For DESIGN ENDEAVOURS Ltd.

DAYLIGHT SUNLIGHT

REPORT

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Site:	Land adjacent to 2 Ash Grove, Hayes, UB3 1JR

Table of Contents

List of Tables

List of Figures

1. General Summary

1.1. Job Scope

This daylight & sunlight report has been prepared for Design Endeavour Ltd. for the proposed new built, 2-storey 2-bedroom dwelling at land adjacent to 2 Ash Grove, Hayes, UB3 1JR. The objective of this report is to evaluate the daylight sunlight performance of the newly proposed dwelling, and any potential impact of the surrounding buildings on the proposed development.

Note: The building on the proposed site is a two-storey structure with a pitch roof. It consists of a kitchen/dining and a bedroom on the ground floor and an additional bedroom on the first floor.

1.2. Daylight-Sunlight Standards

To confirm the efficacy of this study, a detailed daylight sunlight assessment is carried out following the guidelines set out in

- the 3rd edition 2022 Building Research Establishment (BRE guide BR-209-2022), titled as: **'Site Layout Planning for Daylight and Sunlight – A good practice guide'** and

- British Standard 8206 – 2: 2008 – **'Lighting for Buildings – Part 2: Code of Practice for Daylighting'**.

A brief description of the standards and guidelines employed in this assessment can be found in Appendix A.

1.3. Daylight & Sunlight Assessment Report – A Summary

The architectural plans for the proposed development conform to the daylight & sunlight criteria set forth by the BRE guidelines. Consequently, there are no valid reasons to contest the proposed development of a house concerning the well-being of daylight and sunlight.

1.4. Approach to BRE Guidelines

BRE guidelines offer important benchmarks for construction. However, flexible approach towards BRE guidelines before carrying out computational assessment allows for adaptability, innovation, and responsiveness to changing circumstances and objectives. BRE acknowledge this flexibility, and this approach makes the project handling more practical, sustainable, and community-oriented. Section 3.3 discuss in detail the mitigating factors considered in this study.

2. Introduction

2.1. Job Scope

We have carried out a detailed daylight sunlight assessment for the proposed development work at **land adjacent to 2 Ash Grove, Hayes, UB3 1JR**. The assessment is to evaluate the potential impact of the surrounding buildings on the "Right to Light" claim for the proposed design and vice versa.

2.2. Site Location Plan

As notified in section 1.2, both BRE guidelines and British Standard 8206 – 2: 2008 are taken into consideration while preparing the daylight sunlight report for the proposed design.

The OS Map of the site location in **Figure 1** illustrates the layout of neighboring structures in relation to the proposed design.

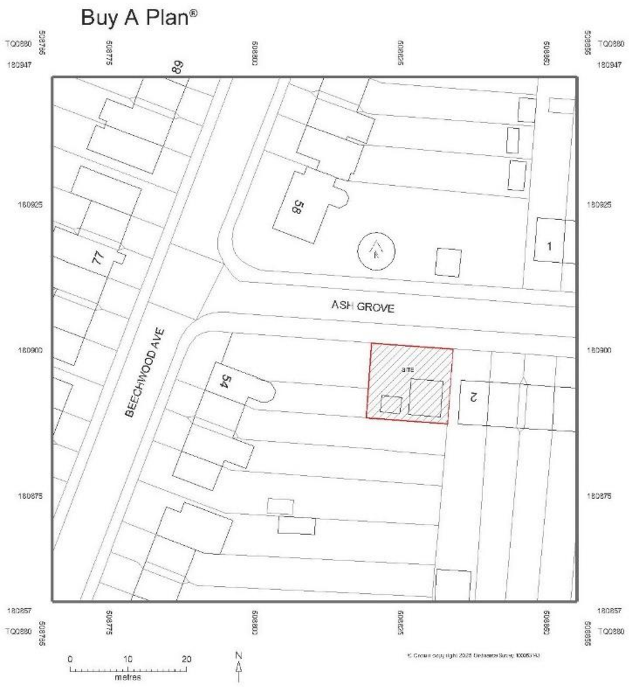

Figure 1. OS MAP of the site under consideration

Table 1 below shows the list of neighboring buildings under investigation that could potentially impact the daylight sunlight access of the proposed building.

It is important to highlight that not all of the surrounding structures need to undergo a comprehensive evaluation. The reasons for this selective assessment are further elaborated in section 3: Results and Considerations.

Table 1. List of nearby structures surrounding the proposed design.

S.No.	Designation	Building Type	Position
1	B1	Residential	East
2	B2	Garage	South
3	B3	Garage	South
4	Main Building	*Proposed Design*	-

2.3. Report Assessment Limitations

- Report assessment of the proposed building under daylight sunlight assessment is based on the attached proposed drawings.

- A detailed topographical survey is not required for existing surrounding buildings and ground heights because of its relatively plain topology. Thus, surrounding building locations and any heights are derived through site photographs, CAD drawings, oblique aerial photography, Google Earth, and general visual assessment.

- Developmental drawings and other relevant details required for the daylight sunlight assessment are provided with this report.

3. Assessing BRE Standards & Mitigation

3.1. Daylight Standards

- BRE guidelines recommend a target Vertical Sky Component (VSC) assessment value of 27%. However, in cases where VSC values of the proposed design are lower than 27%, the BRE permits a reduction of 20% from that obtained in the existing building.

These criteria should not be regarded as rigid due to the intricate nature of urban planning. A reduction in daylight distribution exceeding 20% may indeed be noticeable to the occupants, but it's important to note that "noticeable" does not necessarily translate to "significant" or "adverse." Instead, it underscores the need for thorough consideration within the broader context of the development.

In essence, these guidelines remain flexible because urban planning is influenced by a multitude of intricate factors. A decrease in daylight beyond 20% might be perceptible to individuals, but it does not automatically imply a substantial or negative impact. To make informed decisions in urban planning, we must assess the situation comprehensively, taking all relevant factors into account.

3.2. Sunlight Standards

- BRE guidelines recommend an Annual Probable Sunlight Hours (APSH) target value of 25% for living rooms. A 5% of this sunlight should be available during the winter months. However, in cases where APSH values fall below 25%, the BRE permits a reduction of 20% from that obtained in the existing building.

- This flexibility is approached after considering mitigating factors.

3.3. Mitigating Factors

In complex design studies, especially within densely populated areas, a multitude of factors can complicate adherence to the BRE guidelines. Hence, it becomes imperative to meticulously evaluate mitigating factors as an essential phase in the development process.

It's important to consider these mitigating factors alongside the quantitative data at hand. The aim is to adopt a balanced approach that takes into account the concerns and entitlements of neighboring parties while still permitting developers to make reasonable use of the land.

Thus, BRE guidelines emphasize flexibility for designers rather than strict constraints. They are meant to be used as tools to aid in the creation of thoughtful, context-aware designs. This approach encapsulates the essence of responsible and holistic urban planning, where the needs and concerns of both the community and developers are weighed fairly to create a harmonious and sustainable built environment.

Following are some mitigating factors considered in this study;

- **Mitigating Factor #1:** A key mitigating factor arises when nearby buildings are positioned very closely to the planned site boundary. This situation can significantly obstruct light for the intended design. In such instances, it could be difficult to prevent a reduction in daylight or sunlight. Consequently, the local authority may consider applying different target values.

- **Mitigating Factor #2:** In cases where sites are either undeveloped or require infill development, it's often challenging to avoid increased obstruction and more frequent non-compliance with guidelines. For instance, if there's a gap between terraced properties or an existing street with tall buildings, it's generally acceptable in planning to fill such gaps or reinstate previous structures, even if it affects neighboring buildings.

- **Mitigating Factor #3:** The BRE guidelines also acknowledge that when buildings align with the height and proportions of existing surrounding structures, a greater level of obstruction may be inevitable, resulting in more instances of non-compliance.

- **Mitigating Factor #4:** When considering daylight and sunlight assessments, kitchens and bedrooms typically receive less importance compared to primary spaces like living rooms.

- **Mitigating Factor #5:** The orientation and architectural design of the building itself can significantly impact how daylight is distributed within the interior spaces. For example, the north facing spaces are expected to receive less direct sunlight compared to other orientations.

- **Mitigating Factor #6:** The height of the proposed building is a pivotal factor that can greatly impact the availability of daylight for the proposed design.

The preliminary assessment shows that the north face orientation of the proposed development can create significant degree of loss in its natural daylight access.

4. Results and Consideration

4.1. Daylight Assessment Report

The detailed results of the daylight tests conducted for the proposed building, in compliance with the BRE recommendations, are provided in Appendix B.

4.2. Assessment Steps & Criteria

To conduct a daylight assessment for the proposed design, we carefully evaluated the nearby structures to understand their potential impact on the new development and vice versa.

4.2.1. Proposed development effects on neighboring structures

- Since Sun traverse from East to West, buildings on East, B1, can have significant impact on their right to light access from the proposed new development, particularly on the west facing window during summer. It is expected that this window might open to a stairway, which may not be significant case for the current daylight sunlight assessment.

- The proposed development is expected to reduce daylight access to the west-facing window of Building B1 due to its similar height and aligned edges, casting a shadow that limits natural light penetration.

4.2.2. Neighboring structures effect on the proposed development

- Since building B1 is on the east of the proposed development, its impact will be minimal. Other two south facing structures, B2 and B3, are only single storey. Their impact is again going to be negligible. We couldn’t find any other structure casting any significant impact on the proposed design.

4.2.3. Building orientation impact on the proposed design

- The north-facing side of the proposed development is expected to have the greatest impact on daily sunlight access, as the sun travels from east to west, leaving the north side without direct sunlight.

4.2.4. General assessments and criteria

- Our analysis revealed that buildings surrounding the proposed development are predominantly residential in nature.

- In our analysis, as depicted in **Figure 3**, we have selectively focused on specific set of structures that is expected to cast substantial shading impact on the proposed development. Other structures have not been taken into consideration as they are far off from the proposed development.

- When assessing the proposed building, our primary focus is on prioritizing the windows in the living rooms. We have compiled a comprehensive list of all the windows (or window elements) in question and have conducted a thorough evaluation. To provide a detailed assessment, we have further subdivided these windows, considering their positions on the walls, in order to gauge the net daylight impact effectively.

- As for the surrounding buildings, we've estimated their floor areas and heights through a combination of Google Maps data, images, and general on-site surveys. This topographical and building size assessment is observed to closely align with the actual values found at the site.

- Elements such as opaque glazing, soil pipes, stairwells, etc., typically indicate areas like toilets, bathrooms, or circulation spaces, which, as per the BRE guidelines, do not require assessment.

4.3. Proposed development General Site Assessment

The proposed development at **the land adjacent to 2 Ash Grove, Hayes, UB3 1JR**, is located in the London Borough of Hillingdon, in the western part of London.

- The proposed development site is situated in a well-established urban area, characterized by a mix of residential and commercial properties.

- It is conveniently located within walking distance of public transportation, including local bus stops and train stations.

- Nearby amenities include shops, restaurants, parks, and other facilities, offering convenience and accessibility for future residents.

CAD drawings are attached with it for more information and detailed planning layout of the proposed structure.

4.4. Assessment of Surrounding Buildings Under Observation

The assessment of daylight and sunlight in relation to the proposed design also considers the impact on neighboring buildings. A preliminary investigation focused on buildings particularly to the east and south of the site was conducted for this analysis. Other buildings are either far off or insignificant to be a part of this analysis. The findings indicate that the proposed development will have a minimal impact on the surrounding buildings. **Figure 3** illustrates the labeling and naming conventions for the proposed building and adjacent structures as used in the IESVE software interface.

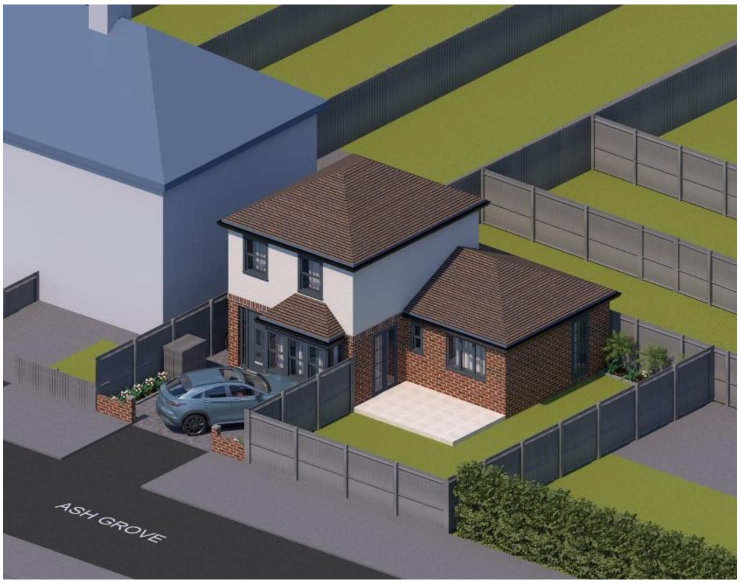

Figure 2. 3D model of the proposed development.

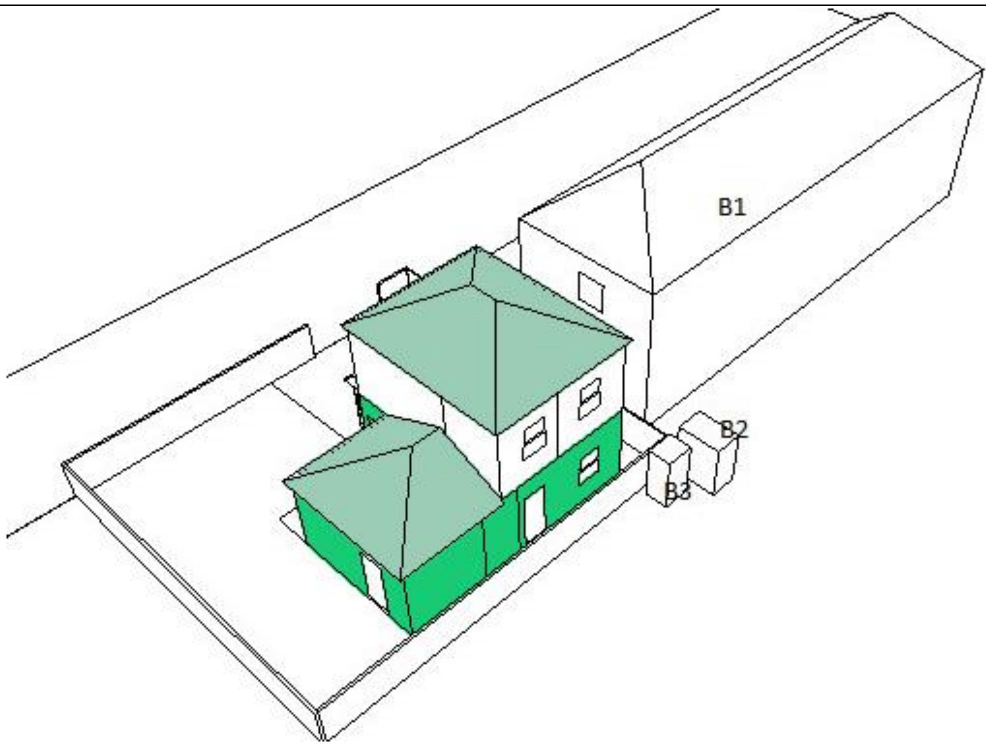

Figure 3. Nomenclature for the proposed building (colored) and its surrounding structure drawn on IESVE software.

4.4.1. Building B1

- From **Figure 1** and **Figure 3**, structure B1 is on the eastern side of the proposed development. It has its edges aligned with height parallel to the proposed development.

- Being on the eastern side, it will have a minimal impact on the proposed development. Moreover, there is no window on the eastern side of the proposed development, therefore, the overall impact will be negligible.

- The proposed development may cast shadow on the west-facing window of building B1. It is expected that this window might represent the stairway, which may not be significant for analysis. However, its daylight analysis was still carried out for general assessment.

4.4.2. Building B2 and B3

- Buildings B2 and B3 are single storied garage kind structure on the south of the proposed development. Given their heights, their impact will be negligible on the south facing windows of the proposed development.

4.5. Daylight Sunlight Summary for the Proposed Design

Figure 4 and **Figure 5** illustrate the window positions in relation to the building elevations and the naming conventions used in this report for all window elements.

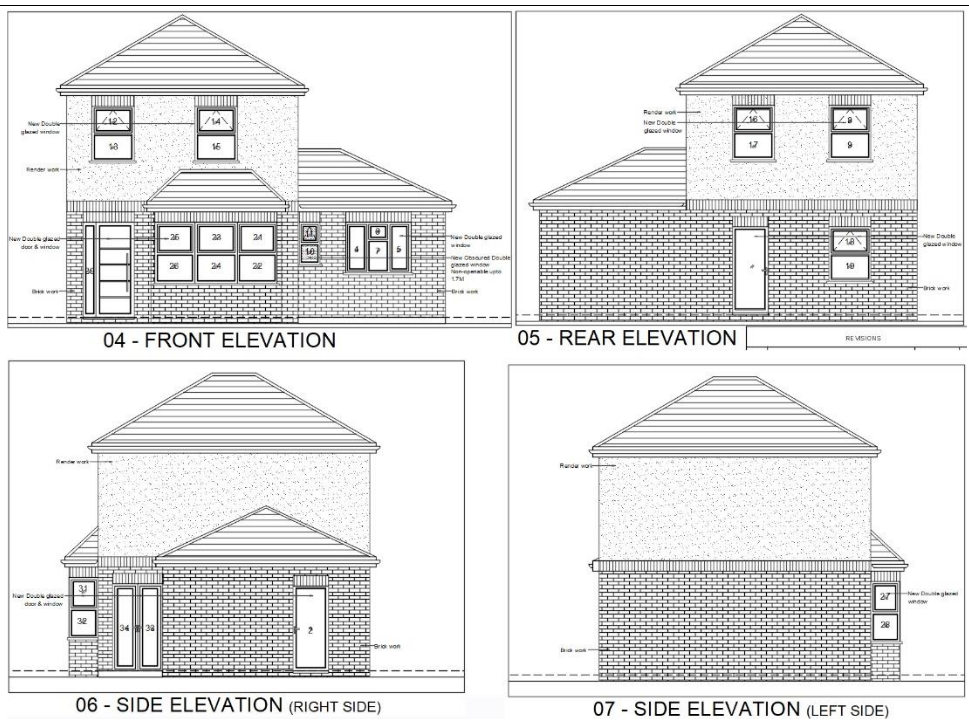

Figure 4. Naming conventions of the window elements on the a) front b) rear and c), d) side elevations.

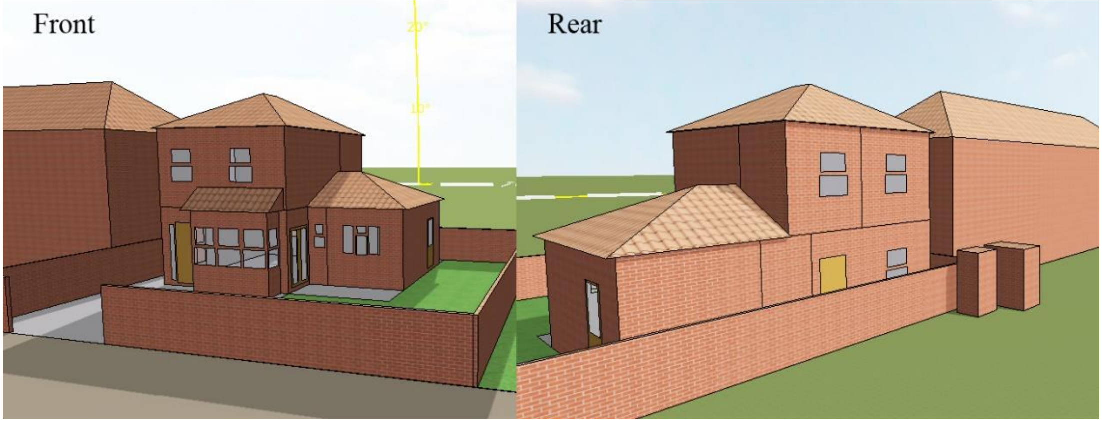

Figure 5. Window elements representation on an IESVE model on both (a) front and (b) rear side of the proposed building site.

A detail analysis of all daylight sunlight components is discussed below:

4.5.1. Vertical Sky Component (Daylight):

Almost all the window elements in the proposed development representing bedrooms and/or living/kitchen comply with the BRE guidelines, achieving at least 27% and/or 0.8 times their previous VSC values or above, as shown in **Figure 6**. For a living/kitchen, two window elements facing eastward and a glass door adjacent to the bathroom wall matches the minimum criteria of 18% and/or 0.6 times their previous VSC values. A slight reduction in VSC values is ascribed to the window orientation, nearby building B1, and wall shading, causing a restricted direct sunlight early in the morning particularly during summer time.

The window representing the neighboring building still achieves at least 18% VSC or 0.6 times its original value. A reduction in direct sunlight access is expected due to the upcoming proposed development, which matches the existing height and aligns with the building edges. However, since this window likely serves a stairway, the impact is still minimal. **Table 2** in **Appendix B** shows the obtained results for the VSC assessment.

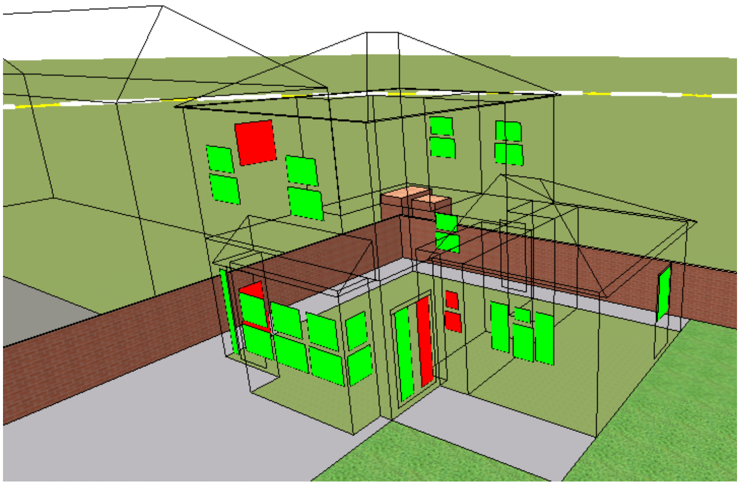

Figure 6. VSC assessment of all window elements.

4.5.2. Direct Sunlight Hours (Sunlight):

The proposed development faces north, which naturally limits direct sunlight on March 21st. Given the sun's movement from east to west, the northern side will not receive any direct sunlight on that date. As a result, the north-facing windows fail to meet the minimum requirement of at least two hours of direct sunlight for the living/kitchen area and one hour for bedrooms. Therefore, the northern side is deemed to receive minimal direct sunlight on March 21st.

On the western side, two window elements and a single glass door element facing westward receive more than two hours of direct sunlight, which is due to their orientation. However, the glass door adjacent to the wall failed to receive the minimum 2 hours of direct sunlight due to the shadow casted by the bathroom wall.

On the southern (rear) side of the proposed structure, all windows successfully receive more than two hours of direct sunlight. Two of the south-facing windows on the first floor are connected to an open stairway, which opens directly into the living/kitchen area. The other two south-facing windows on the ground floor are directly installed to the living/kitchen area. All of them successfully meet the minimum requirement of two hours of direct sunlight on March 21st, as shown in **Figure 7**.

The impact on the neighboring structure is minimal, as their windows continue to receive more than two hours of direct sunlight. In the present case, the building's orientation is a key factor in its sunlight exposure.

Table 4 in **Appendix B** shows the obtained results for the Direct Sunlight Hour assessment.

Figure 7. Direct Sunlight Hours analysis of window elements of the proposed development on 21st March as seen from (a) north view, (b) west view, and (c) rear view.

4.5.3. Annual Probable Sunlight Hours (APSH) (Sunlight):

APSH is the total number of hours each year when sunlight is expected to shine on the center of each window, considering the usual cloudiness for the area.

This test is commonly employed to evaluate facades that face within 90 degrees of due south. The BRE Handbook mentions:

"…a south facing window will, in general, receive most sunlight, while a north facing one will receive it only on a handful of occasions. East and west facing windows will receive sunlight only at certain times of day".

For existing residential buildings, the BRE Handbook suggests that:

"all main living rooms of dwellings… should be checked if they have a window facing within 90° of due south. Kitchens and bedrooms are less important, although care should be taken not to block too much sun".

Time Range: Summertime – 21st March-to-21st September:

The proposed structure faces north and follows a north-south orientation. During the summer, the sun moves from the northeast to the northwest, providing limited daylight to the north-facing windows.

The north-facing windows receive sunlight in the early morning, but as the sun rises higher and shifts westward, these windows no longer receive direct sunlight. As a result, the north-facing windows achieve relatively low APSH values, meeting only the minimum 13% or less and/or 0.4 times as per BRE standards.

In contrast, the south-facing windows, particularly those linked to the living/kitchen area (elements 18 and 19), successfully meet the minimum APSH requirement of 25% as per BRE standards. These windows are connected to the living/kitchen, which directly opens into the living/kitchen area, leading to higher APSH values. The south-facing side is largely unobstructed, allowing these windows to receive direct sunlight throughout the day, especially during mid-morning and afternoon. Furthermore, the west facing glass door to the bedroom on the ground floor also found closer to have the minimum APSH value of 25% due to their unobstructed view.

Given the limitations of the north-facing side, this assessment clearly indicates the daylight availability in accordance with the required BRE standards.

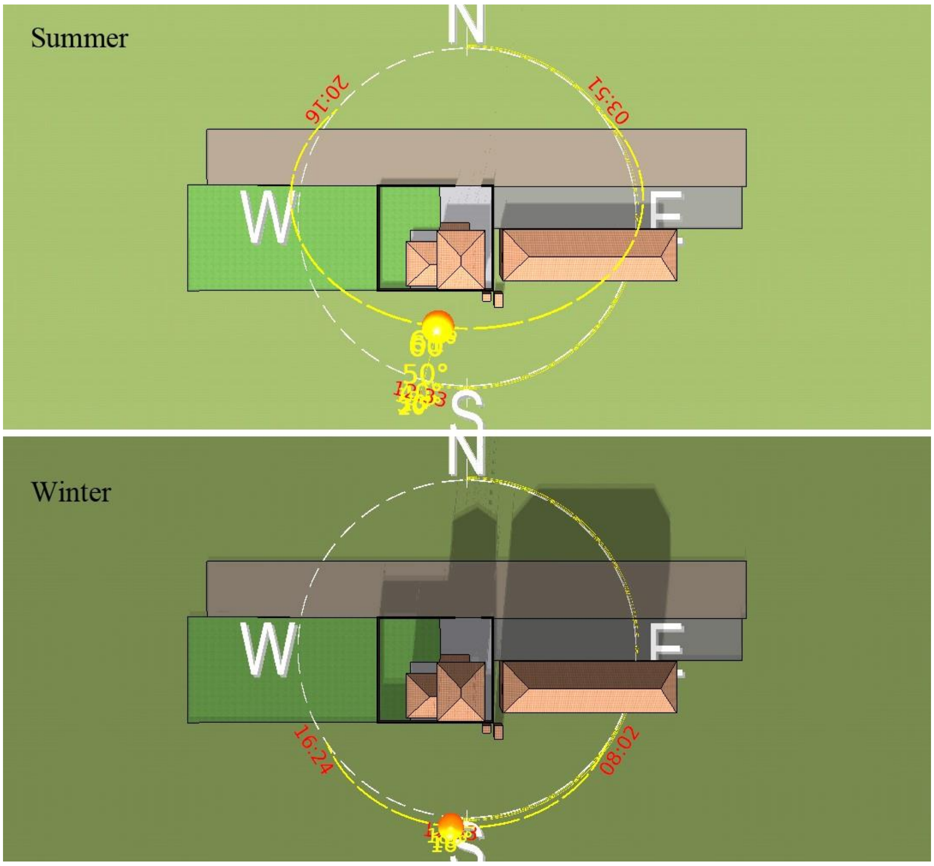

Figure 8. Sun path diagram and shading effect on the proposed design during winter

Time Range: Wintertime – 21st September-to-21st March:

During winter, the APSH values for the north-facing windows decrease significantly because of the sun's lower angle and its path shifting from southeast to southwest, as shown in **Figure 8**. In contrast, the south-facing windows receive limited light throughout the day, benefiting from their unobstructed view.

4.5.4. Daylight Factor (DF)

According to the BRE guidelines, the DF is defined as the ratio of the total daylight flux reaching the working plane, expressed as a percentage of the outdoor illuminance on a horizontal plane under unobstructed CIE standard overcast sky conditions. For housing, BS 8206-2 provides minimum DF values of 2% for kitchens, 1.5% for living rooms, and 1% for bedrooms.

The daylight factor results for the living and kitchen areas of the proposed house exceed the minimum requirement of 2%, significantly surpassing the threshold level of 1.5% for living rooms. Additionally, the DF for bedrooms on the ground and the first floor meets or exceeds the minimum of 1%. These results indicate that the selected rooms comply with the BRE guidelines for daylight factor assessment.

Table 5 in **Appendix B** shows the obtained results for the daylight factor assessment. **Figure *9*** shows the contour levels of daylight factor for different rooms of the proposed design.

5. Conclusion

Assessing daylight and sunlight access for the proposed design at the site requires a detailed interpretation of BRE guidelines, considering various mitigating factors. The goal is to evaluate the daylight performance of the proposed development. Because of the building north-south orientation, restricted daylight access can be perceived particularly during the winter. Despite these limitations and constraints, the proposed development meet or exceed the minimum criteria required as per BRE standards. The analysis reveals that the new design does not significantly affect the daylight and sunlight access of neighboring windows, nor do nearby buildings substantially diminish the access for the proposed design. This favorable result is due to strategic design enhancements and careful consideration of mitigating factors during the planning process.

In summary, the proposed development fully adheres to BRE guidelines regarding daylight, sunlight, and overshadowing. Consequently, there are no significant grounds to challenge the development based on its compliance with established daylight and sunlight standards.

Appendix A

The 3rd edition 2022 Building Research Establishment (BRE) Report BR-209-2022 titled "**Site Layout Planning for Daylight and Sunlight – a good practice guide**", commonly referred to as the BRE Guidelines, serves as a fundamental resource for building designers and urban planners. These guidelines offer comprehensive advice and recommendations for achieving optimal daylight and sunlight conditions in the context of site layout planning. Here are some key points to expand upon the significance and scope of these guidelines:

- The BRE Guidelines prioritize the well-being and amenity of residents, not only for the proposed development but also for people in open spaces and surrounding buildings.

- BRE Guidelines opts for an optimal balance between new developments and the existing environment. This makes the BRE guidelines an essential part of the legal and planning framework for construction projects in many jurisdictions.

- BRE Guidelines provide methodologies for conducting daylight and sunlight assessments. These assessments involve calculations and simulations to evaluate how proposed buildings will affect natural light levels, both within and outside the development site.

- Maximizing natural light reduces the need for artificial lighting and heating, contributing to energy efficiency and reducing environmental impact.

Within the BRE Guidelines, a set of evaluations and numerical criteria have been formulated to assess proposed developments to determine if they conform to the required standards for ensuring adequate levels of daylight and sunlight comfort. Here are some of the key details provided:

- **Daylight:** This centers on examining the presence and dispersion of natural sunlight within and in the vicinity of the proposed design. Elements such as the daylight factor (which measures the intensity of natural light) and the annual sunlight exposure are employed for daylight assessment.

- **Sunlight:** This concerns on how sunlight reaches various areas within and around a development. These evaluations consider aspects such as the duration of direct sunlight exposure, shading caused by nearby structures, and the potential effects on outdoor areas.

- **3D Computer Modeling:** The BRE Guidelines often recommend the use of 3D computer modeling and simulation software to visualize and analyze the impact of proposed buildings on daylight and sunlight conditions.

- **Mitigation Measures:** In cases where a proposed development falls short of the recommended daylight and sunlight levels, the BRE Guidelines also offer guidance on potential mitigation measures, such as adjusting building orientation or redesigning building elements.

In suburban development sites with lower population density, the BRE Guidelines are typically more suitable, allowing for more flexibility in site layout planning. Conversely, in densely populated urban areas, development sites often face more constraints, often due to neighboring buildings and other factors. Therefore, in dense urban environments, the guidelines should be applied with a degree of adaptability. The BRE Guidelines explicitly acknowledge this aspect in their guide book.

a) Daylight Assessment

The guidelines for evaluating daylight conditions in nearby existing buildings can be found in the pages 4 to 8 of the BRE Guidelines.

Typically, assessments for daylight should focus on habitable rooms within residential structures and the primary rooms within non-residential buildings like schools, hospitals, and offices, where occupants reasonably anticipate sufficient daylight. The primary methods employed to evaluate daylight for surrounding existing buildings are detailed below, along with an additional daylight assessment typically utilized when planning new residential structures.

The 25° section line test serves as a straightforward rule of thumb for assessing whether an existing building can continue to receive sufficient daylight in the presence of a proposed development. It helps quickly gauge if the new construction might negatively impact the daylight conditions of the surrounding structures or vice versa.

This assessment method is most effective in low-density suburban settings, where new developments are spaced apart, relatively short in height, and follow a uniform pattern. In contrast, it may not be suitable for densely populated urban areas, where tall, closely spaced buildings already block more than 25 degrees of the view from existing windows. In such urban scenarios, it's often necessary to conduct more detailed assessments from the beginning because the 25-degree assessment doesn't apply as effectively.

b) The Vertical Sky Component (VSC) Assessment

The Vertical Sky Component (VSC) assessment measures how much natural daylight directly enters a specific window. To evaluate this, the central point of the window, aligned with the outer wall, serves as the reference point. The VSC assessment is crucial for understanding the direct daylight a window can capture. It provides valuable information for optimizing natural lighting within a building, aiding in energy efficiency and occupants' well-being. Although the VSC test is helpful in predicting how a nearby development might affect things, it only looks at the light on one spot. This means it doesn't take into account the window's size or other windows that also brighten up the same room.

A VSC, or Visible Sky Coverage, is represented as a percentage. It signifies the proportion of illuminance received from a Standard Overcast Sky (CIE Sky) on a vertical surface (like a window) in comparison to the illuminance received on a horizontal surface under an unobstructed hemisphere of the same Standard Overcast Sky. In simpler terms, the Visible Sky Coverage (VSC) can be understood as the percentage of direct sky visibility that a window gets, regardless of any obstructions, compared to the direct sky exposure that an unobstructed horizontal roof-light would receive.

The highest amount of direct skylight that a vertical window can receive from a Standard Overcast Sky is 39.62%, which is commonly rounded up to 40%. According to the BRE (Building Research Establishment), when a VSC value of 27% is attained, it signifies that an adequate amount of skylight or direct daylight can reach the window of an existing building. This value is roughly comparable to a uniform obstruction of 25 degrees, as mentioned in the previous assessment.

In general, for new developments in low-density areas, it is advisable for the VSC component to exceed 27%, assuming no mitigating factors are applicable. This ensures that an adequate amount of direct daylight can reach the windows of the new building. However, when such a site is situated in a densely populated area and the VSC assessment of the existing structure on the site was already below 27%, the BRE guidelines specify that the new development on the existing site should only cause a maximum reduction of 20% in VSC. This limitation is in place to ensure that the change in VSC is not significant enough to be noticeable or disruptive to the occupants of the building.

In summary, while the 27% guideline is a general target, it can be adjusted based on the specific context of the development site, especially in densely populated areas, to minimize the impact on existing structures and their occupants.

c) Direct Sunlight Hours

BS EN 17037 is a European standard that provides guidelines for daylight in buildings. Published in 2018, titled as "Daylight in Buildings", this standard aims to establish requirements and recommendations for daylight in buildings. It also ensures the well-being and visual comfort of occupants while promoting energy efficiency.

- Daylight Availability: Amount of daylight available in different spaces within a building.

- Daylight Distribution: This provides guidelines on the distribution of daylight within a building.

The BRE guidance provides recommendations for preserving sunlight in outdoor spaces, both existing and planned. This advice applies to areas like back gardens, parks, playing fields, playgrounds, waterways, and public spaces. However, it excludes the need for assessment in the case of small front gardens and parking areas.

The permanent overshadowing assessment is carried out on March 21st, the spring equinox. This assessment identifies parts of an amenity area where no sunlight will be present during the winter months. However, it's important to note that these areas might still receive some sunlight during the summer.

As per BRE guidelines, a garden or amenity area remains well-lit throughout the year. It is thus advisable for at least half of that area to get a minimum of 2 hours of sunlight on March 21st. If, due to new development, an existing garden or amenity area doesn't meet these criteria, and the portion receiving 2 hours of sunlight on March 21st is less than 80% of what it used to be (a 20% reduction), then people are likely to notice the loss of sunlight in that area.

So, if an open outdoor space, whether existing or proposed, is shaded for over 2 hours, accounting for more than 50% of its area, and this shading is increased by over 20% due to new development, then people are likely to notice the reduction in sunlight.

d) Annual Probable Sunlight Hours (APSH) Assessment

Natural sunlight holds significant value in both residential and commercial structures. It is not only prized for its capacity to provide warmth and create a cheerful ambiance within a room but also for its potential to bestow therapeutic benefits upon occupants, fostering a sense of well-being.

In residential properties, the foremost consideration for sunlight centers on the living room and conservatories. It becomes imperative to evaluate these spaces, particularly when they feature a primary window facing within a 90-degree angle of due south. Conversely, while the significance of sunlight in areas like kitchens and bedrooms is somewhat reduced, it remains imperative to exercise caution and avoid excessive obstruction.

Within commercial or non-residential buildings, the necessity for sunlight varies according to the building's intended use. In accordance with recommendations from the Building Research Establishment (BRE), any space within a commercial establishment possessing a specific or distinctive demand for sunlight should be subjected to comprehensive evaluation.

The assessment of APSH (Annual Probable Sunlight Hours) is conducted for the primary window openings of both residential and commercial structures, specifically when these windows are oriented within a 90-degree range of true south. "Probable Sunlight Hours" can be described as the cumulative count of hours throughout the year during which sunlight is anticipated to illuminate unobstructed ground surfaces, accounting for typical cloud cover conditions.

BRE guidelines state that if a living room in an existing house has a main window facing mostly south, and if a new building nearby casts a shadow that's more than 25 degrees below the window, it can reduce the sunlight coming into the living room. This happens if, over a year, the window's center gets less than one-fourth (25%) of the yearly sunlight hours, including at least 5% between September and March. Moreover, if sunlight hours during those months drop below 80% of what they were before, then the residents of the new development can feel the change.

As a result of a new development, the amount of sunlight reaching an existing building may decrease by up to 20% during either the whole year or the winter months before people start to notice the difference.

e) Daylight Factor (DF)

The Daylight Factor (DF) is a metric used in architecture and building design to evaluate the amount of natural daylight that penetrates into the interior of a building. It is typically expressed as a percentage and represents the ratio of the illuminance (light level) inside a space to the illuminance outside the building on an overcast day.

The DF provides a way to assess the quality of daylighting in a building. A higher DF percentage indicates better natural daylighting conditions, which can lead to reduced reliance on artificial lighting during the day, energy savings, and improved occupant comfort and well-being.

Appendix B

Table 2. VSC assessment report of all window element on the proposed design. GF – Ground Floor, FF – First Floor.

Floor Proposed	Room Type	Window Ref	VSC / SC	Result
GF	Bedroom1	1 Door	-	-
GF	Bedroom1	2	39.19	Meet
GF	Bedroom1	4	33.34	Meet
GF	Bedroom1	5	36.59	Meet
GF	Bedroom1	6	35.22	Meet
GF	Bedroom1	7	35.87	Meet
FF	Staircase	8	39.76	Meet
FF	Staircase	9	39.89	Meet
GF	Bathroom1	10	25.68	Minor
GF	Bathroom1	11	25.08	Minor
FF	Bedroom2	12	39.31	Meet
FF	Bedroom2	13	39.19	Meet
FF	Bedroom2	14	39.43	Meet
FF	Bedroom2	15	39.35	Meet
FF	Bathroom2	16	39.47	Meet
FF	Bathroom2	17	40.01	Meet
GF	Living/Kitchen	18	39.2	Meet
GF	Living/Kitchen	19	30.33	Meet
GF	Living/Kitchen	20 Door	-	-
GF	Living/Kitchen	21	38.43	Meet
GF	Living/Kitchen	22	38.38	Meet
GF	Living/Kitchen	23	38.5	Meet
GF	Living/Kitchen	24	38.53	Meet
GF	Living/Kitchen	25	38.33	Meet
GF	Living/Kitchen	26	38.57	Meet
GF	Living/Kitchen	27	20.34	Minor
GF	Living/Kitchen	28	19.89	Minor
GF	Living/Kitchen	29	36.09	Meet
GF	Living/Kitchen	30 Door	-	-
GF	Living/Kitchen	31	32.62	Meet
GF	Living/Kitchen	32	30.87	Meet
GF	Living/Kitchen	33	22.66	Minor

GF	Living/Kitchen	34	27.45	Meet
GF	Living/Kitchen	35 Door		
GF	Neighbor	37	24.18	Minor

Table 3. APSH results of all window elements of the proposed structure. GF – Ground Floor, FF – First Floor.

Floor Proposed	Room Type	Window Ref	Summer	Result	Winter	Result	Annual	Result
GF	Bedroom1	1 Door	-		-		-	
GF	Bedroom1	2	23.3	Minor	21.91	Minor	1.39	Major
GF	Bedroom1	4	5.42	Major	5.42	Major	0	Major
GF	Bedroom1	5	6.76	Major	6.76	Major	0	Major
GF	Bedroom1	6	4.86	Major	4.86	Major	0	Major
GF	Bedroom1	7	6.97	Major	6.97	Major	0	Major
FF	Staircase	8	35.33	Meet	32.56	Meet	2.78	Moderate
FF	Staircase	9	35.42	Meet	32.64	Meet	2.78	Moderate
GF	Bathroom1	10	5.66	Major	5.66	Major	0	Major
GF	Bathroom1	11	4.86	Major	4.86	Major	0	Major
FF	Bedroom2	12	8.19	Major	8.19	Major	0	Major
FF	Bedroom2	13	8.2	Major	8.2	Major	0	Major
FF	Bedroom2	14	9.1	Major	9.1	Major	0	Major
FF	Bedroom2	15	9.72	Major	9.72	Major	0	Major
FF	Bathroom2	16	34.71	Meet	31.93	Meet	2.78	Moderate
FF	Bathroom2	17	35.35	Meet	32.58	Meet	2.78	Moderate
GF	Living/Kitchen	18	35.42	Meet	32.64	Meet	2.78	Moderate
GF	Living/Kitchen	19	34.58	Meet	32.64	Meet	1.94	Major
GF	Living/Kitchen	20 Door	-		-		-	
GF	Living/Kitchen	21	9.03	Major	9.03	Major	0	Major
GF	Living/Kitchen	22	9.27	Major	9.27	Major	0	Major
GF	Living/Kitchen	23	8.67	Major	8.67	Major	0	Major
GF	Living/Kitchen	24	9.28	Major	9.28	Major	0	Major
GF	Living/Kitchen	25	7.64	Major	7.64	Major	0	Major
GF	Living/Kitchen	26	8.92	Major	8.92	Major	0	Major
GF	Living/Kitchen	27	2.87	Major	2.87	Major	0	Major
GF	Living/Kitchen	28	2.61	Major	2.61	Major	0	Major
GF	Living/Kitchen	29	2.56	Major	2.56	Major	0	Major
GF	Living/Kitchen	30 Door	-		-		-	
GF	Living/Kitchen	31	17.82	Moderate	17.48	Moderate	0.34	Major

GF	Living/Kitchen	32	16.84	Moderate	16.83	Moderate	0.01	Major
GF	Living/Kitchen	33	7.34	Major	7.34	Major	0	Major
GF	Living/Kitchen	34	13.98	Moderate	13.98	Moderate	0	Major
GF	Living/Kitchen	35 Door	-		-		-	
GF	Neighbor	37	14.13	Moderate	12.99	Moderate	1.14	Major

Table 4. Direct Sunlight assessment of all window elements on the proposed design.

Floor Proposed	Room Type	Opening	Daylight Sunlight Hours	Results
GF	Bedroom1	2	>1	**Pass**
GF	Bedroom1	4	<1	Fail
GF	Bedroom1	5	<1	Fail
GF	Bedroom1	6	<1	Fail
GF	Bedroom1	7	<1	Fail
FF	Bedroom2	12	<1	Fail
FF	Bedroom2	13	<1	Fail
FF	Bedroom2	14	<1	Fail
FF	Bedroom2	15	<1	Fail
GF	Living/Kitchen	18	>2	**Pass**
GF	Living/Kitchen	19	>2	**Pass**
GF	Living/Kitchen	21	<2	Fail
GF	Living/Kitchen	22	<2	Fail
GF	Living/Kitchen	23	<2	Fail
GF	Living/Kitchen	24	<2	Fail
GF	Living/Kitchen	25	<2	Fail
GF	Living/Kitchen	26	<2	Fail
GF	Living/Kitchen	27	<2	Fail
GF	Living/Kitchen	28	<2	Fail
GF	Living/Kitchen	29	<2	Fail
GF	Living/Kitchen	31	<2	**Pass**
GF	Living/Kitchen	32	<2	**Pass**
GF	Living/Kitchen	33	>2	**Pass**
GF	Living/Kitchen	34	<2	Fail

Table 5. Daylight Factor for Rooms under observation at all levels in the proposed design. Grid

Size - 0.3m, Margin - 0.3m.

Floor No.	Room Type	Area	Ave. Daylight Factor (%)	Illuminance (lux)
Proposed				
Ground Floor	Kitchen/Dining	26.2	3.3	399
	Bedroom1	10.34	3.0	365
First Floor	Bedroom2	14.95	1.9	234

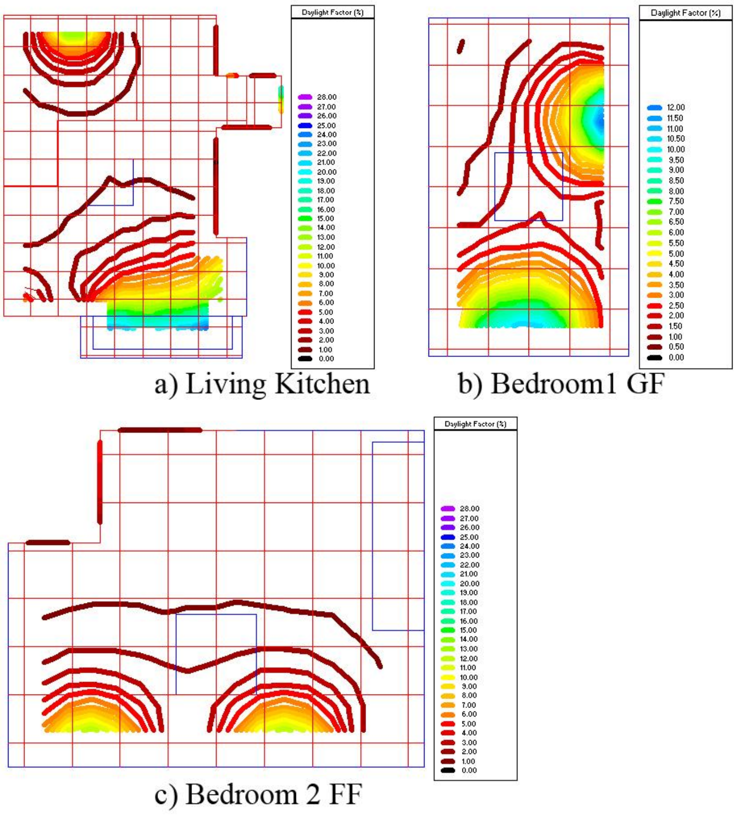

Figure 9. Contour levels of Daylight Factor for Rooms on the first floor in (a) Living/Kitchen, (b) Bedroom1, and (c) Bedroom2. Grid Size - 0.3m, Margin - 0.3m