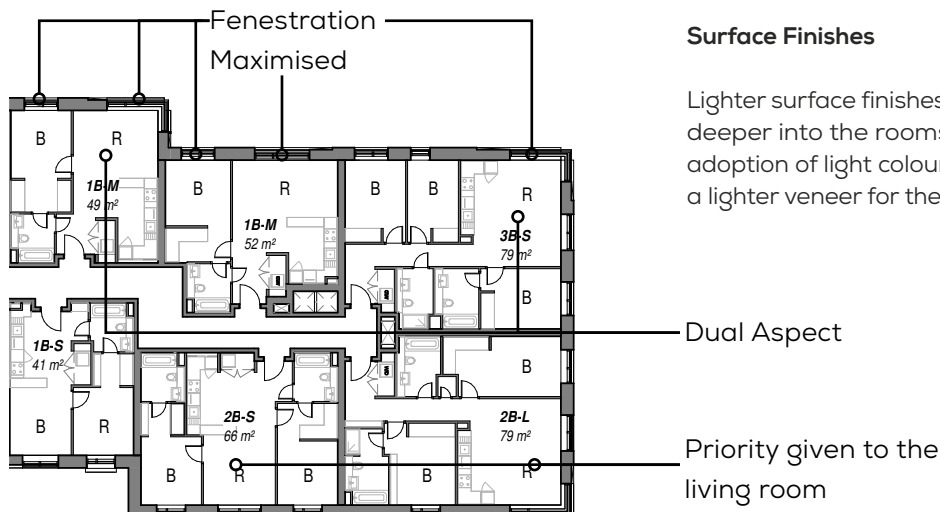
Owing to the site's inherent design constraints, daylight and sunlight should be carefully considered during the development of the detailed design for the residential elements.

As highlighted earlier, Phase 1 of the Station Hill Masterplan had similar levels of daylight and sunlight potential to those of the proposed residential elements of Phase 3. When Phase 1 was designed in detail, a number of features were included within design to make the most of the available daylight and sunlight. As a result, Phase 1 delivers acceptable levels of daylight and sunlight amenity. The following features were successfully used in Phase 1, and could be used in the detailed design of Phase 3 to deliver acceptable levels of light.

Massing Strategy

The massing was refined to improve the daylight reaching the building façades and sunlight ingress into the courtyard. This included:

- a stepped northern facade to provide greater distance between Plots D and E;
- an optimised footprint to increase the number of dual-aspect living rooms and remove acute corners; and
- an increased gap between Plots E and F to improve daylight availability to their respective façades.



Unit Layouts

To provide better quality of accommodation, unit depths were reduced to 7.2m compared to the standard 8m. This decision was beneficial to the daylight performance as it led to shallower rooms and better light distribution.

Internal layouts saw daylight ingress within living areas maximised, where daylight is most valued. As a result, many living rooms enjoy dual aspects. Single aspect units have been designed to give priority to the living space over the kitchen and bedrooms, by including breakfast bars to delineate the front and back part of the living/ kitchen/dining rooms.

Balcony Strategy

Daylight availability informed the balcony strategy. Projecting balconies were provided on the upper floors and south facing units where the daylight availability was generally very good, whilst on the northern façades and lower floors where daylight was more challenged, the majority of units were been provided with juliet balconies to minimise the obstruction of windows beneath.

Fenestration

In areas of lower daylight potential, window sizes were maximised to deliver greater daylight ingress. This has also included increased floor to ceiling heights on the ground floor of the northern courtyard and chamfered reveals to allow greater light to be captured from either end of Garrard Street.

Surface Finishes

Lighter surface finishes were applied to reflect light deeper into the rooms. This was achieved by the adoption of light colour bricks in the courtyard and a lighter veneer for the flats' flooring.

Lighter Coloured Façades

Chamfered Reveals

Juliet Balconies

Increased
Floor-to- Ceiling Height



Massing Stepped
Back

Increased gap
between façades



8 DAYLIGHT POTENTIAL ASSESSMENTS

DAYLIGHT POTENTIAL - Option 1

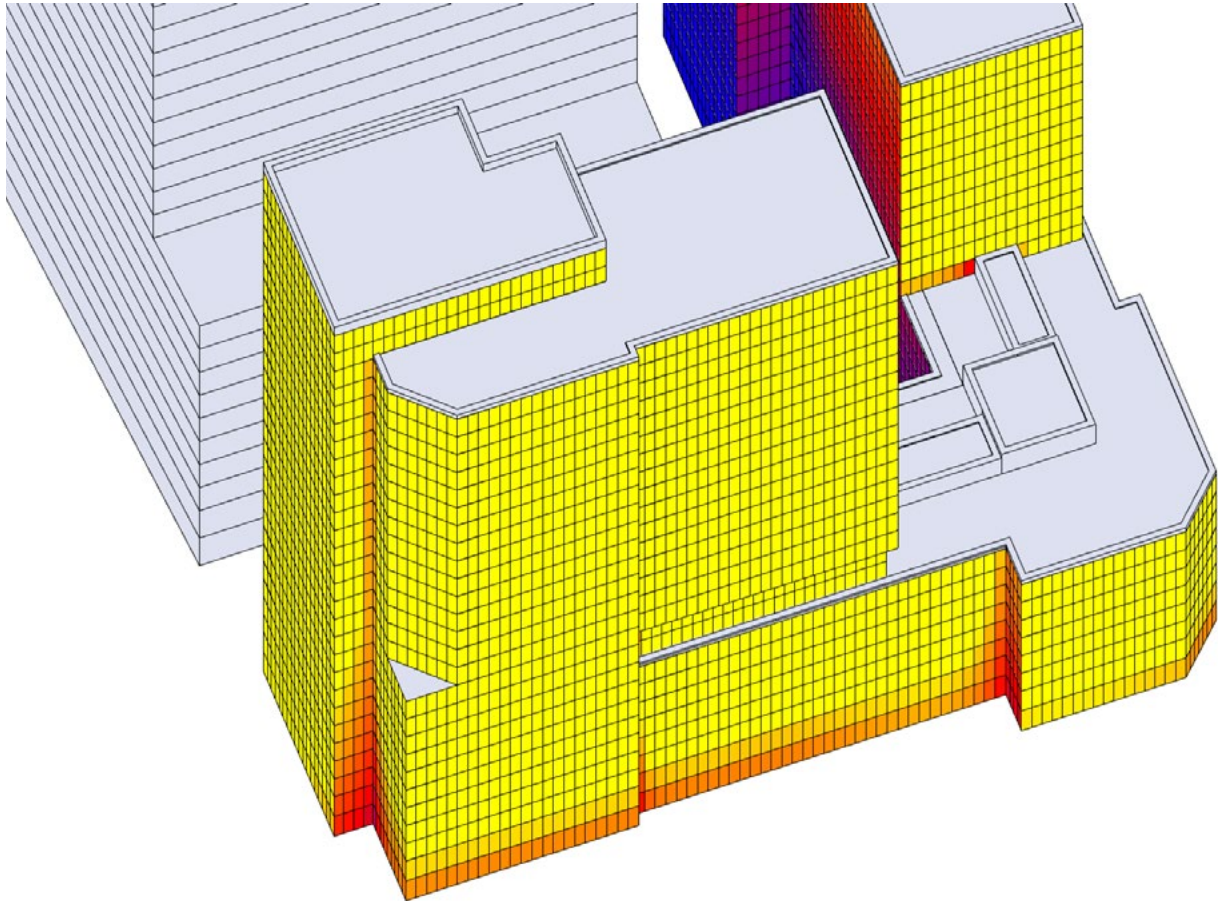
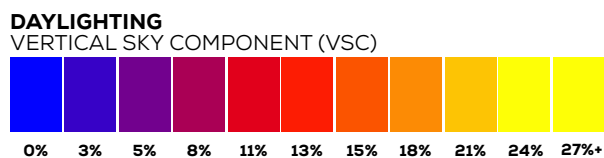


Fig. 09: VSC Diagram - Option 1 - View 1



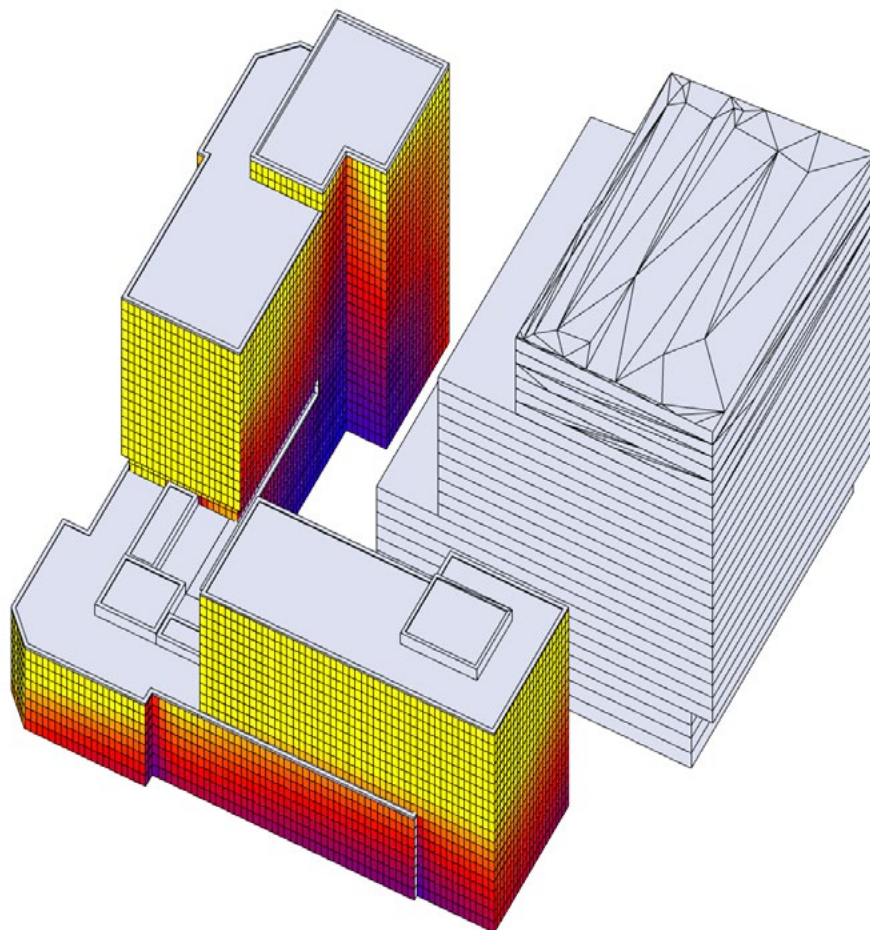
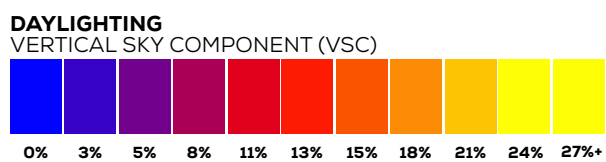


Fig. 10: VSC Diagram - Option 1 - View 2



DAYLIGHT POTENTIAL - Option 1

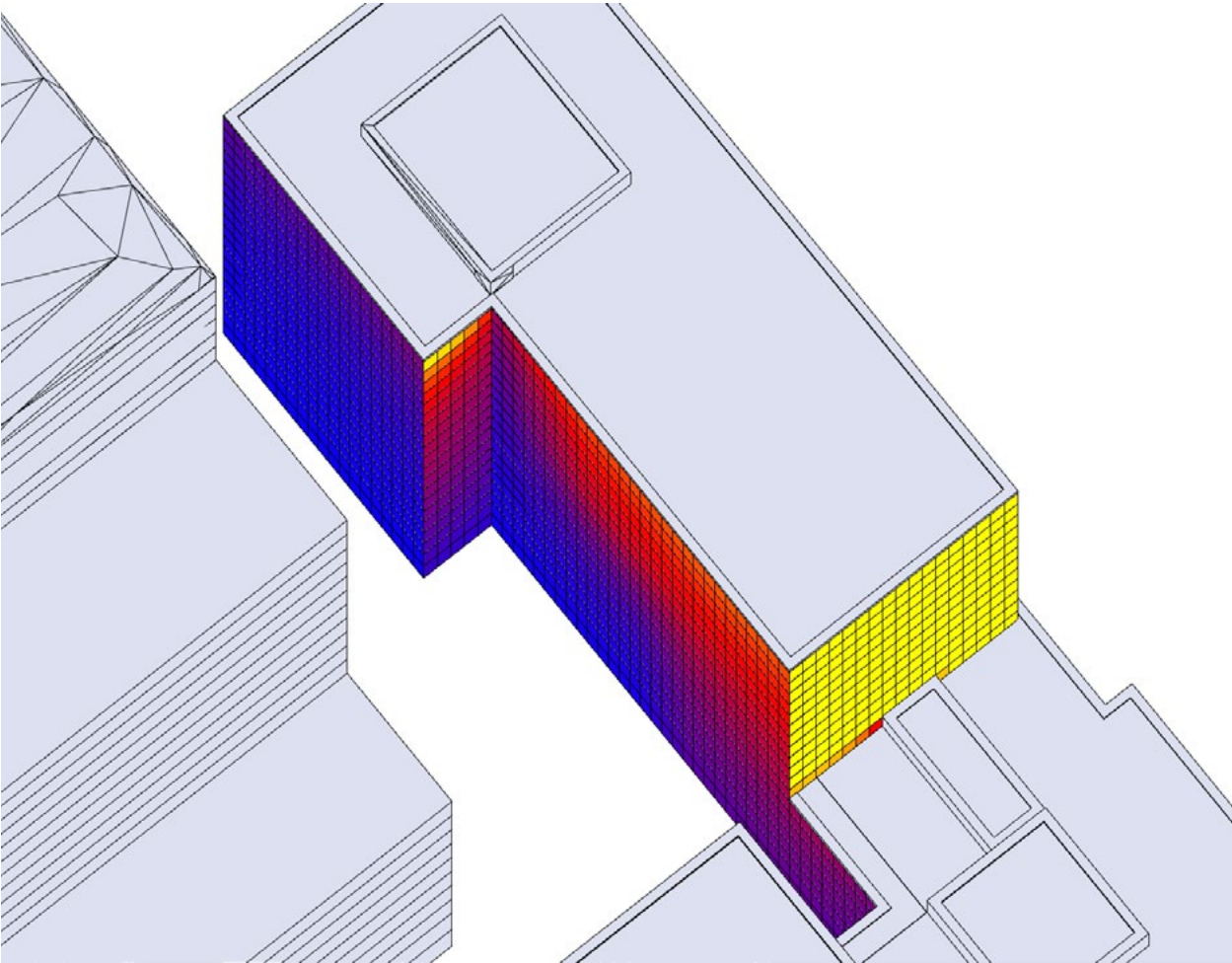
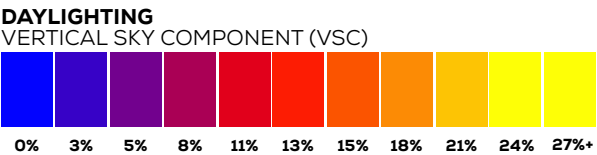


Fig. 11: VSC Diagram - Option 1 - View 3



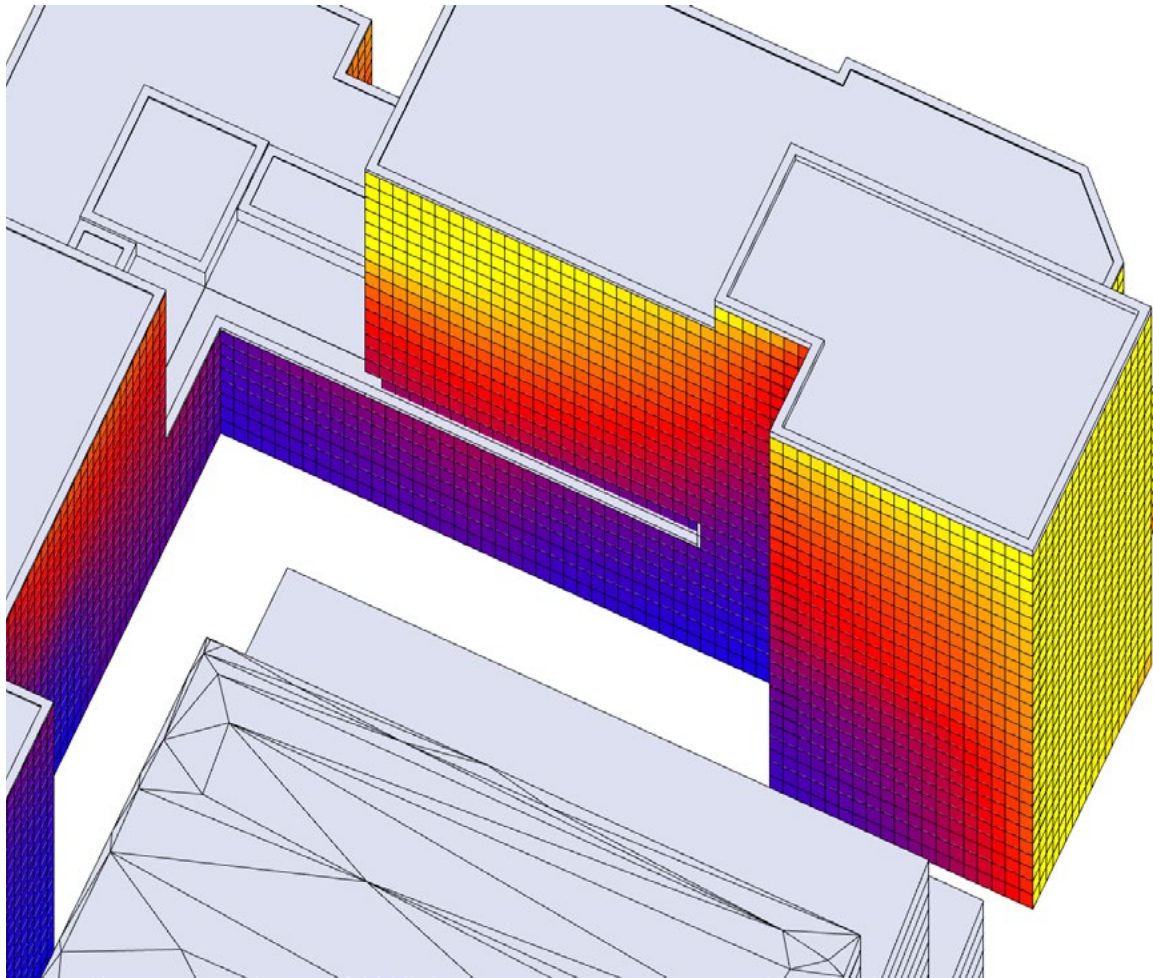
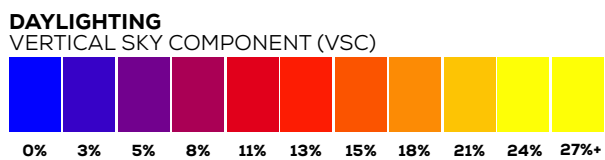


Fig. 12: VSC Diagram - Option 1 - View 4



DAYLIGHT POTENTIAL - Option 2

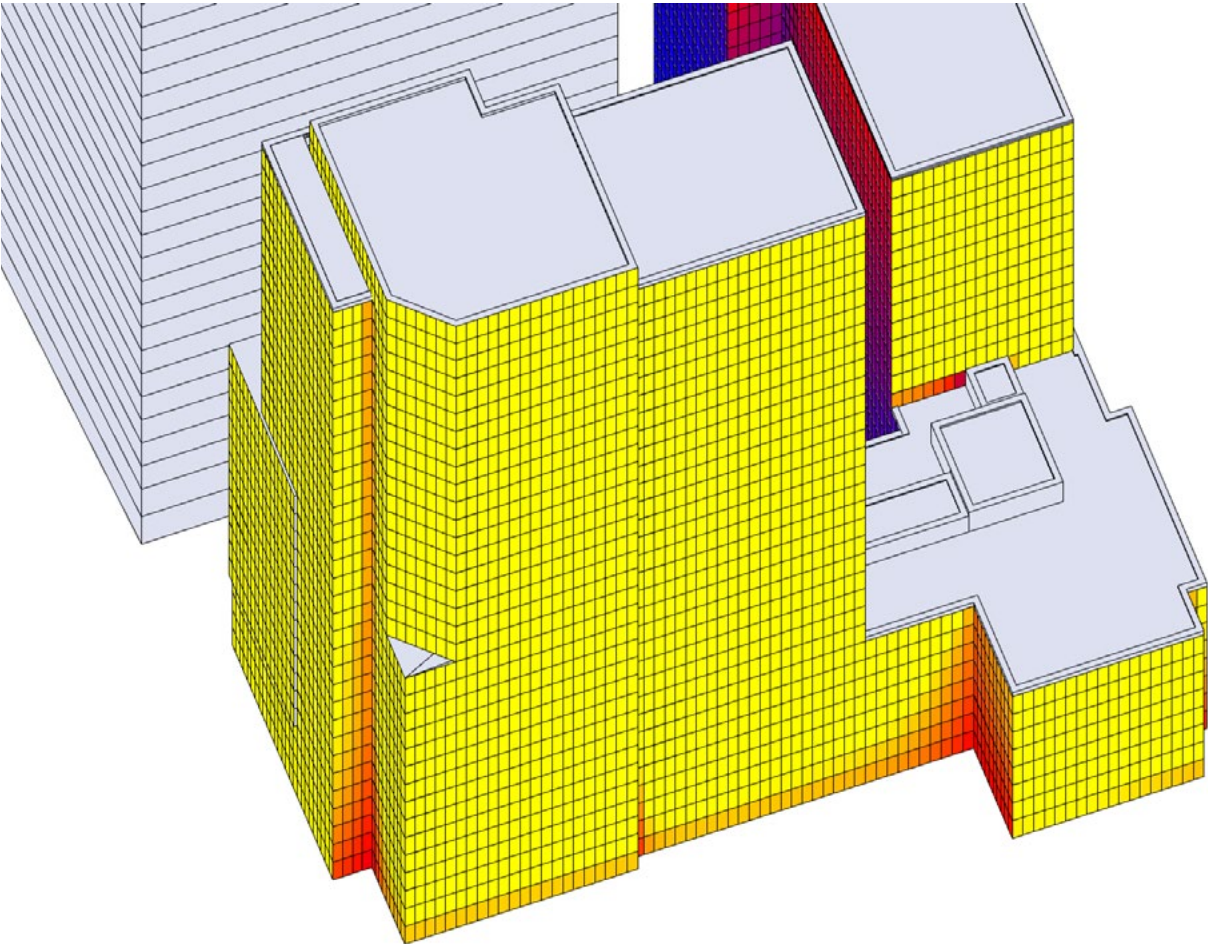
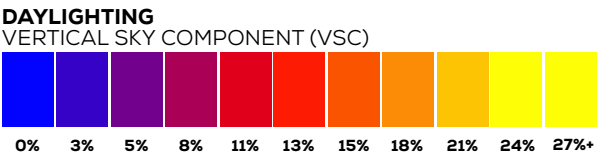


Fig. 13: VSC Diagram - Option 2 - View 1



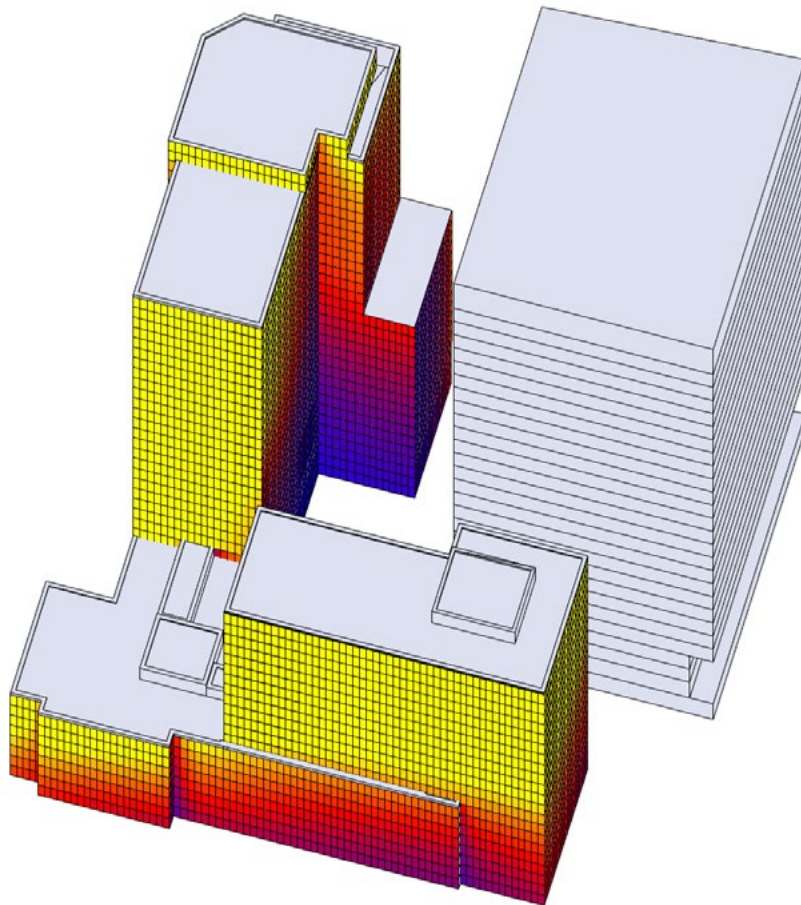
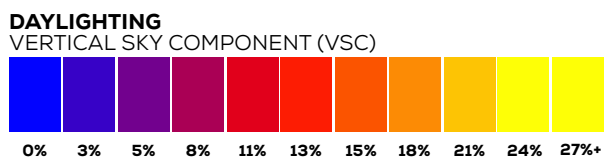


Fig. 14: VSC Diagram - Option 2 - View 2



DAYLIGHT POTENTIAL - Option 2

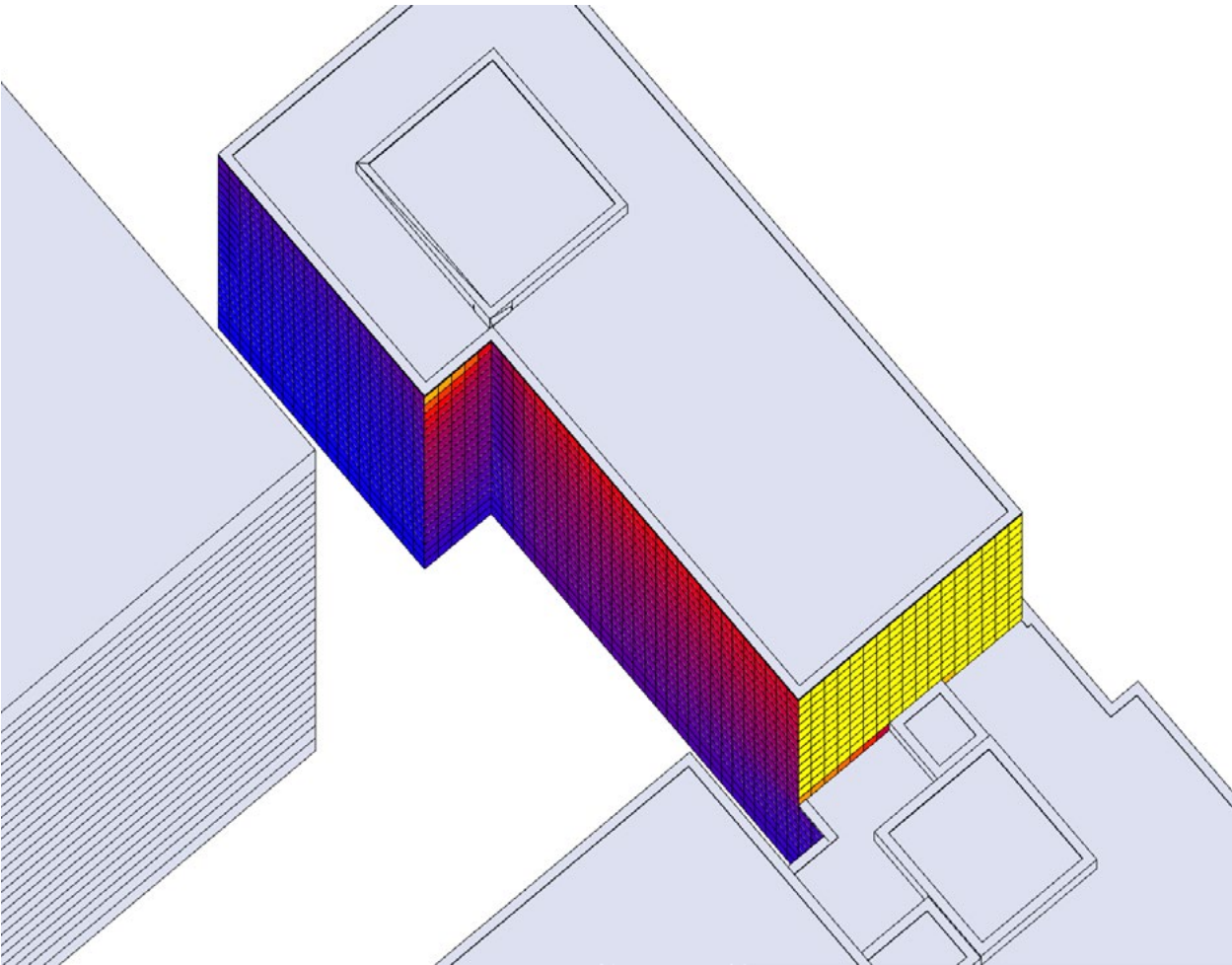
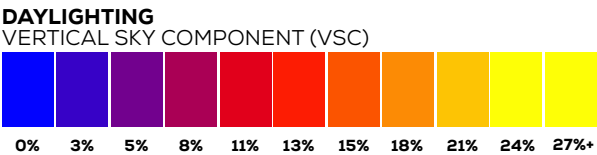


Fig. 15: VSC Diagram - Option 2 - View 3



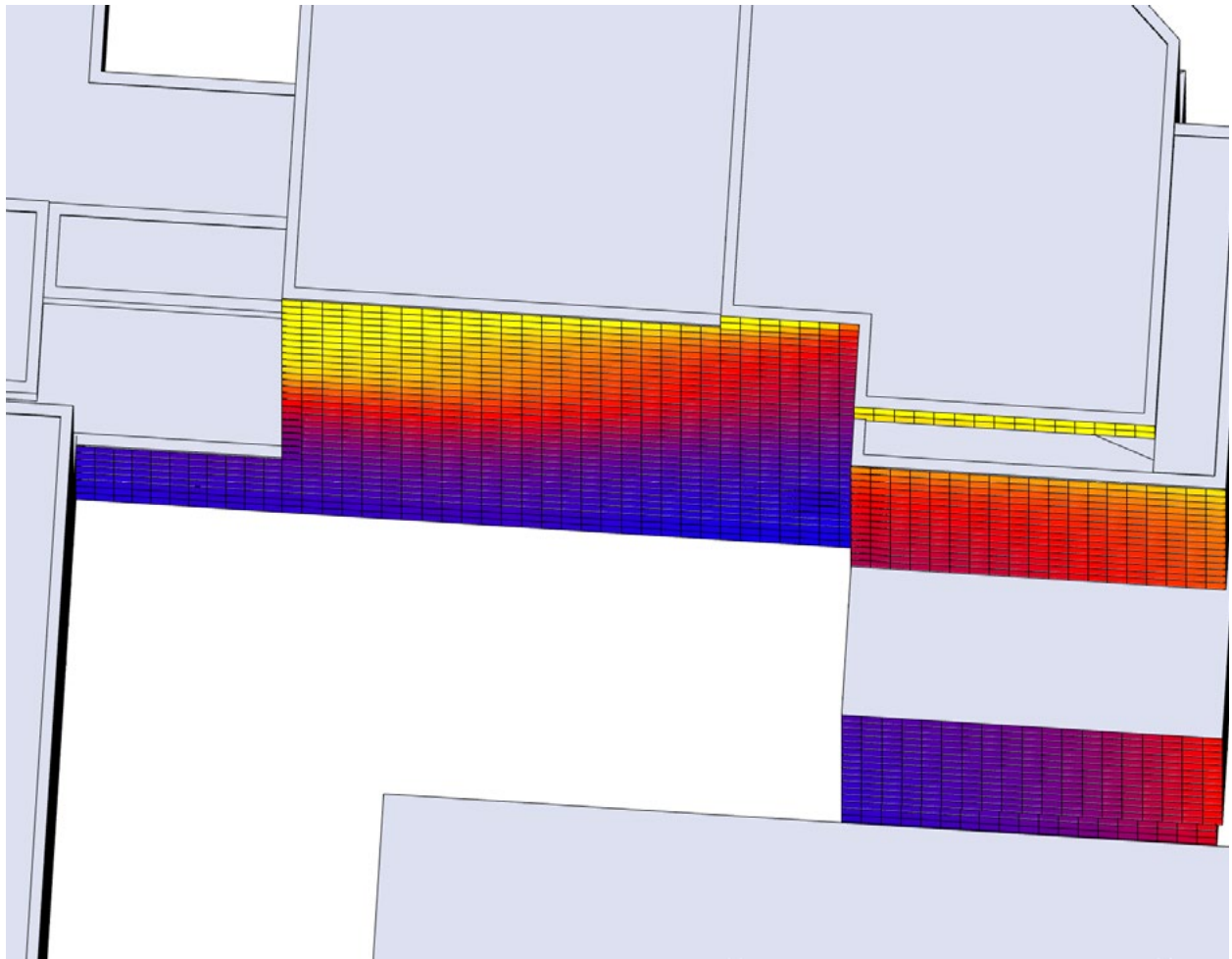
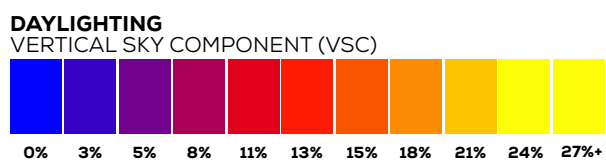


Fig. 16: VSC Diagram - Option 2 - View 4



DAYLIGHT POTENTIAL - Option 3

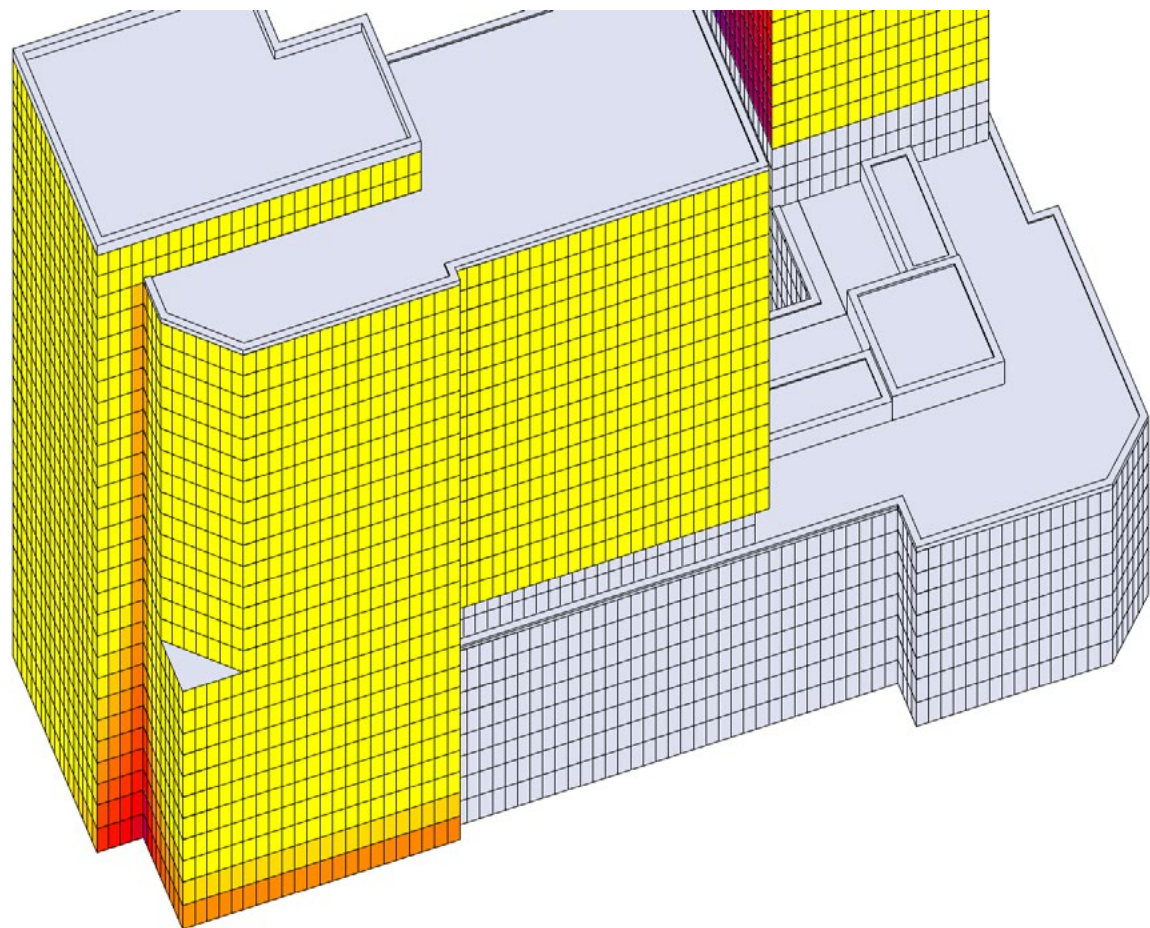
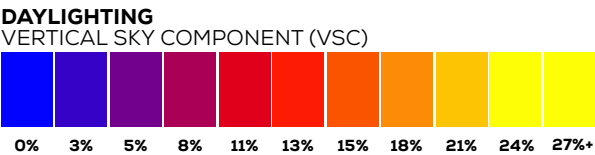


Fig. 17: VSC Diagram - Option 3 - View 1



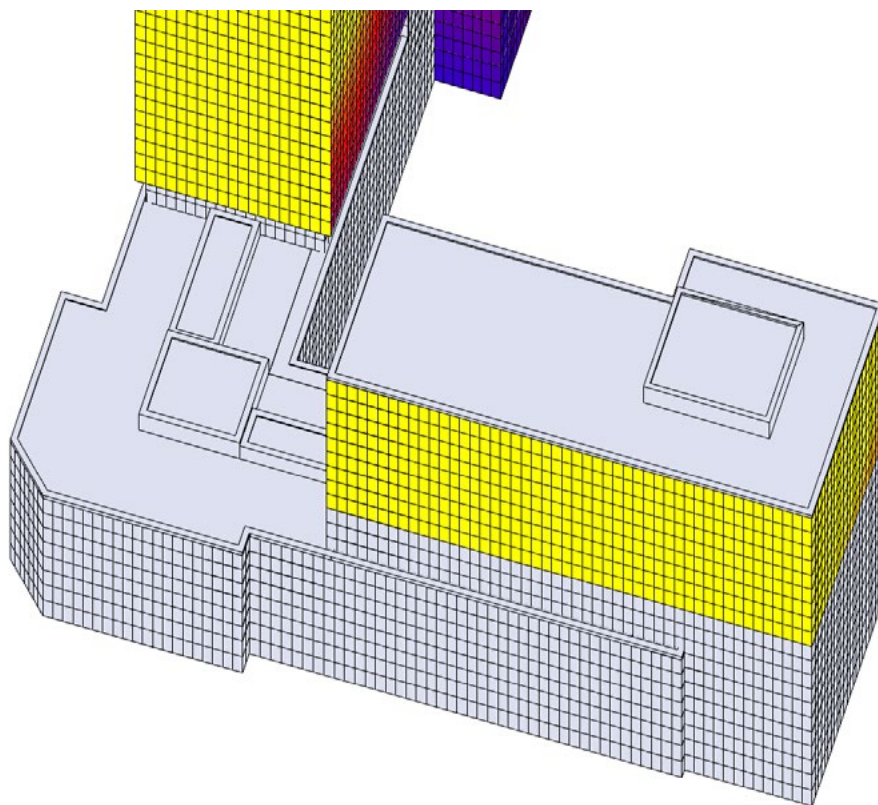
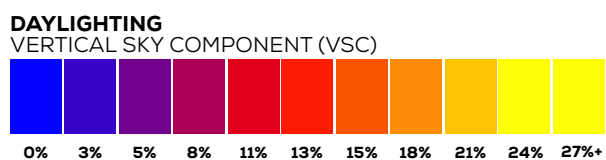


Fig. 18: VSC Diagram - Option 3 - View 2



DAYLIGHT POTENTIAL - Option 3

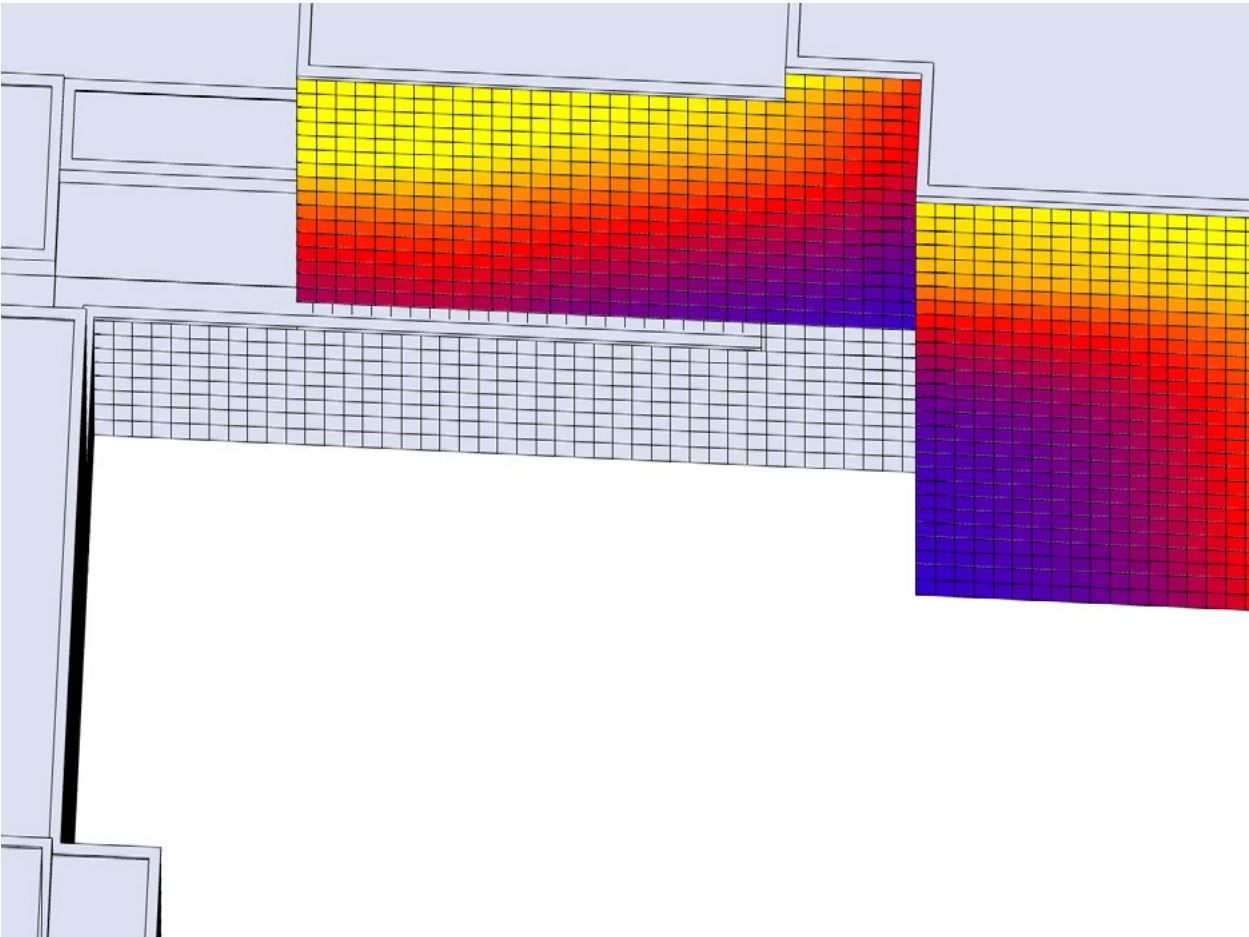
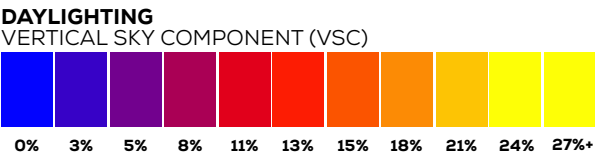


Fig. 19: VSC Diagram - Option 3 - View 3



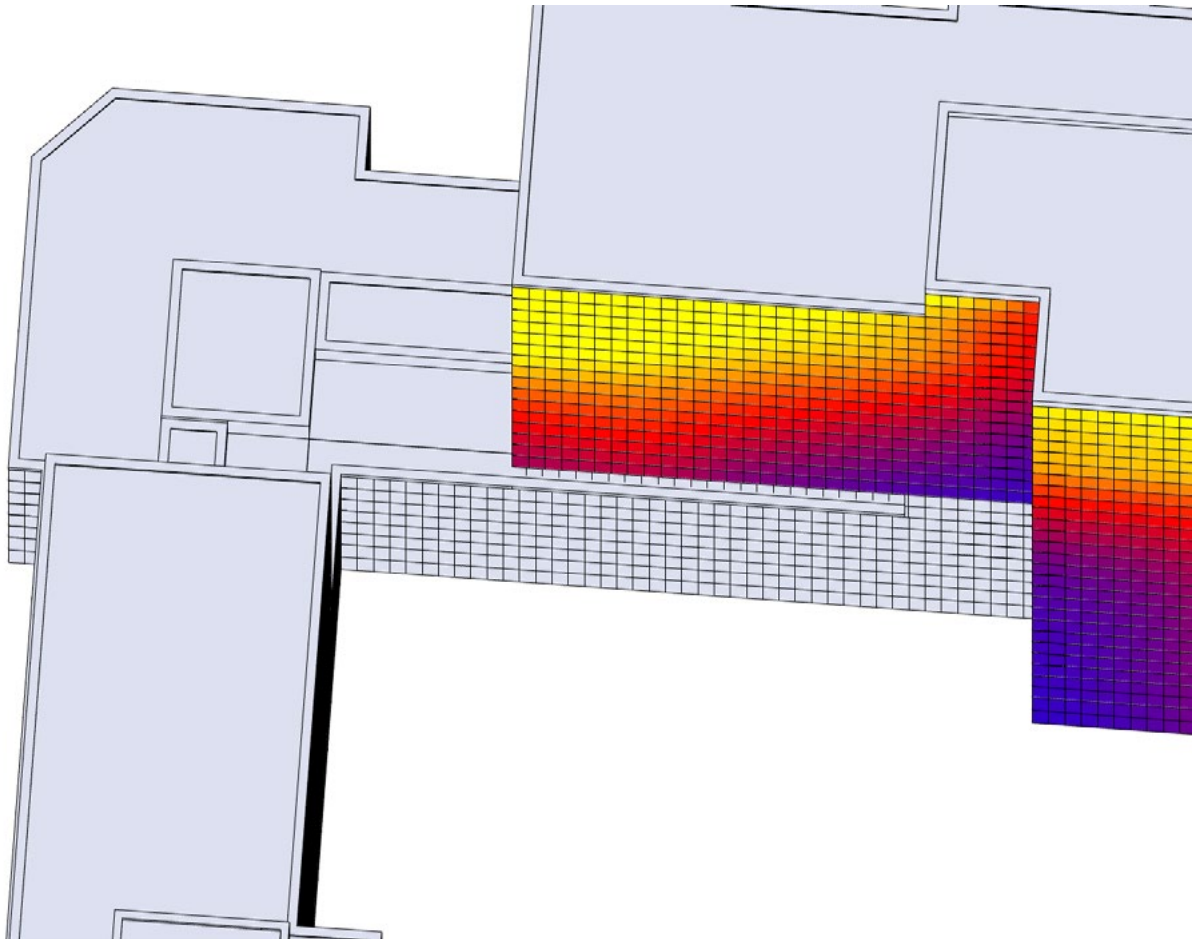
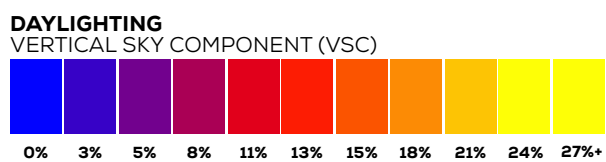


Fig. 20: VSC Diagram - Option 3 - View 4



9 SUNLIGHT POTENTIAL ASSESSMENTS

ANNUAL PROBABLE SUNLIGHT HOURS - Option 1

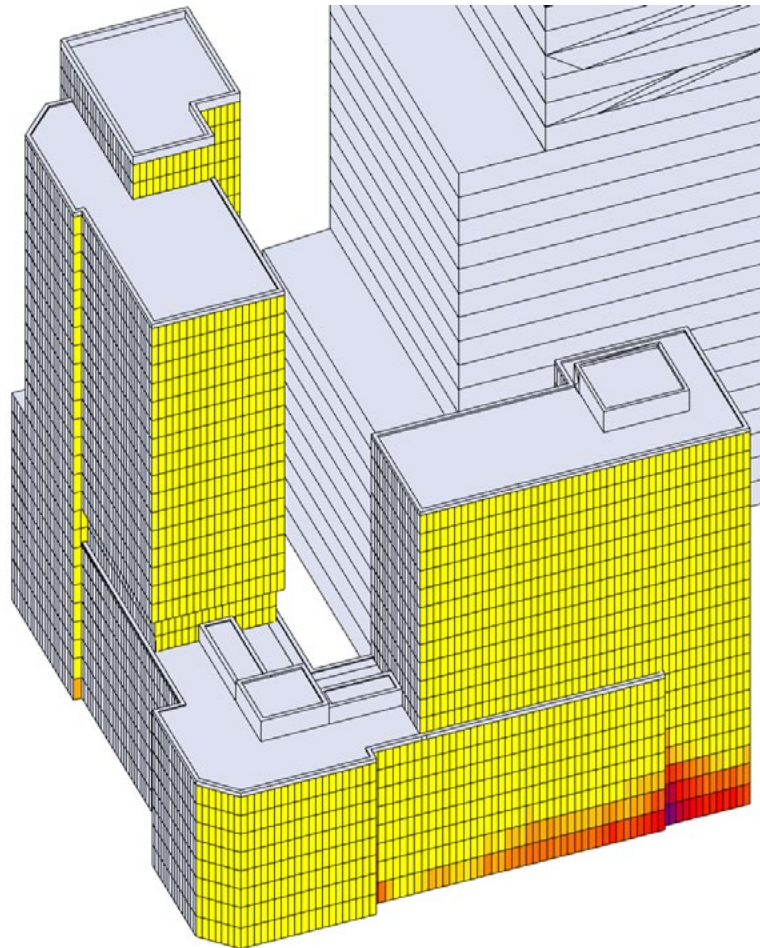
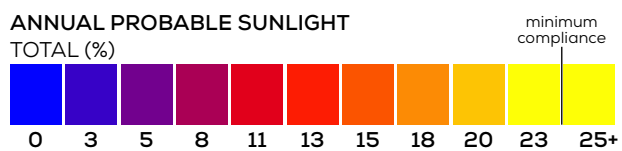


Fig. 21: APSH Diagram - Option 1 - View 1



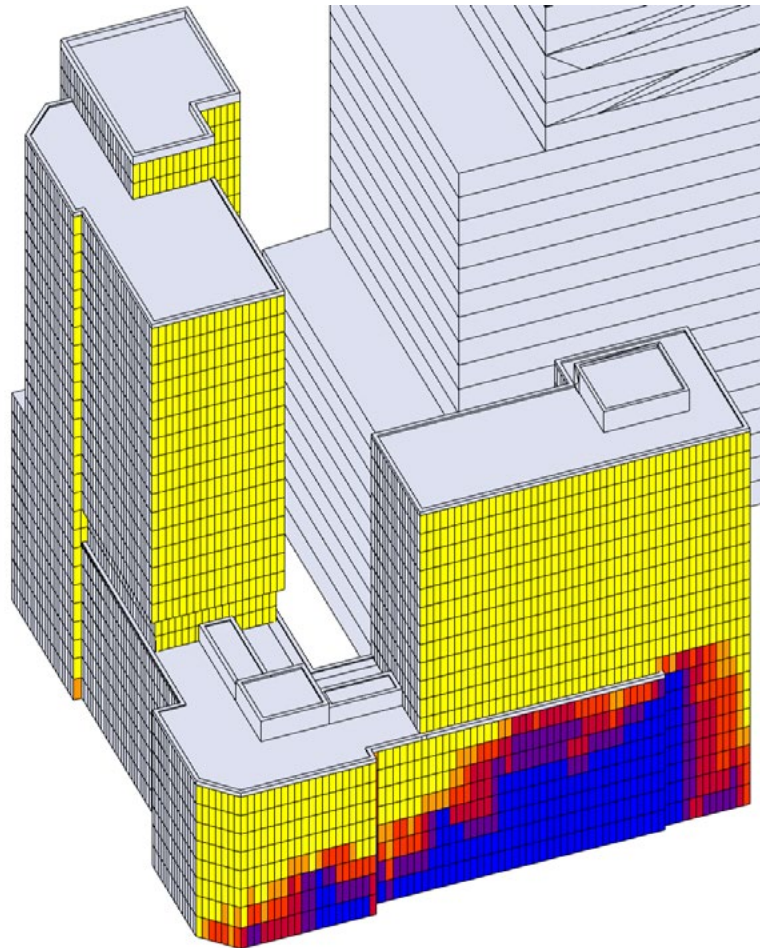
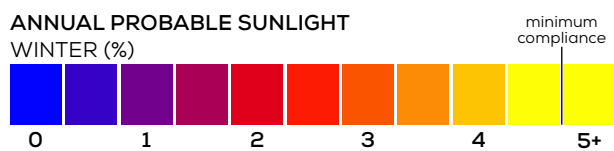


Fig. 22: WPSH Diagram - Option 1 - View 1



ANNUAL PROBABLE SUNLIGHT HOURS - Option 1

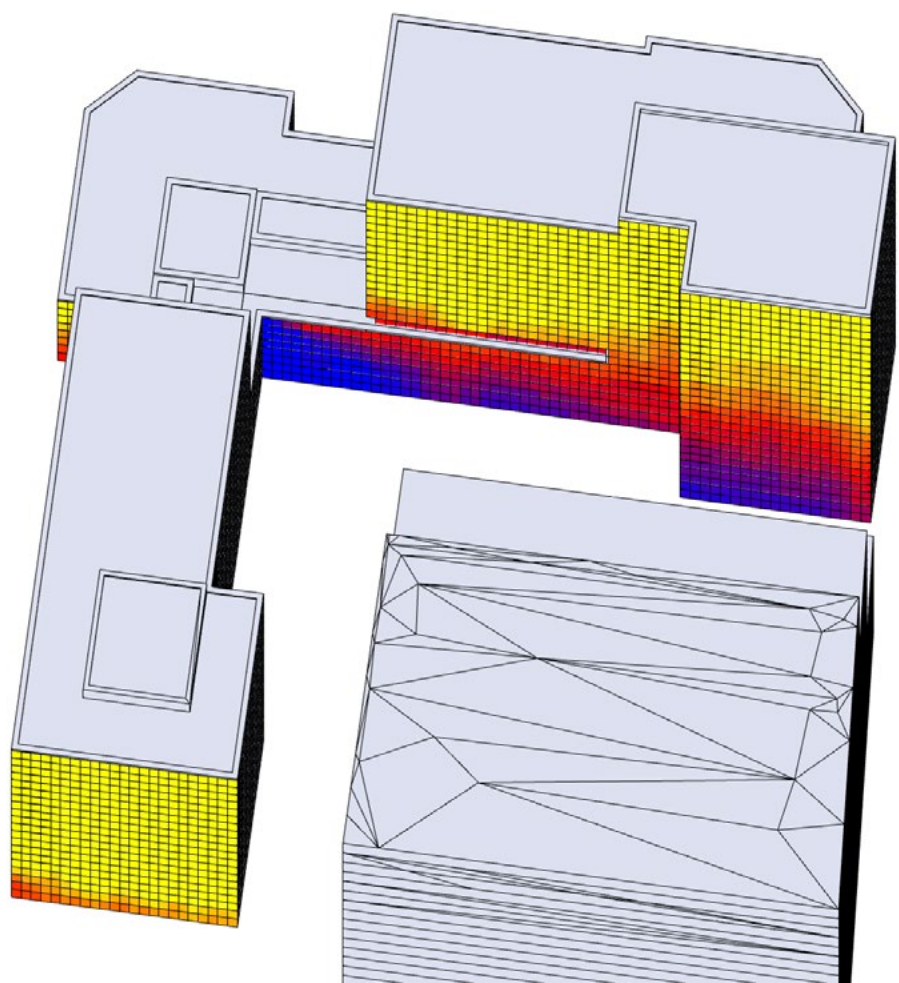
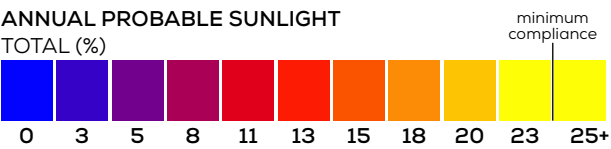


Fig. 23: APSH Diagram - Option 1 - View 4



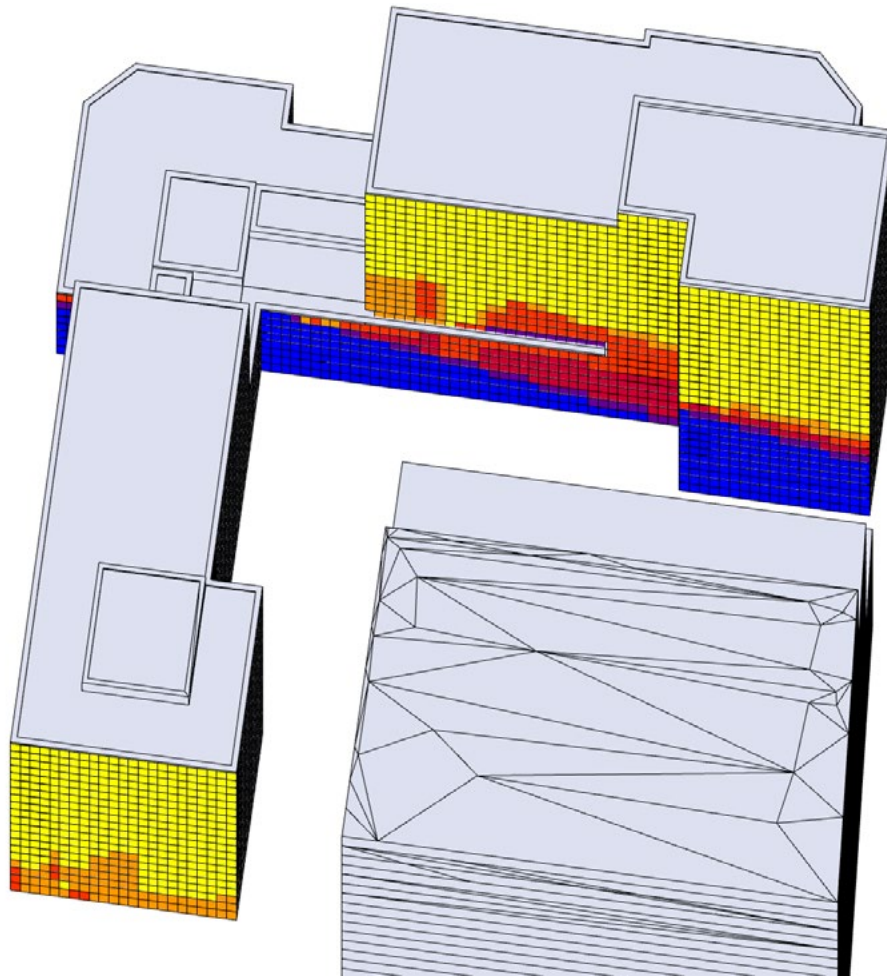
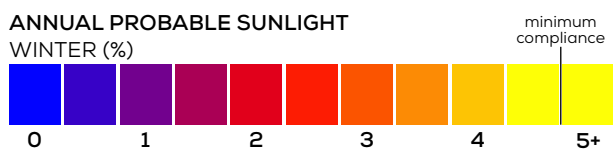


Fig. 24: WPSH Diagram - Option 1 - View 4



ANNUAL PROBABLE SUNLIGHT HOURS - Option 2

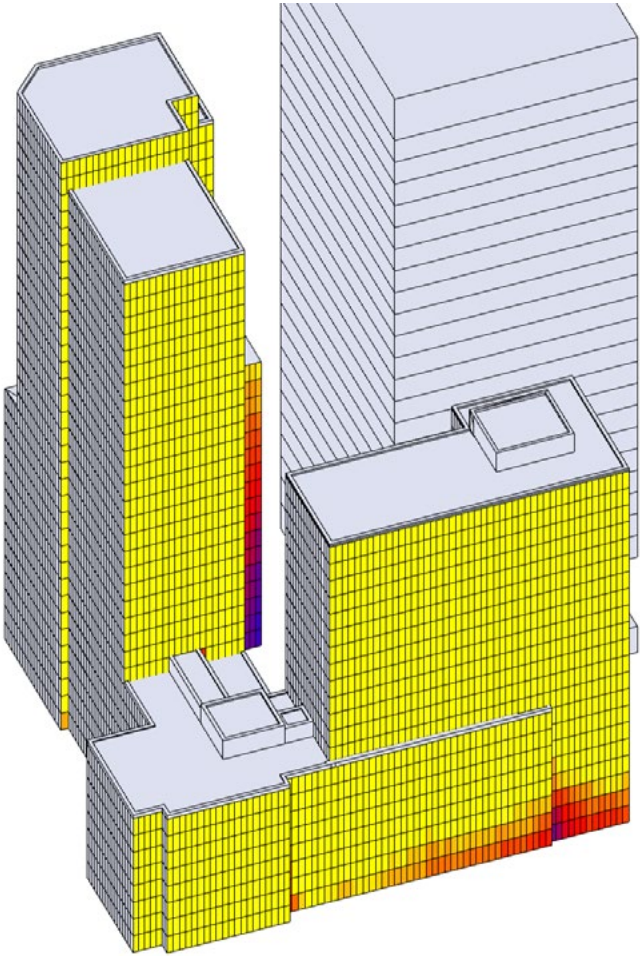
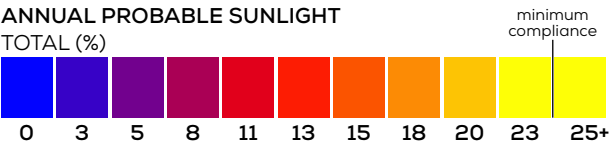


Fig. 25: APSH Diagram - Option 2 - View 1



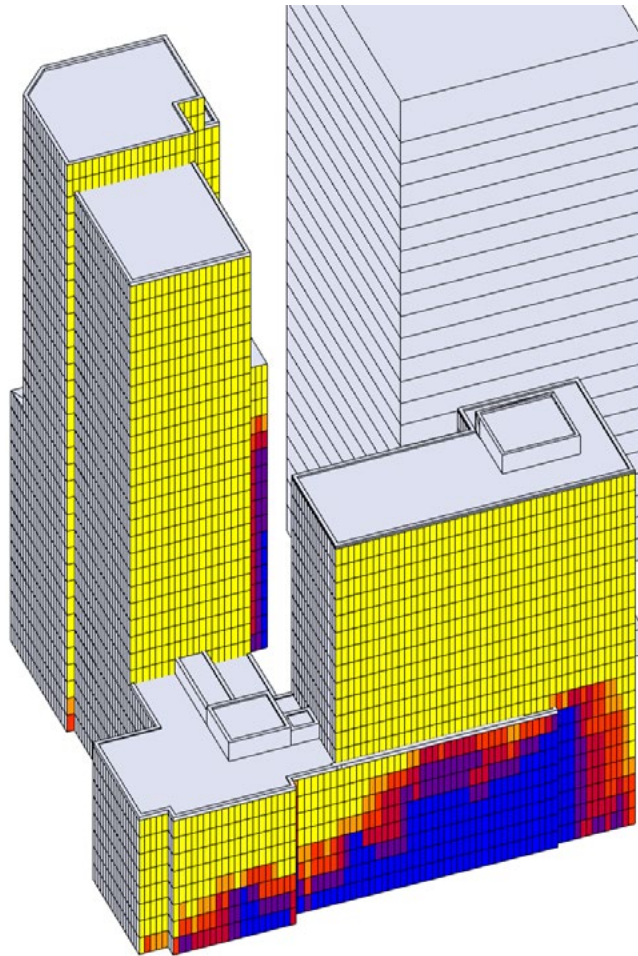
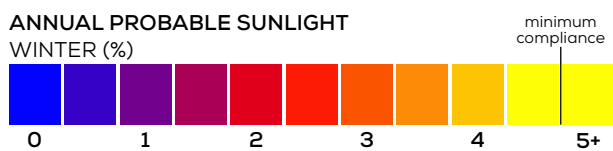


Fig. 26: WPSH Diagram - Option 2 - View 1



ANNUAL PROBABLE SUNLIGHT HOURS - Option 2

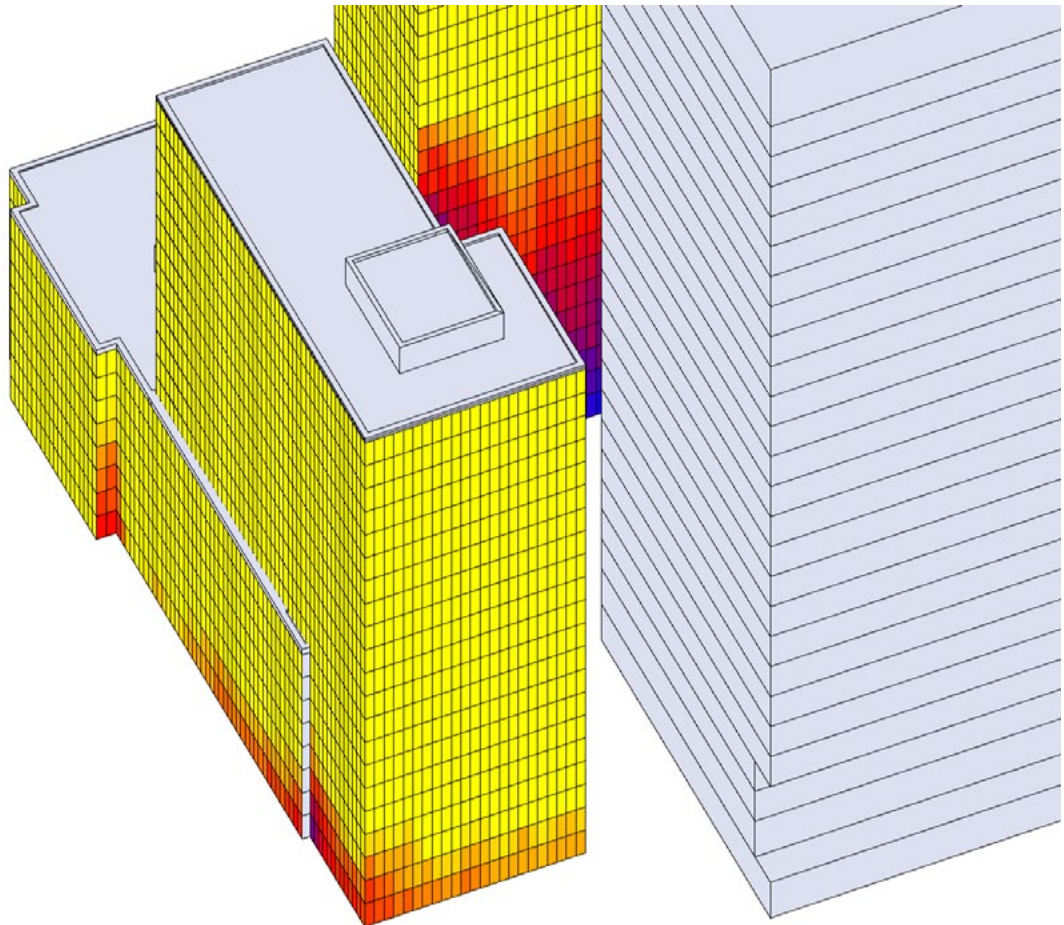
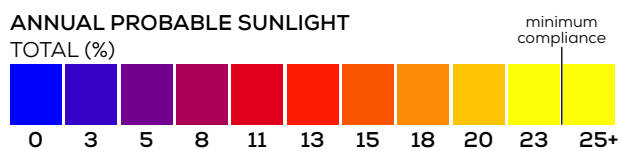


Fig. 27: APSH Diagram - Option 2 - View 2



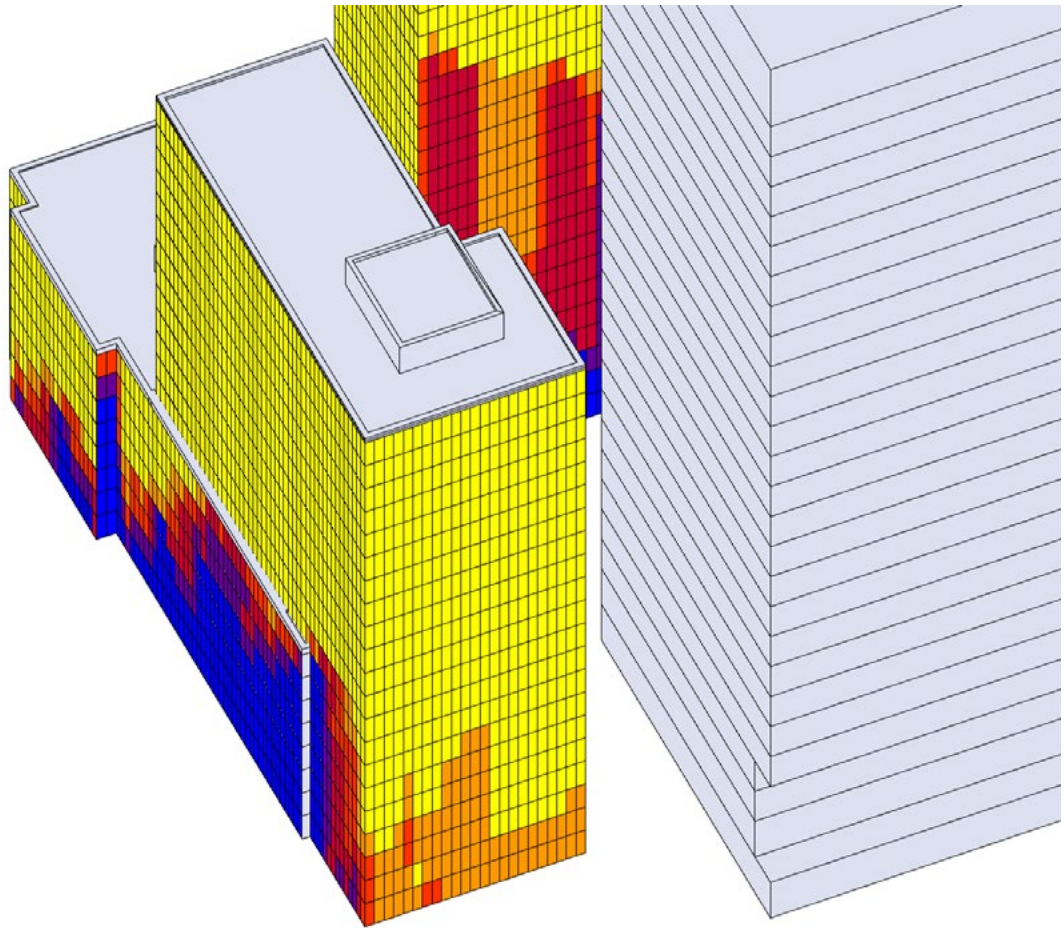
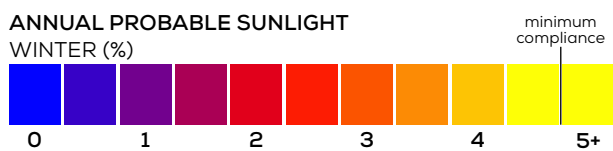


Fig. 28: WPSH Diagram - Option 2 - View 2



ANNUAL PROBABLE SUNLIGHT HOURS - Option 2

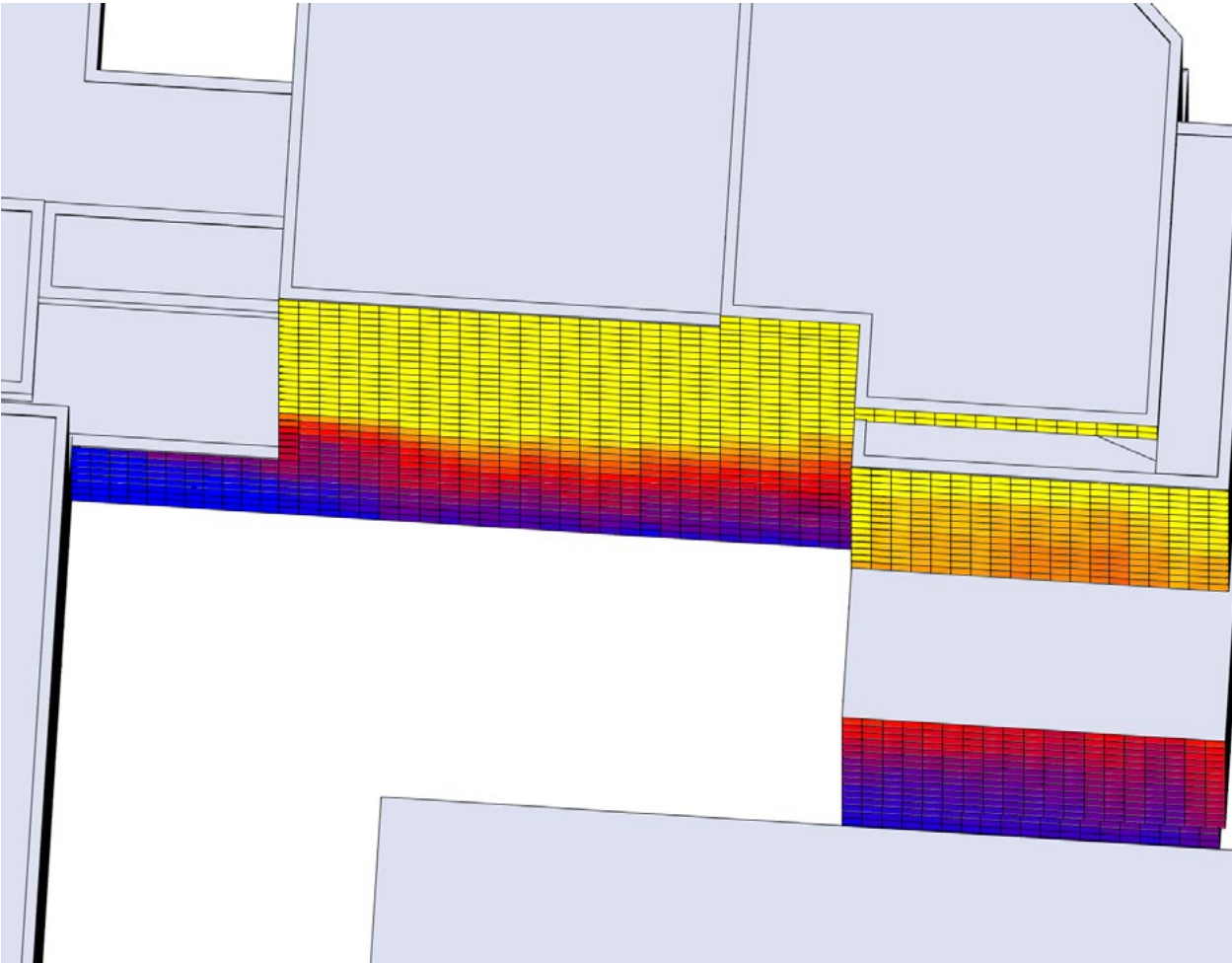
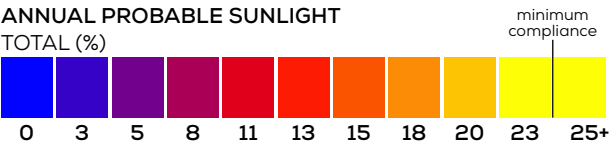


Fig. 29: APSH Diagram - Option 2 - View 3



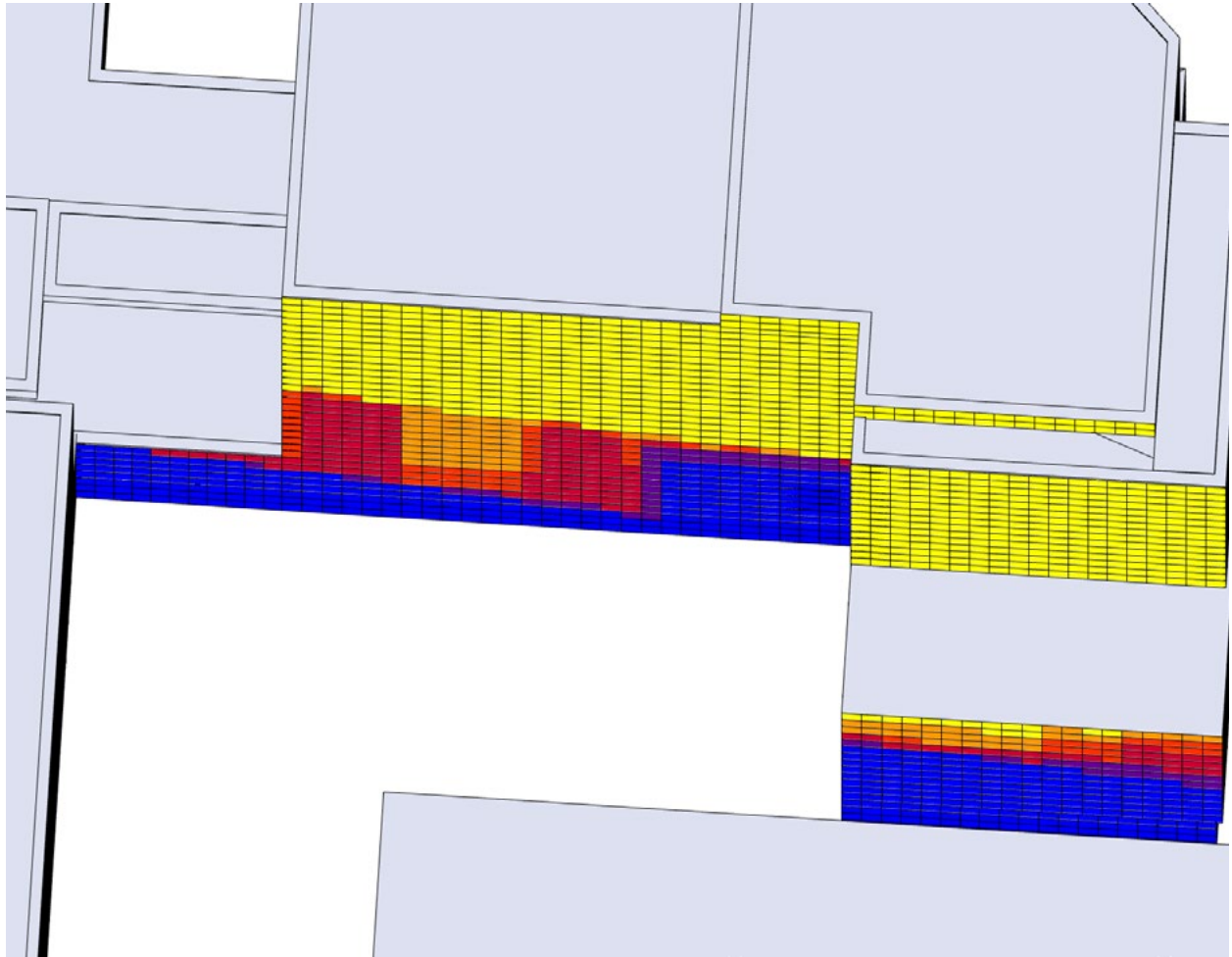
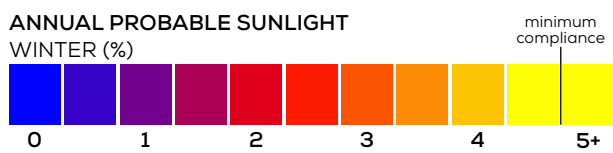


Fig. 30: WPSH Diagram - Option 2 - View 3



ANNUAL PROBABLE SUNLIGHT HOURS - Option 3

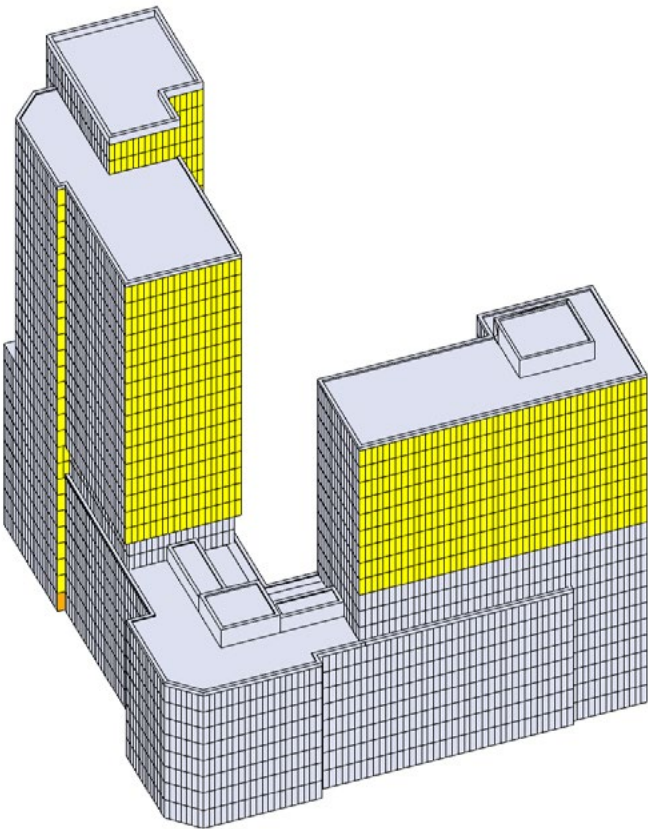
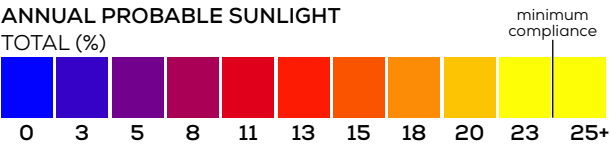


Fig. 31: APSH Diagram - Option 3 - View 1



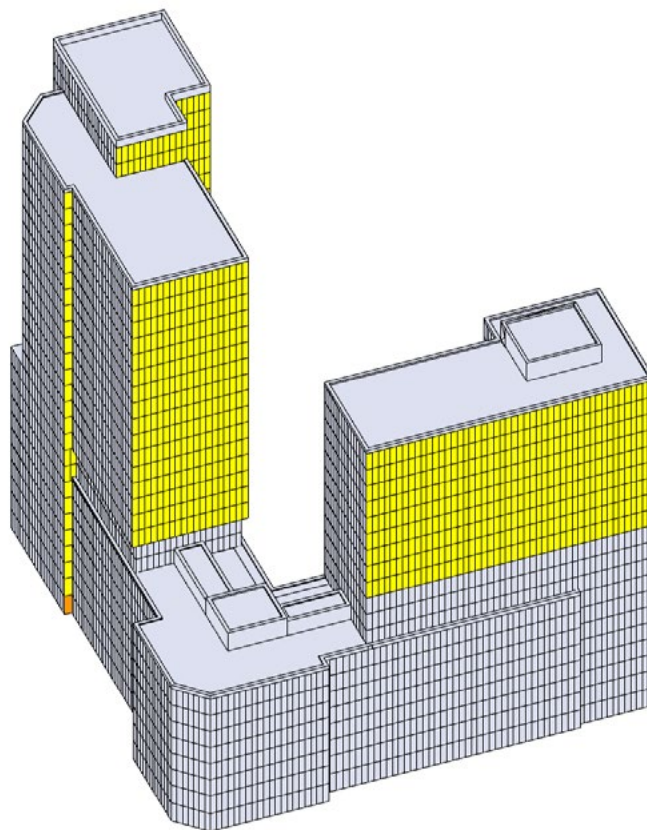
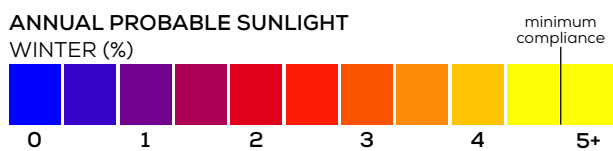


Fig. 32: WPSH Diagram - Option 3 - View 1



ANNUAL PROBABLE SUNLIGHT HOURS - Option 3

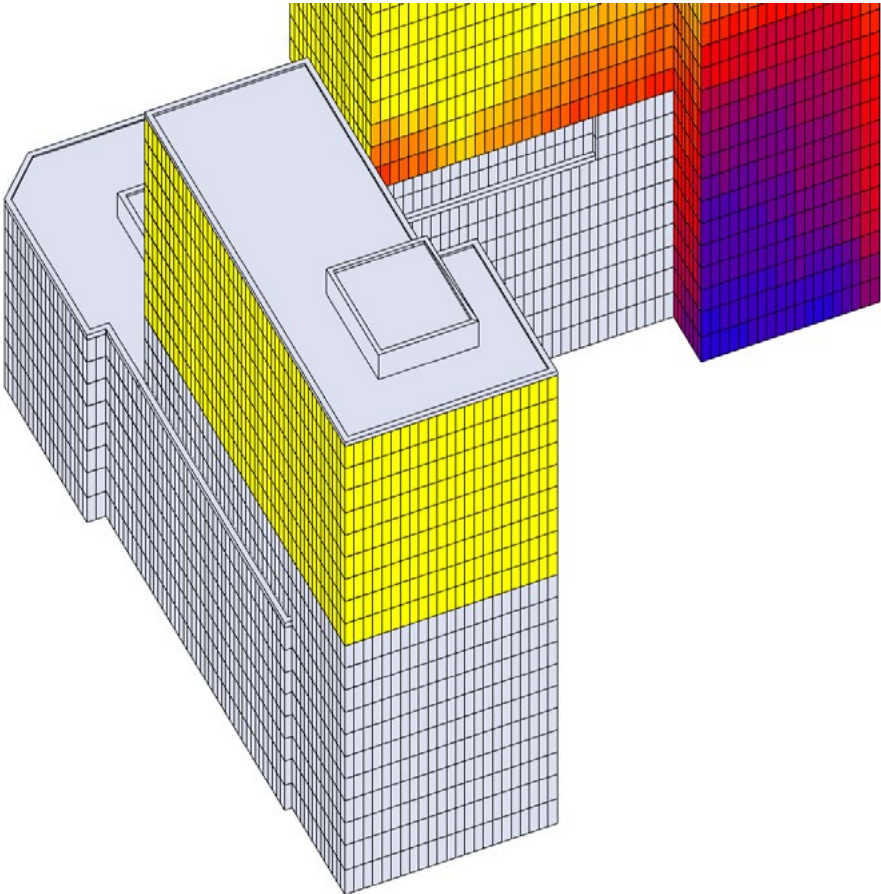
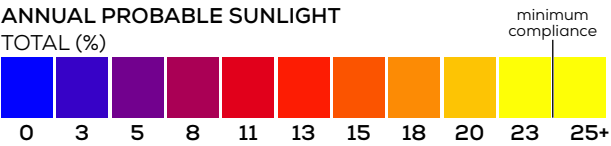


Fig. 33: APSH Diagram - Option 3 - View 2



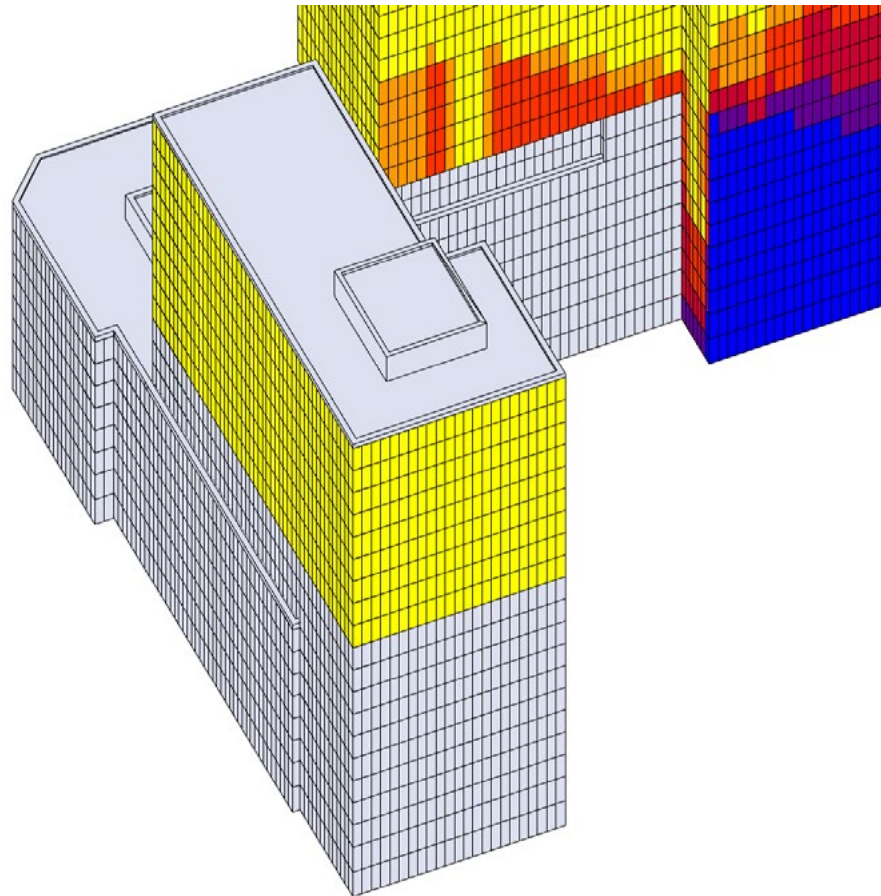
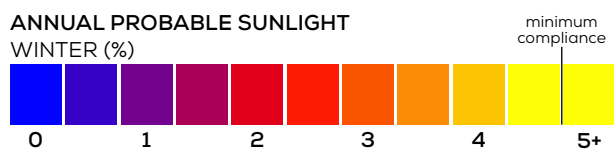


Fig. 34: WPSH Diagram - Option 3 - View 2



ANNUAL PROBABLE SUNLIGHT HOURS - Option 3

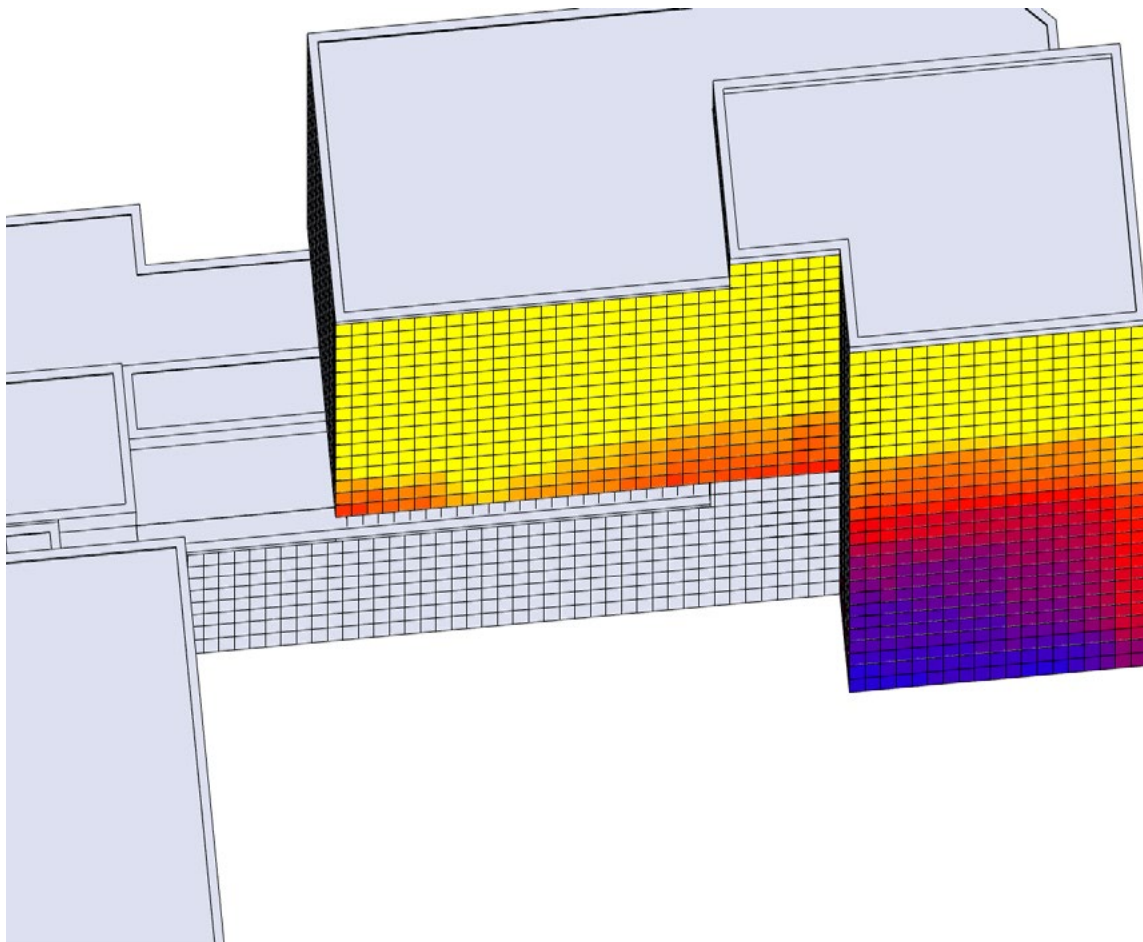
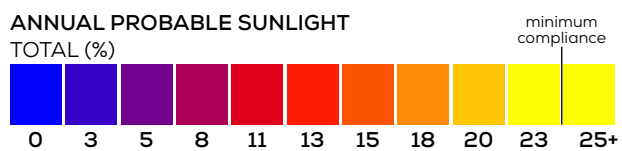


Fig. 35: APSH Diagram - Option 3 - View 3



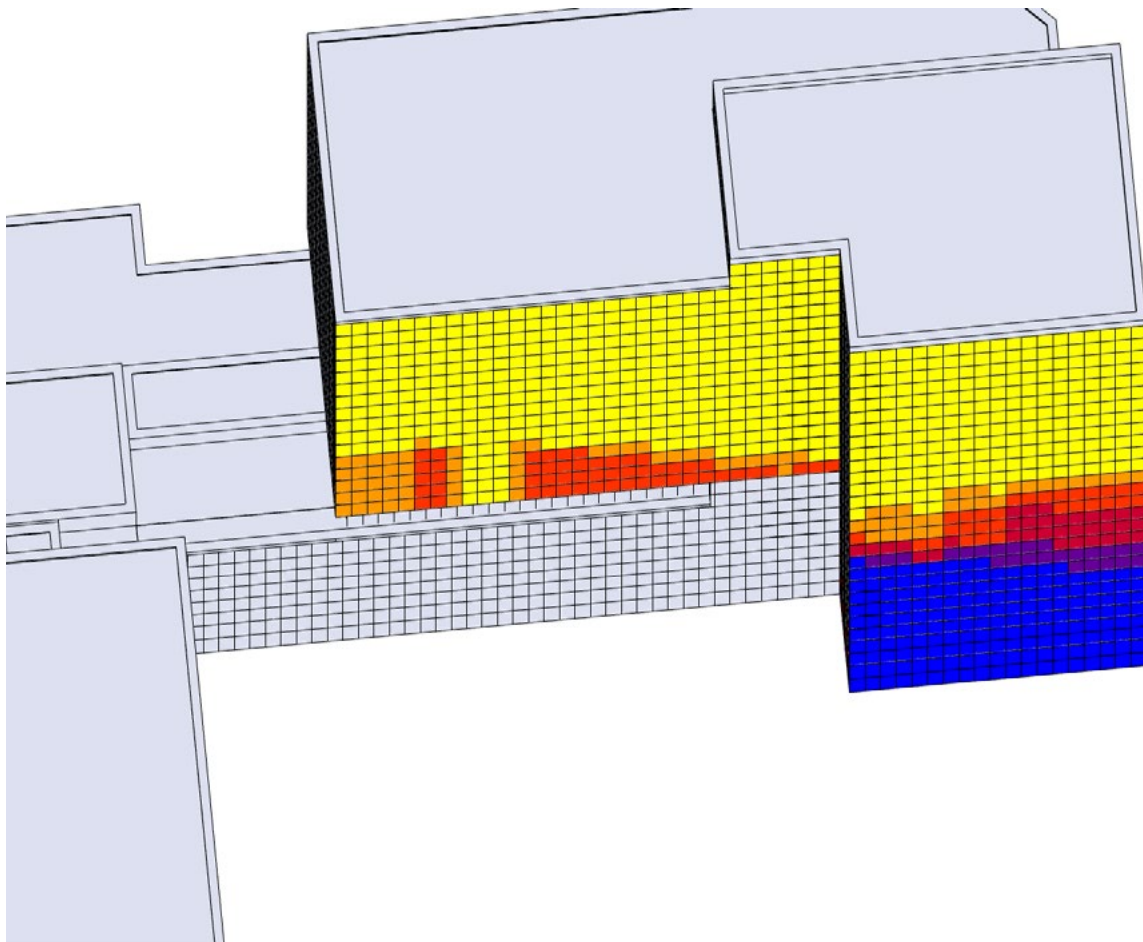
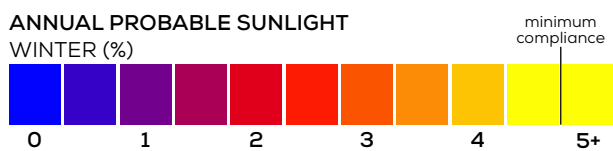


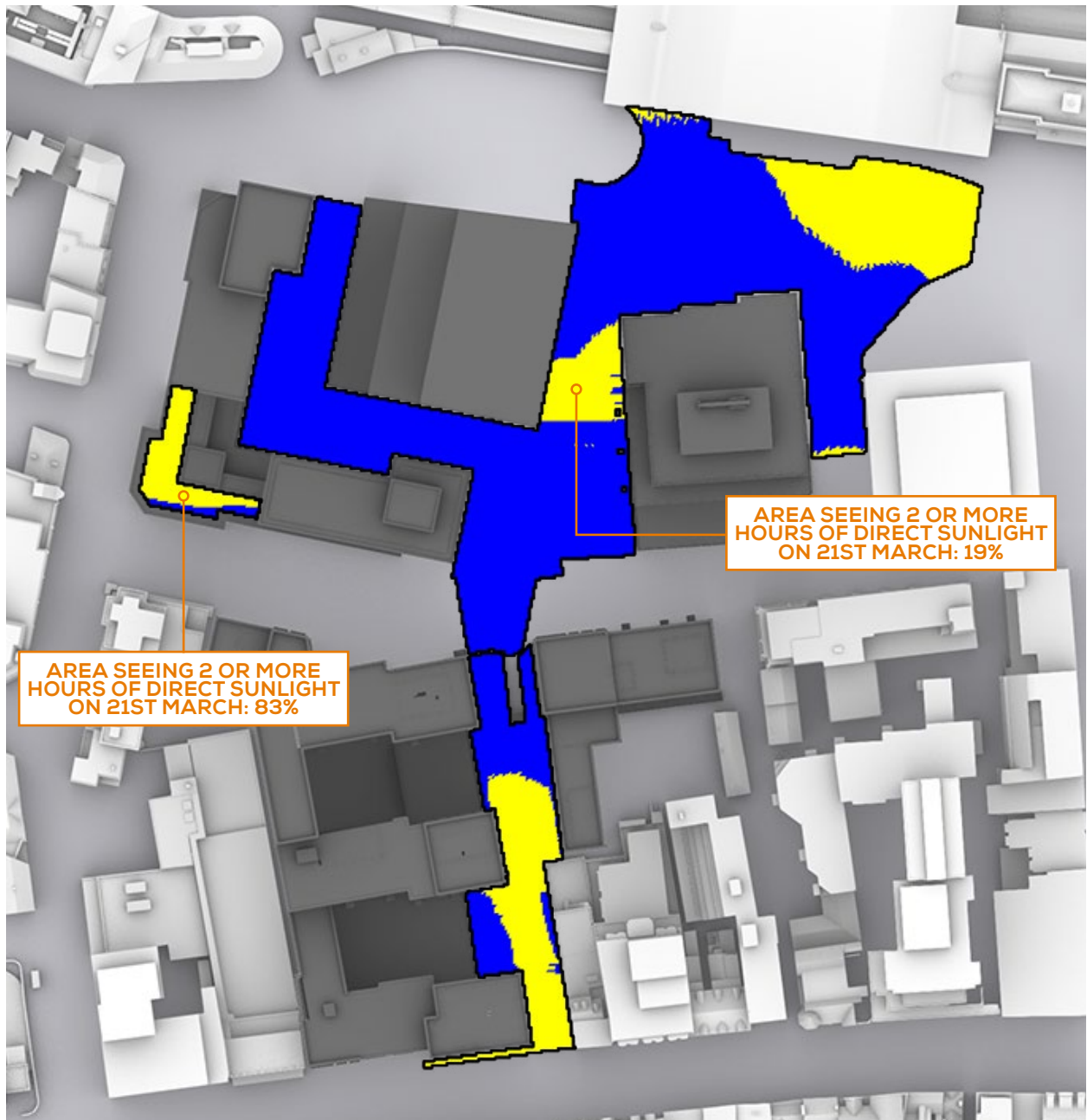
Fig. 36: WPSH Diagram - Option 3 - View 3



10 OVERSHADOWING ASSESSMENTS

Option 1

OVERSHADOWING ASSESSMENT SUN HOURS ON GROUND



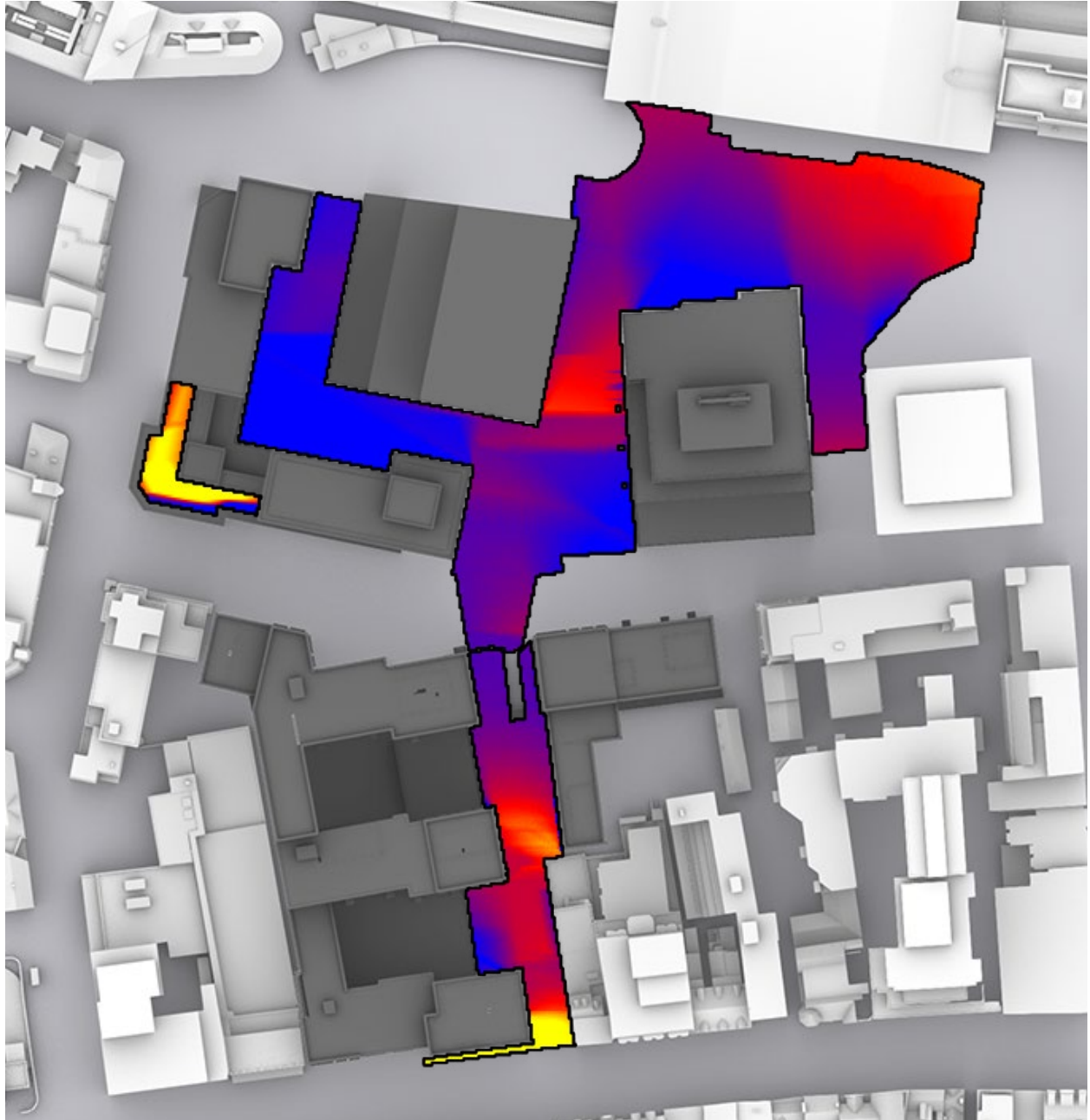
(BRE RECOMMENDS 2+ HOURS OF SUNLIGHT ON 21ST MARCH FOR AT LEAST 50% OF THE OPEN SPACE)

**NOTE FRIAR WALK HAS NOT BEEN INCLUDED WITHIN THE CALCULATIONS AND IS ONLY SHOWN FOR ILLUSTRATIVE PROPOSES*

SUN HOURS ON GROUND



OVERSHADOWING ASSESSMENT
SUN EXPOSURE - 21ST MARCH



SUN EXPOSURE
TOTAL HOURS



21ST MARCH
(SPRING EQUINOX)

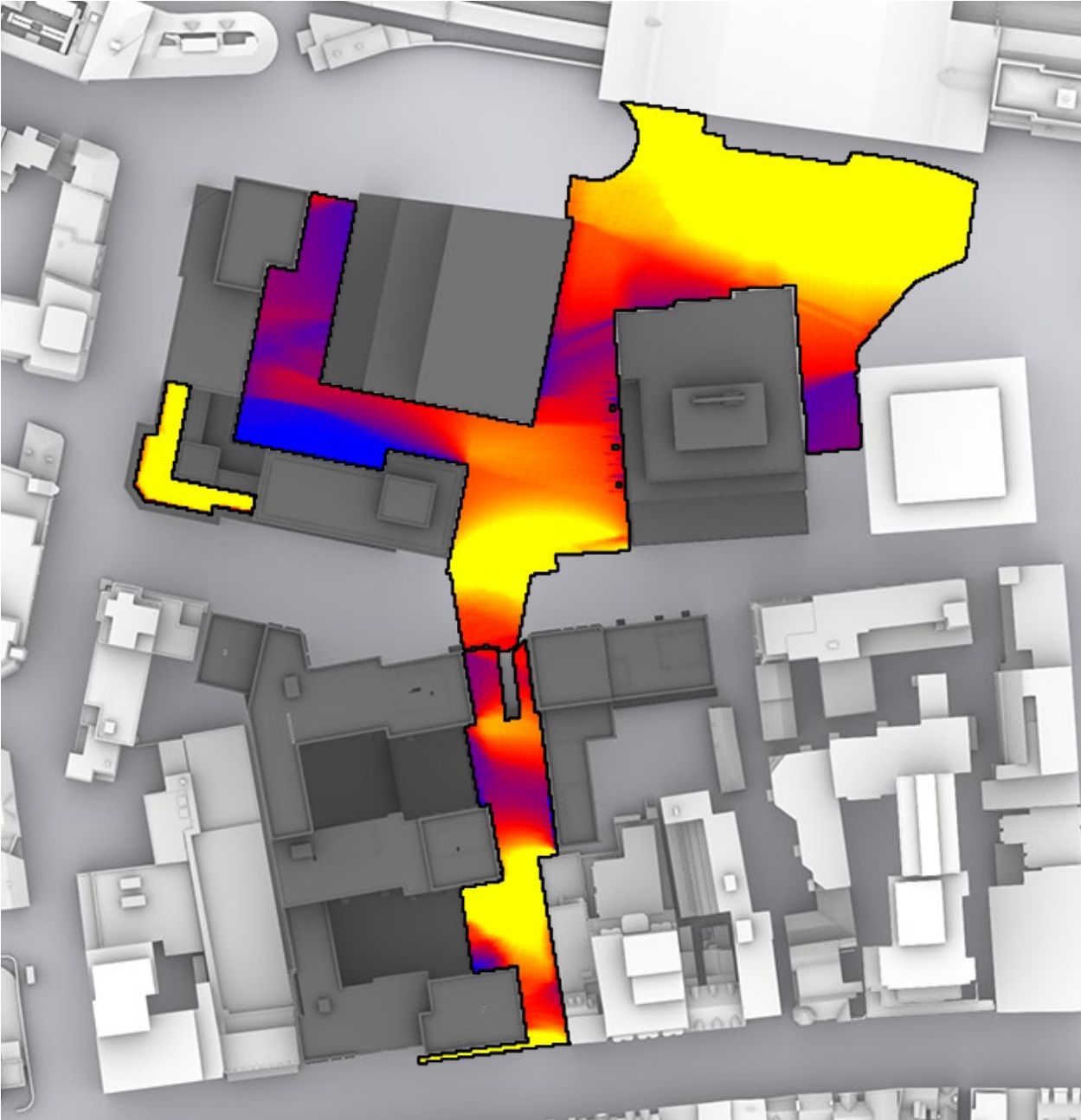
LONDON

Latitude: 51.4
Longitude: 0.0
Sunrise: 06:02 GMT
Sunset: 18:14 GMT

Total Available Sunlight:
12hrs 12mins

Option 1

OVERSHADOWING ASSESSMENT
SUN EXPOSURE - 21ST JUNE



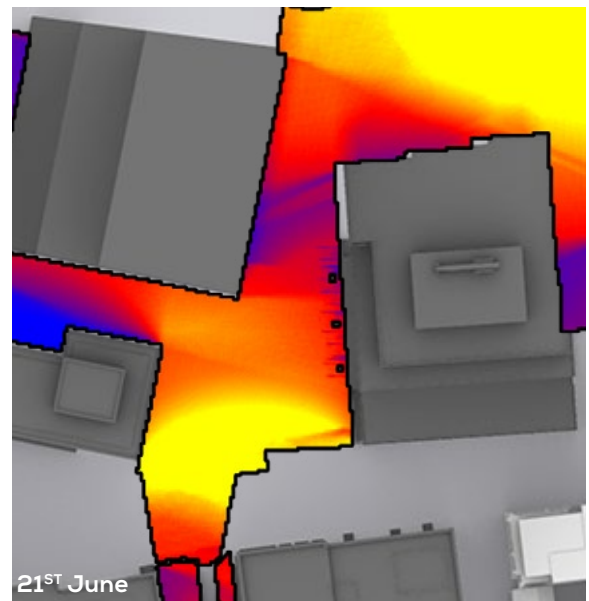
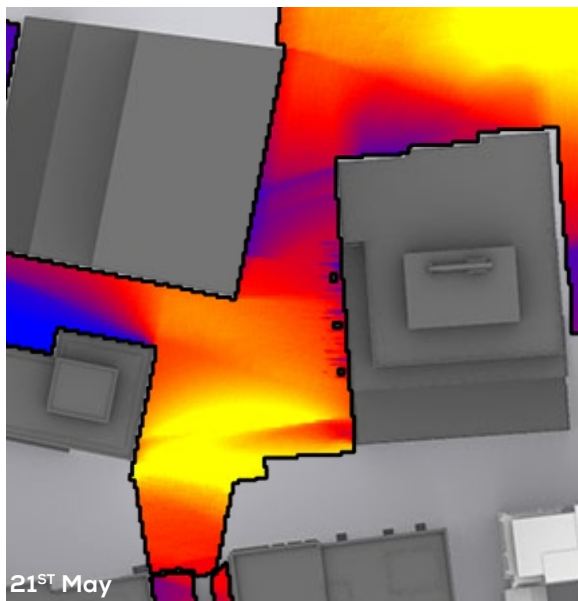
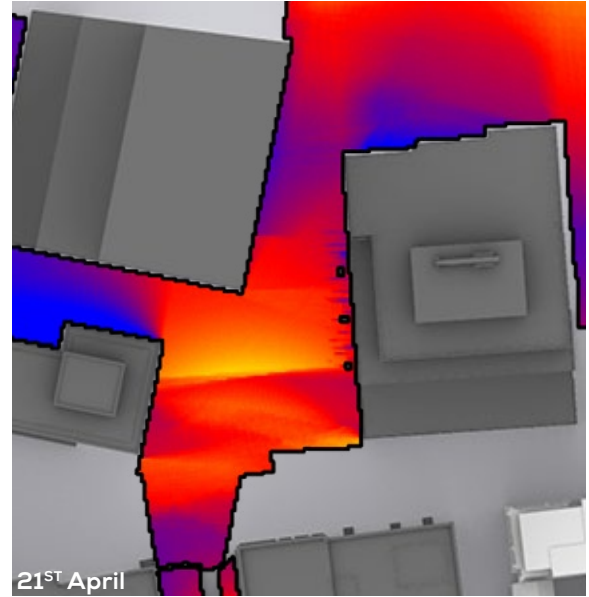
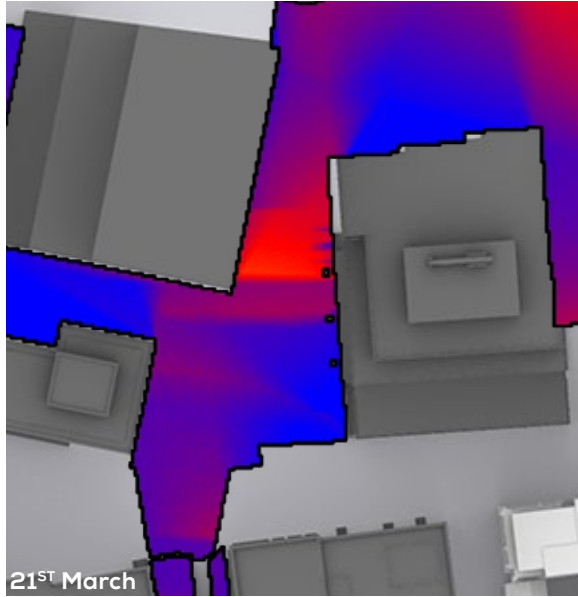
SUN EXPOSURE
TOTAL HOURS



21st JUNE
(SUMMER SOLSTICE)

LONDON
Latitude: 51.4
Longitude: 0.0
Sunrise: 04:43 GMT
Sunset: 21:21 GMT

Total Available Sunlight:
16hrs 38mins

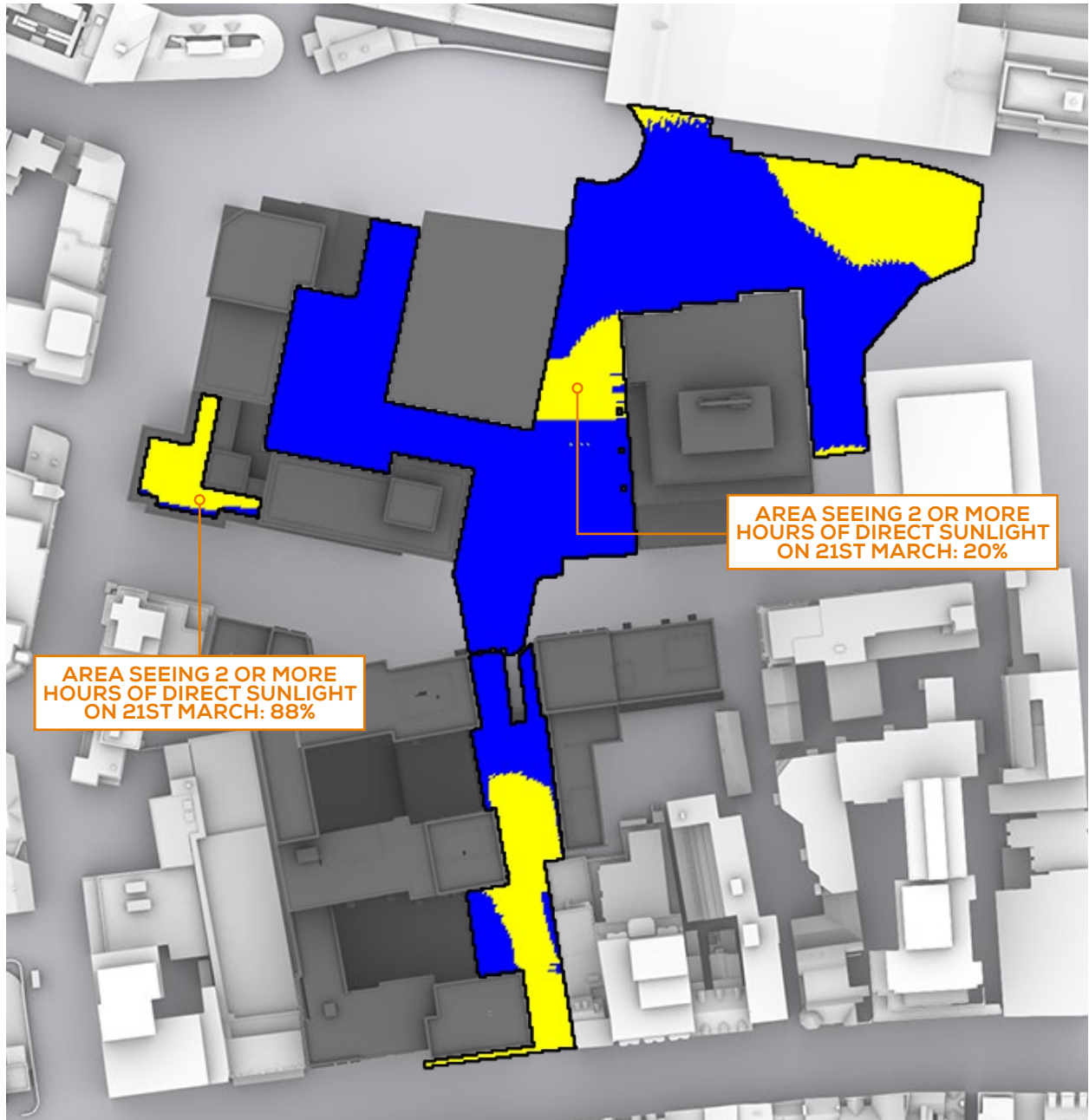


SUN EXPOSURE
TOTAL HOURS



Option 2

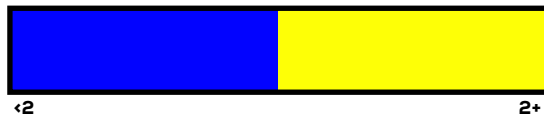
OVERSHADOWING ASSESSMENT SUN HOURS ON GROUND



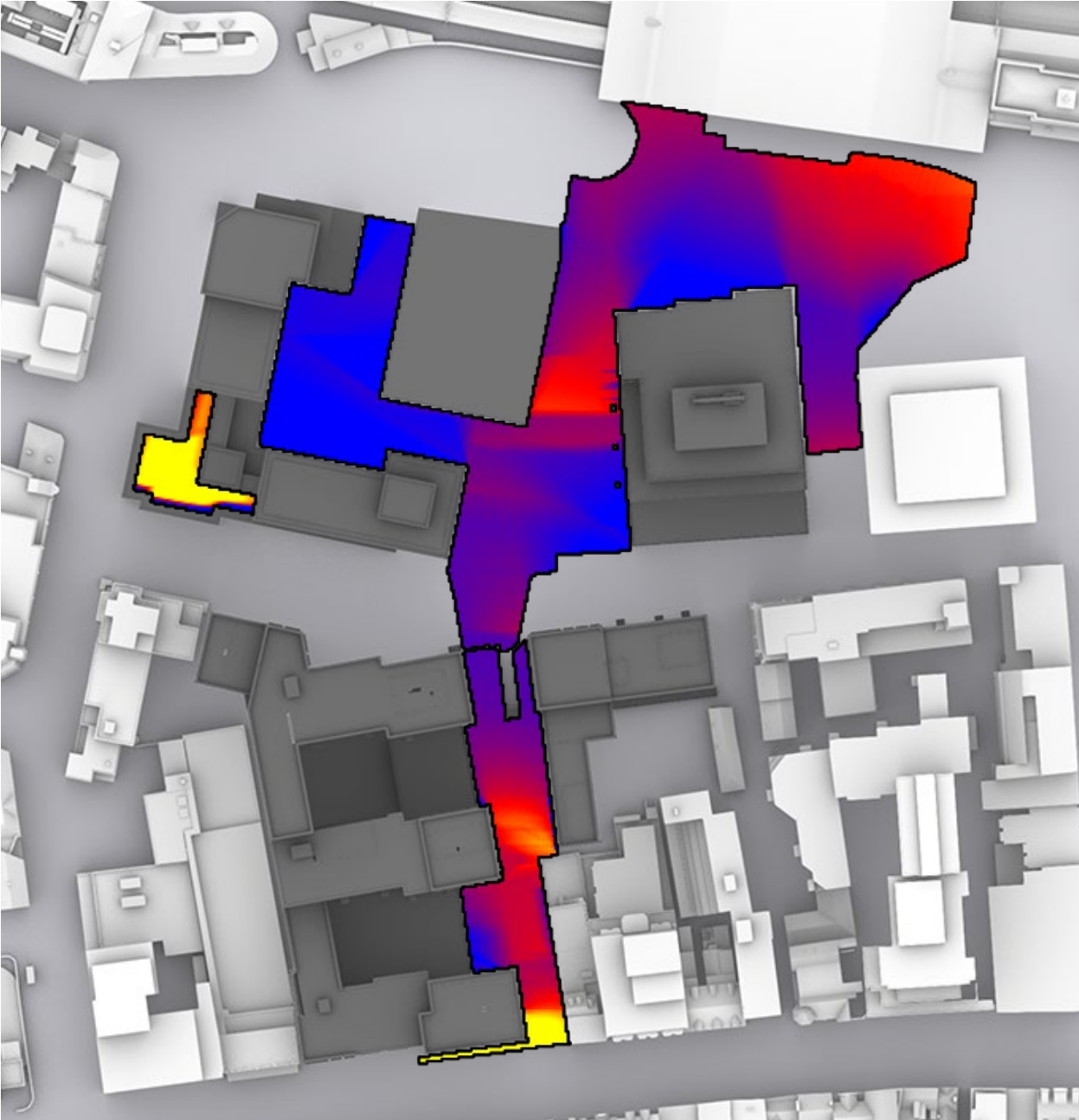
(BRE RECOMMENDS 2+ HOURS OF SUNLIGHT ON 21ST MARCH FOR AT LEAST 50% OF THE OPEN SPACE)

**NOTE FRIAR WALK HAS NOT BEEN INCLUDED WITHIN THE CALCULATIONS AND IS ONLY SHOWN FOR ILLUSTRATIVE PROPOSES*

SUN HOURS ON GROUND



OVERSHADOWING ASSESSMENT
SUN EXPOSURE - 21ST MARCH



SUN EXPOSURE
TOTAL HOURS



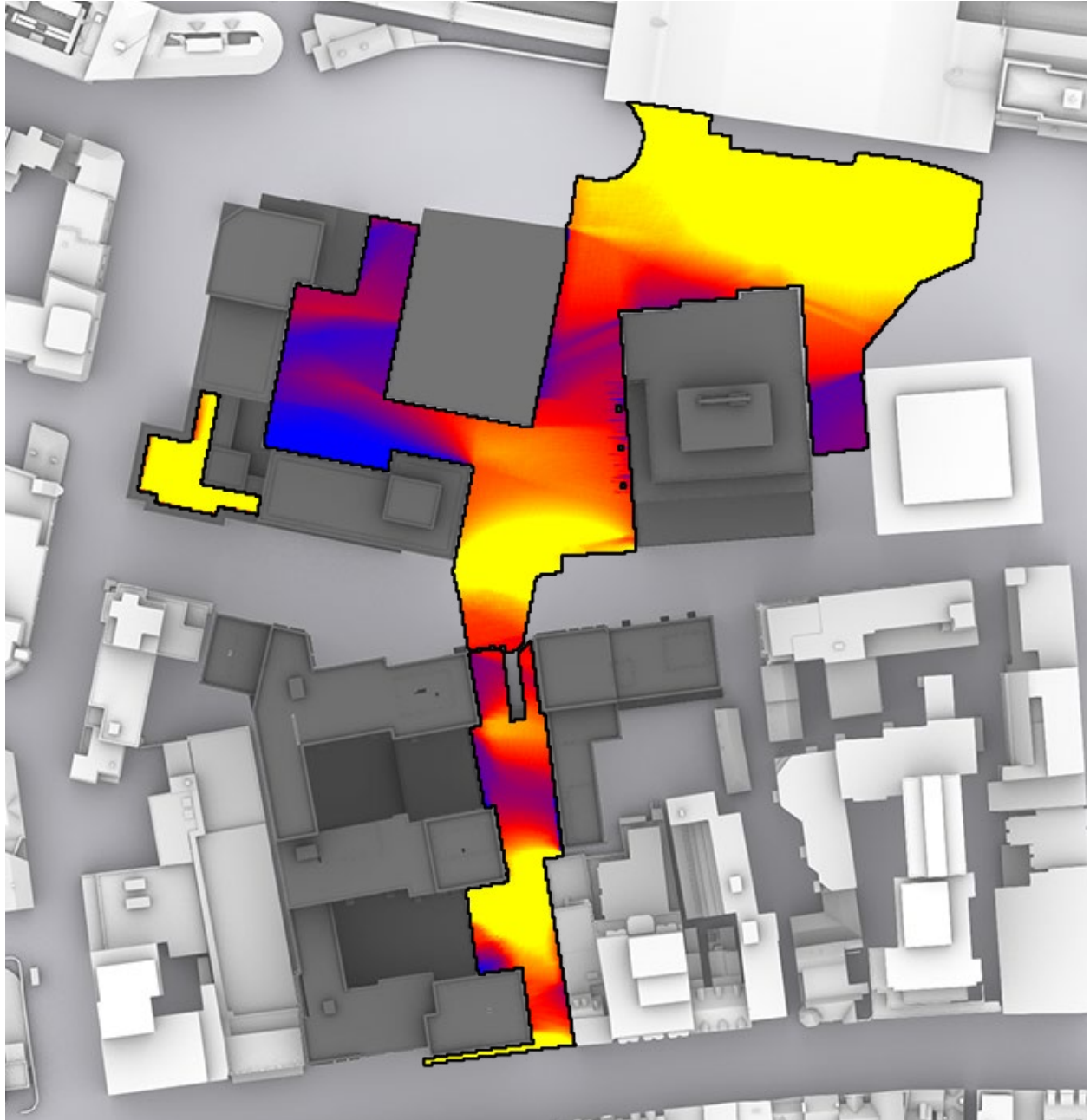
21st MARCH
(SPRING EQUINOX)

LONDON
Latitude: 51.4
Longitude: 0.0
Sunrise: 06:02 GMT
Sunset: 18:14 GMT

Total Available Sunlight:
12hrs 12mins

Option 2

OVERSHADOWING ASSESSMENT SUN EXPOSURE - 21ST JUNE



SUN EXPOSURE TOTAL HOURS

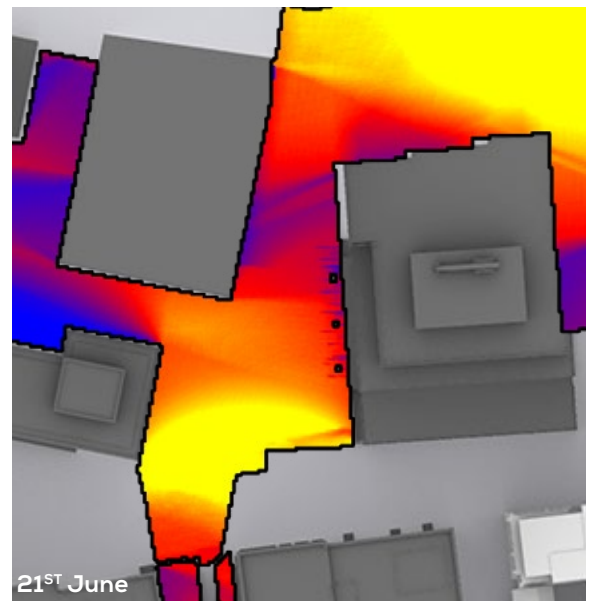
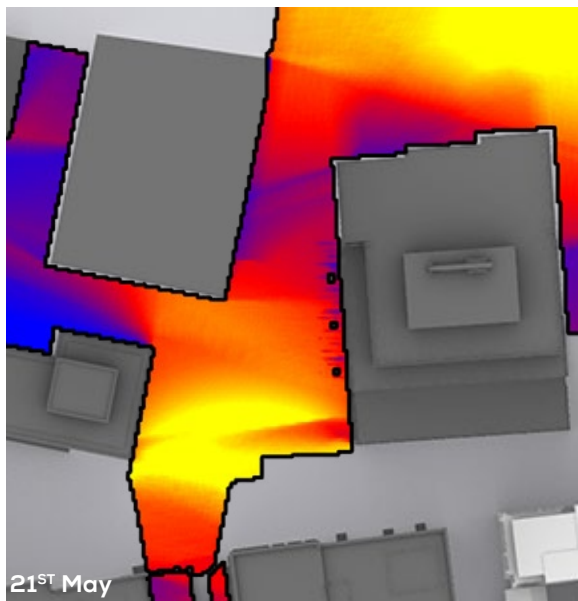
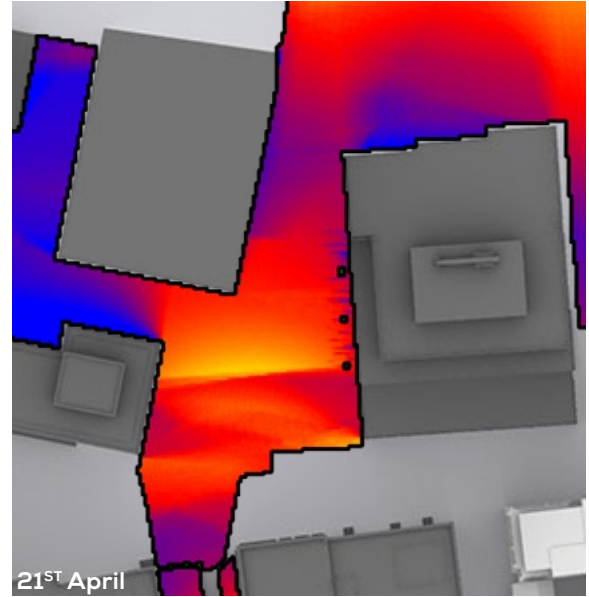
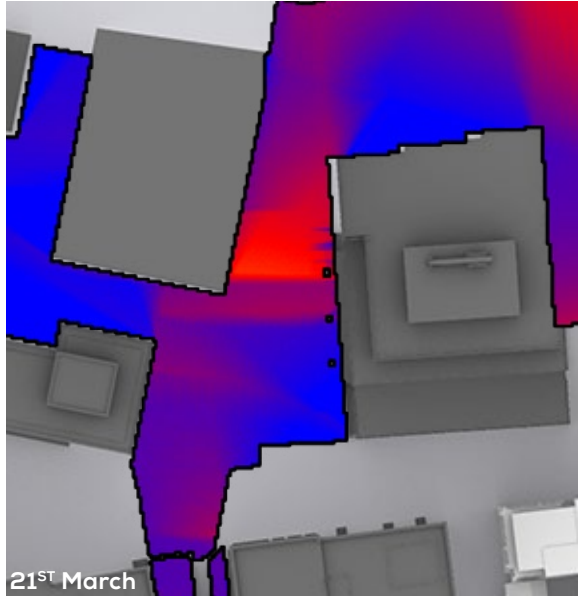


21st JUNE
(SUMMER SOLSTICE)

LONDON

Latitude: 51.4
Longitude: 0.0
Sunrise: 04:43 GMT
Sunset: 21:21 GMT

Total Available Sunlight:
16hrs 38mins

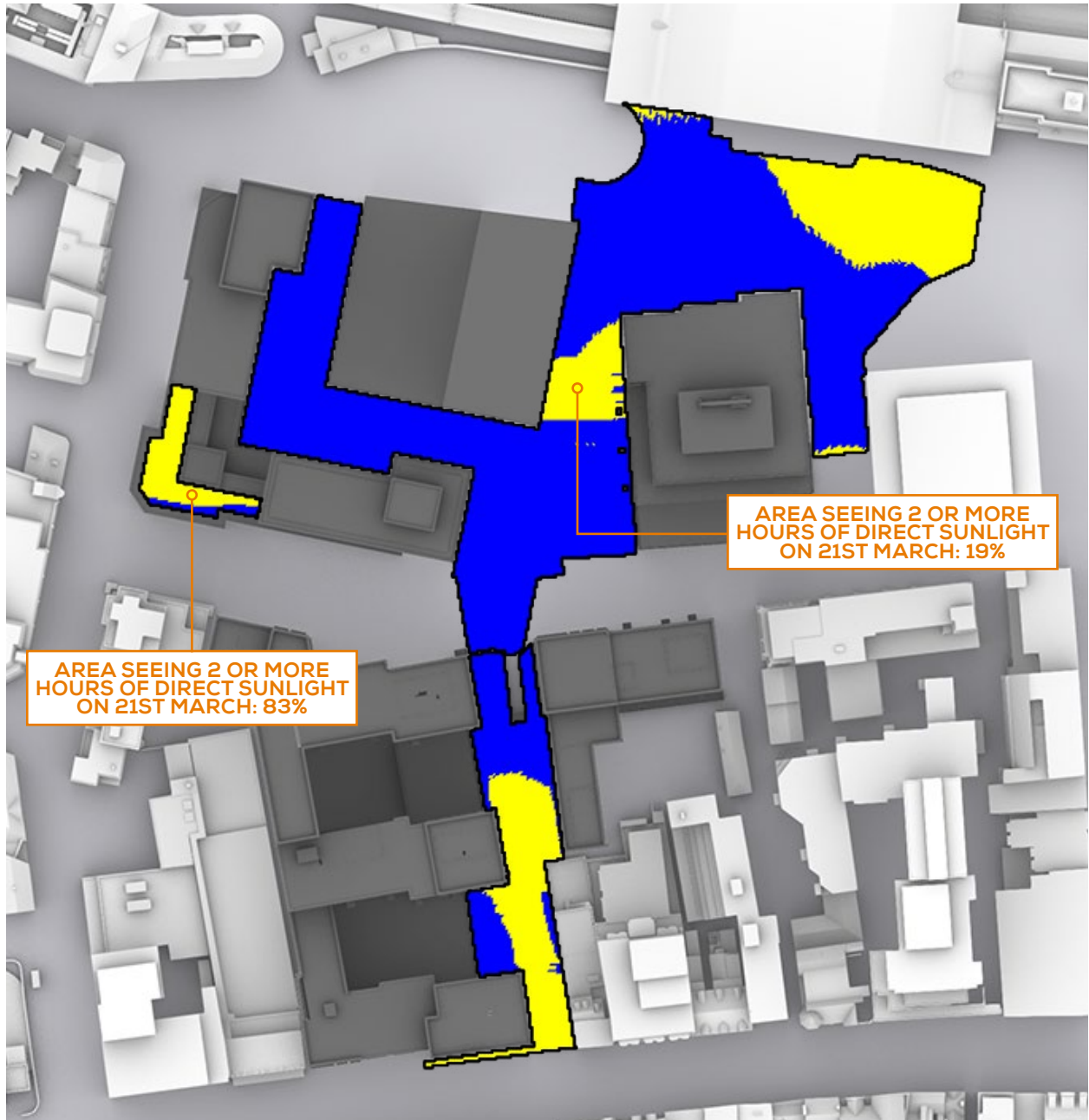


SUN EXPOSURE TOTAL HOURS



Option 3

OVERSHADOWING ASSESSMENT SUN HOURS ON GROUND



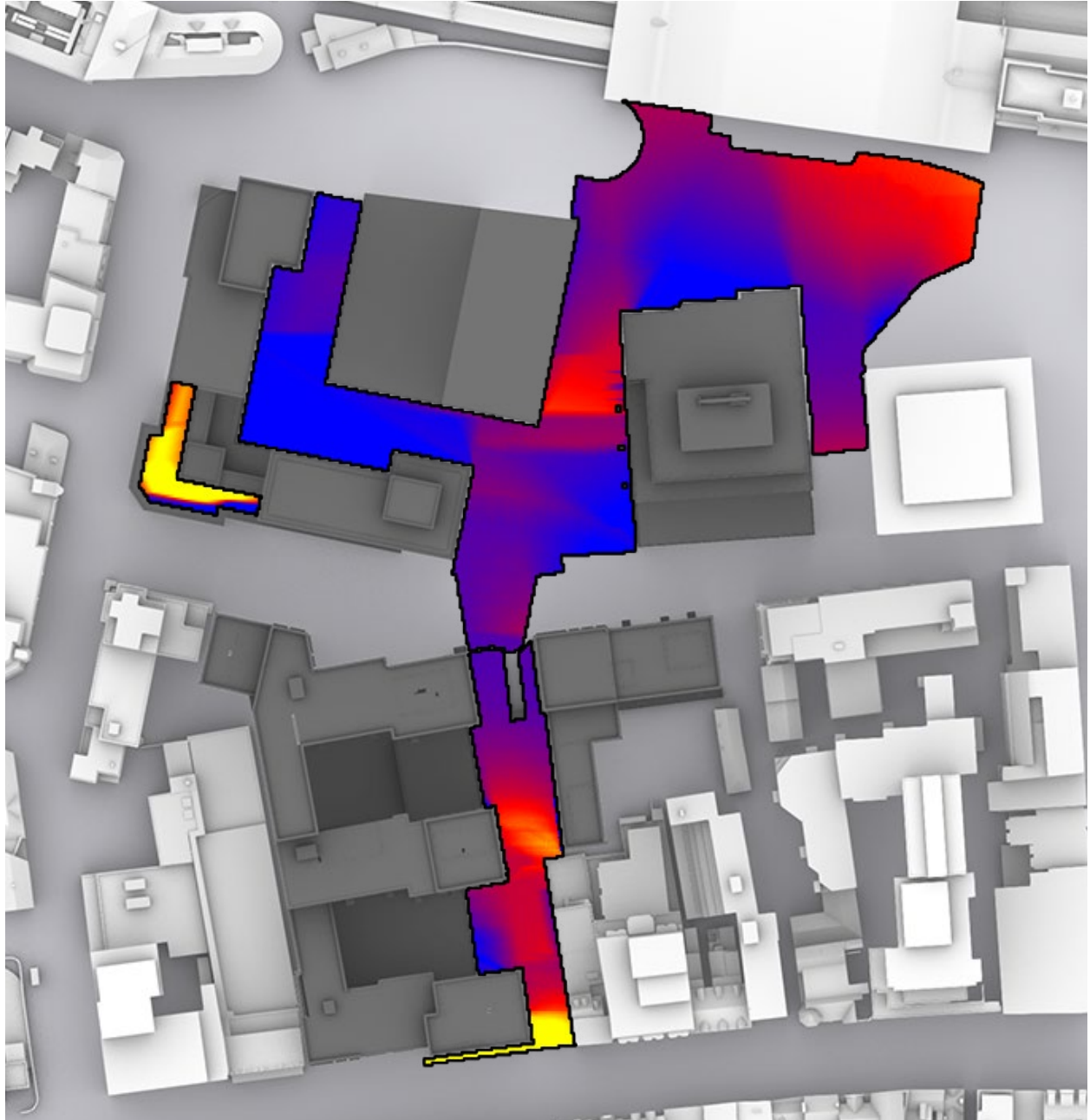
(BRE RECOMMENDS 2+ HOURS OF SUNLIGHT ON 21ST MARCH FOR AT LEAST 50% OF THE OPEN SPACE)

**NOTE FRIAR WALK HAS NOT BEEN INCLUDED WITHIN THE CALCULATIONS AND IS ONLY SHOWN FOR ILLUSTRATIVE PROPOSES*

SUN HOURS ON GROUND



OVERSHADOWING ASSESSMENT
SUN EXPOSURE - 21ST MARCH



SUN EXPOSURE
TOTAL HOURS



21ST MARCH
(SPRING EQUINOX)

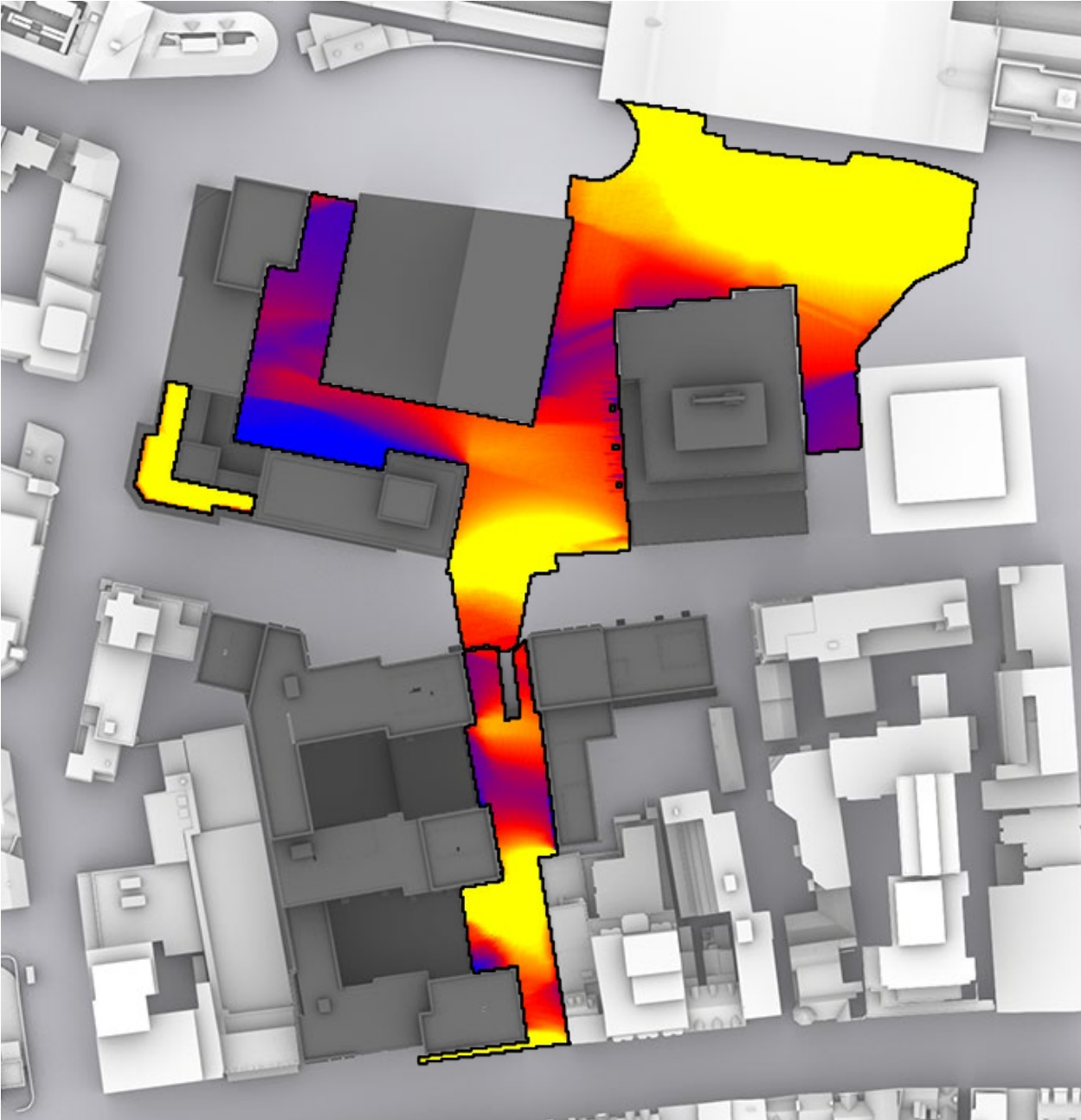
LONDON

Latitude: 51.4
Longitude: 0.0
Sunrise: 06:02 GMT
Sunset: 18:14 GMT

Total Available Sunlight:
12hrs 12mins

Option 3

OVERSHADOWING ASSESSMENT
SUN EXPOSURE - 21ST JUNE



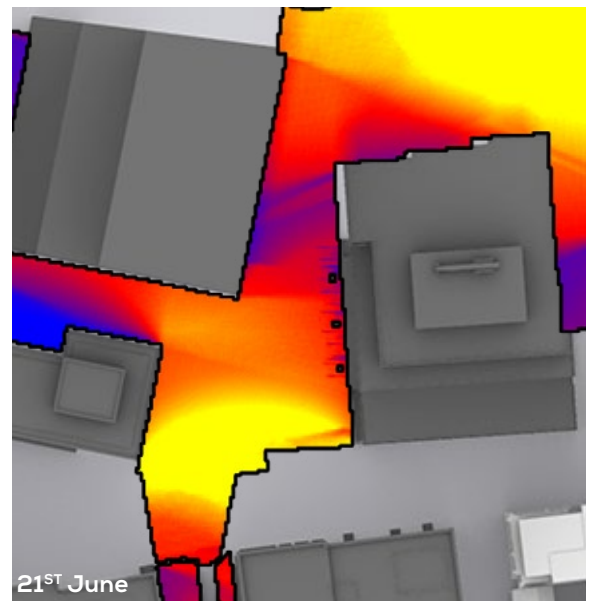
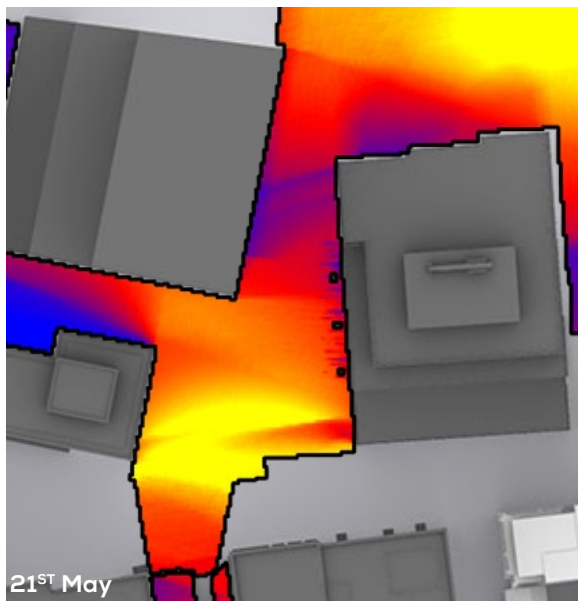
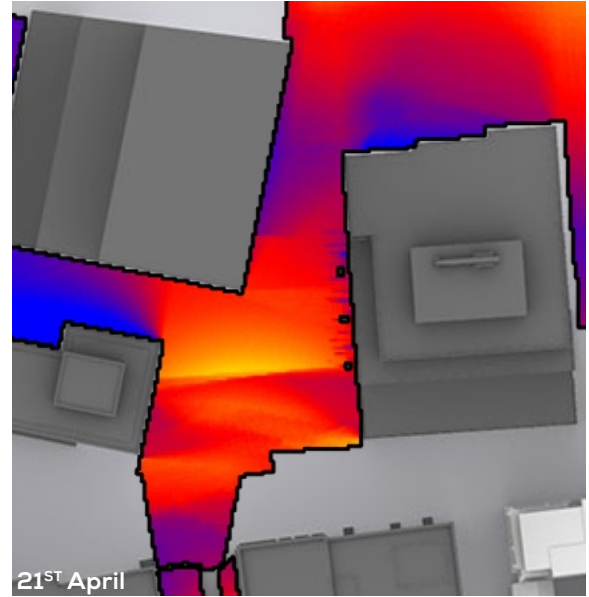
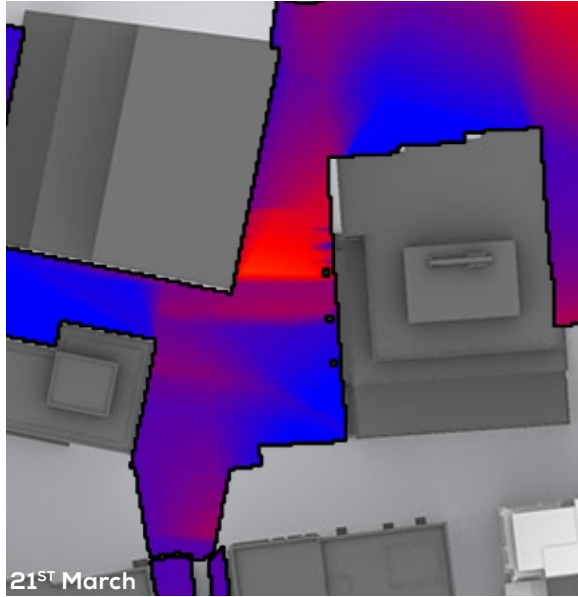
SUN EXPOSURE
TOTAL HOURS



21st JUNE
(SUMMER SOLSTICE)

LONDON
Latitude: 51.4
Longitude: 0.0
Sunrise: 04:43 GMT
Sunset: 21:21 GMT

Total Available Sunlight:
16hrs 38mins



SUN EXPOSURE
TOTAL HOURS



