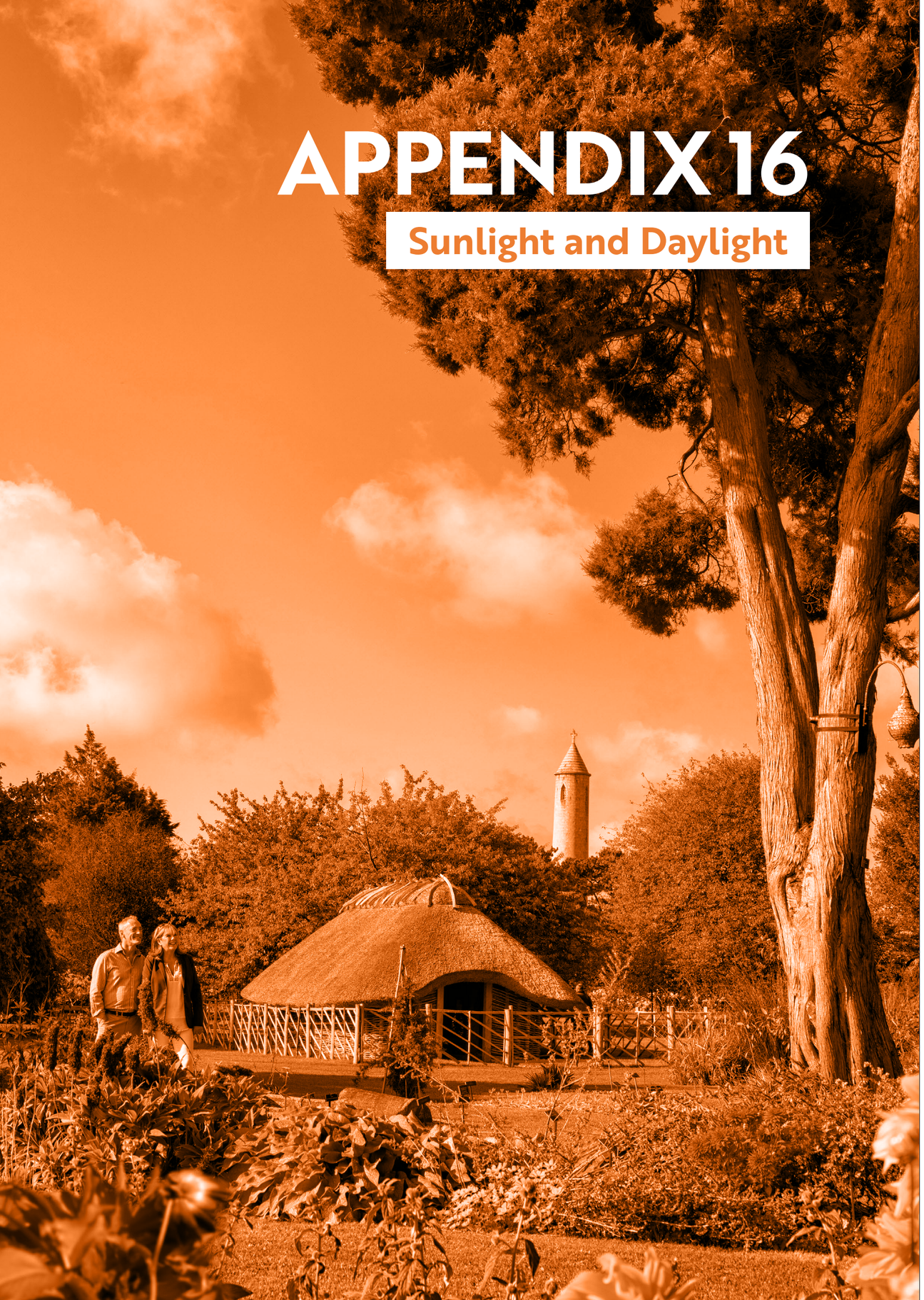


APPENDIX 16

Sunlight and Daylight

1.0 Introduction

To date, the introduction of a new European standard for daylight[1] has caused uncertainty as to how daylight and sunlight assessments are completed in Ireland. There is lack of clarity regarding the appropriate standards, methods and metrics that need to be applied as well as how presented results should be interpreted and benchmarked. These issues have led to a variance in the methods used in daylight and sunlight assessments. They have also resulted in a series of judicial reviews[2] on the topic.

This guide is intended to provide direction to applicants and consultants carrying out such assessments. Its purpose is to offer clarity on the required technical approach, such that a standardised methodology and set of metrics are used by consultants for completing daylight and sunlight assessments. The guide also contains information on what standards are appropriate and what information should be contained in daylight and sunlight reports to enable the planning authority to complete a robust assessment of potential impacts and mitigation measures.

The intended outcome of this guide is to ensure a consistent approach to completing daylight and sunlight assessments. This guide does not outline exact, city wide, expected results or a suite of results that are likely to be considered acceptable by the planning authority. Proposals will continue to be assessed on a case-by-case basis depending on site specific circumstances and location.

2.0 Why Daylight?

The benefits of daylight are well documented[3, 4]. Access to daylight is vital for our health and daylight is the only true source of sustainable light. These are two key reasons why prioritising daylight in developments is important for developers, architects and society as a whole.

3.0 Guidance, Standards and National Policy

There is a lack of clarity in Ireland over the standards and guidance documents that are applicable to daylight and sunlight assessments. There are four key documents that relate to this topic. Further information on each is given in the following section.

3.1 BR 209 (2011) – Site Layout Planning for Daylight and Sunlight, A Guide to Good Practice (Second Edition)

This document[5] is referenced in local and national planning policy. It is widely used to inform the methodologies applied for daylight and sunlight assessments. It offers information that aims to guide designers of new developments on how to produce well daylit spaces. It also gives clear guidance on how new developments will impact on existing developments in the surrounding area.

3.2 BS 8206-2:2008 – Lighting for Buildings, Part 2: Code of Practice for Daylighting

This standard[6] describes good practice in daylight design and presents criteria intended to enhance the well-being and satisfaction of people in buildings. BS 8206-2 is referenced multiple times within BR 209. There is significant overlap between BS 8206-2 and BR 209, and they are intended to be applied in tandem.

BS 8206-2 was superseded in 2018. It was replaced by BS EN 17037:2018 – Daylight in Buildings. Whilst it has been superseded, the associated and overlapping information within BR 209 has not yet been updated. As such, it retains relevance.

3.3 BS EN 17037:2018 – Daylight in Buildings

In 2018, a new European wide standard for daylight was introduced, being EN 17037. In the UK, this standard[7] was published as BS EN 17037 and importantly, it contains a national annex. The national annex in BS EN 17037 attempts to align the guidance and expectations of the new European standard with the now superseded BS 8206-2. BS EN 17037 does not offer any guidance on how new developments will impact on existing surrounding developments. The minimum daylight provision targets given within the national annex have relevance.

3.4 IS EN 17037:2018 – Daylight in Buildings

Prior to 2018, Ireland had no standard for daylight. In 2018, the National Standards Authority of Ireland[8] adopted EN 17037 to directly become IS EN 17037. It is important to note that no amendments were made to this document and unlike BS EN 317037, it does not contain a national annex. It offers only a single target for new buildings (there are no space by space targets – e.g. a kitchen would have the same target as a warehouse or office). It does not offer guidance on how new developments will impact on surrounding existing environments. These limitations make it unsuitable for use in planning policy or during planning applications. BR 209 must still be used for this purpose.

3.5 National Policy

Beyond guidance given in the Dublin City Development Plan 2022 – 2028, direction and information on daylight and sunlight is given within the Urban Development and Building Height Guidelines for Planning Authorities (2018)[9] and the Sustainable Urban Housing: Design Standards for New Apartments (December 2020)[10]. Both documents refer to BR 209 and BS 8206-2. Neither document refers to BS EN 17037 or EN 17037.

3.6 Understanding and Expectations

The planning authority understand that, at present, there is some ambiguity in what may be considered the appropriate standard to apply for daylight and sunlight assessments. There is a period of transition at present, during which BS 8206-2 has been superseded, but the relevant guidance within BR 209 has not yet been updated. Thus, both BS 8206-2 and BS EN 17037 have relevance. As such, both for clarity and as an interim measure during this transition period, the planning authority

will look to receive relevant metrics from BR 209, BS 8206-2 and BS EN 17037. If, over the coming years, a revised version of BR 209 is to be issued, the guidance within this new version will take precedence.

4.0 Relevant Metrics

Daylight and sunlight assessments require the application of a range of metrics and methods. The standards and guidance documents described in the section prior give a full and complete description of the relevant metrics, but the section below provides a brief overview for reference. Where the text below is unclear or where there is ambiguity over a particular piece of information, the relevant standard and guidance document shall always take precedence. Where the term daylight is used, this describes the combined effect of both skylight and sunlight. Skylight is the light available from the sky but excludes direct light from the sun. Sunlight is light experienced directly from the sun.

4.1 Annual Probable Sunlight Hours (APSH – sunlight metric)

Probable sunlight hours are defined in BR 209 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 for the location in question". Clause 3.1.10 within BR 209 outlines "BS 8206-2 recommends that interiors where the occupants expect sunlight should receive at least one quarter (25%) of APSH".

4.2 Winter Probable Sunlight Hours (WPSH – sunlight metric)

In addition to annual probable sunlight hours, BR 209 outlines that at least 5% of annual probable sunlight hours should occur in the winter months between the 21st of September and the 21st of March. This is typically referred to as the winter probable sunlight hours.

4.3 Sun on Ground (SOG – sunlight metric)

BR 209 makes recommendations for the quantity of sunlight that is appropriate in external amenity spaces. It suggests that for an amenity space to appear reasonably sunlit, at least half the area within amenity spaces should receive two hours sunlight on the 21st of March.

4.4 Average Daylight Factor (ADF – skylight metric)

The average daylight factor is defined in BR 209 as the "average illuminance on the working plane in a room, divided by the illuminance on an unobstructed horizontal surface outdoors. The CIE overcast sky is used, and the ratio is usually expressed as a percentage". BR 209 lays out the following:

If a predominantly daylit appearance is required, then the average daylight factor should be 5% or more if there is no supplementary 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. The additional recommendations are minimum values of average daylight factor which should be attained even if a predominantly daylit appearance is not achievable.

Where a room consists of more than one use, BS 8206-2 offers clarity:

"Where one room serves more than one purpose, the minimum average daylight factor should be that for the room type with the highest value. For example, in a space which combines a living room and a kitchen the minimum average daylight factor should be 2%".

4.5 No Sky Line (NSL – skylight metric)

BR 209 describes the no sky line as "The outline on the working plane of the area from which no sky can be seen". Appendix C in BR 209 lays out "If a significant area of the working plane (normally no more than 20%) lies beyond the no sky line (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".

4.6 Target Illuminance (E_t – illuminance metric, combined skylight and sunlight)

Target illuminance is as defined within EN 17037, being the given illuminance target for the space that is achieved over 50% of the target area, and for greater than half of the daylight hours available in a year. Target illuminance can be calculated using two separate methods. A detailed explanation of these simulations methods is given within EN 17037[1]. In short, method (a) uses a standard sky type that represents

the median external sky condition and completes a single calculation and method (b) completes a simulation for every hour of the year with illuminance values taken from a local climate or weather file.

BS EN 17037 gives target illuminance values for residential settings, being 200 lux for kitchens, 150 lux for living rooms and 100 lux for bedrooms. Similar to BS 8206-2, it outlines that where one room has two usages, the most onerous of the targets shall be delivered:

Where one room in a UK dwelling serves more than a single purpose, the UK committee recommends that the target illuminance is that for the room type with the highest value – for example, in a space that combines a living room and a kitchen the target illuminance is recommended to be 200 lx.

5.0 Assessment Methodologies

The following section outlines the expected methodology for daylight and sunlight reports to be submitted with planning applications. Daylight and sunlight assessments will generally consist of two parts, being (a) how the proposed development performs and (b) how the proposed development impacts levels of daylight and sunlight availability in surrounding existing buildings. Until such time when BR 209 is updated and all relevant and required information is included (i.e. removal of reference to BS 8206-2 and inclusion of metrics within BS EN 17037), the planning authority will request metrics from both BS 8206-2 and BS EN 17037. These are outlined below for clarity.

5.1 Performance of the Proposed Development

- Annual Probable Sunlight Hours on all windows
- Winter Sunlight Hours on all windows
- Sunlight on Ground in all amenity spaces
- Average Daylight Factor in all habitable rooms
- No Sky Line in all habitable rooms
- Target Illuminance in all habitable rooms

5.2 Impact on the Surrounding Properties

- Vertical Sky Component on all surrounding windows
- Annual Probable Sunlight Hours on all surrounding windows
- Winter Sunlight Hours on all surrounding windows
- Sunlight on Ground in all surrounding amenity spaces

5.3 Other Criteria and Considerations

In addition to the above metrics, the planning authority note the points below for clarity:

- When assessing the impact of a proposed development, it is expected that all surrounding properties are assessed. It is not acceptable to assess only the surrounding residential properties. Residential properties should be clearly marked out and results for these presented separately.
- When assessing the impact of a proposed development on the existing surrounding properties, it is expected that the rule within clause 2.2.4 of BR 209 is applied. This rule outlines that "Loss of light to existing windows need not be analysed if the distance of each part of the new development from the existing window is three or more times its height above the centre of the existing window". Thus, all surrounding buildings that sit within three times the height of the proposed development shall be included within the assessment.
- When analysing the results found to investigate the impact of a proposed development on the surrounding existing buildings, it is expected that the nomenclature and associated descriptions from within Appendix I of BR 209 are used. The wordings of negligible, minor adverse, moderate adverse and major adverse have defined meanings. These meanings have associated descriptors, and these shall be applied during the analytics section of reports. Appendix I in BR 209 provides these descriptions in full.
- The use of average daylight factor in assessing the impact of a new development on surrounding existing developments is not permitted.
- Where alternate target values are being set, this shall be completed in line with Appendix F of BR 209.
- When analysing the performance of a proposed development, it is expected that all rooms with an expectation for daylight are assessed. Assessing only a sample of rooms is not permitted.

- When determining input factors for simulations, the criteria below shall be applied. Deviations from these values shall not be accepted.

Table 1: Input Parameters

Input Parameter	Value
Internal floor reflectance	20 %
Internal wall reflectance	50 %
Internal ceiling reflectance	70 %
External material reflectance	20 %
Glazing Transmission	70 %
Glazing Maintenance Factor	88 %
Framing Factor	95 %
Grid Height above ground (Residential)	0.85 m
Grid Height above ground (Commercial)	0.70 m

- For residential developments, the internal daylight levels shall be benchmarked against the relevant targets in both BS 8206-2 and BS EN 17037. These are given below for clarity.

Table 2: Internal Daylight Levels

Room Type	BS 8206 Average Daylight Factor	BS EN 17037 Target Illuminance
Bedroom	1.0 %	100 lux
Living Room	1.5 %	150 lux
Kitchen	2.0 %	200 lux
Kitchen, Living & Dining	2.0 %	200 lux

- When assessing target illuminance, it shall be clearly stated which of the two methodologies within BS EN 17037 has been applied. Where the climatic data approach is used, the minimum time step shall be hourly and the weather file chosen shall be stated. Assessments shall not combine both methods (e.g., where the median external sky method is used to assess north facing rooms, this shall also be used to assess all other rooms).

- For combined kitchen, living and dining rooms, the full extent of the area within these spaces shall be included in assessments of internal daylight. Where galley type kitchens are provided, the application shall clearly set out how they were unavoidable in the design. It is expected that developments will not consist entirely of units that rely on galley type kitchens.

6.0 Designing for Daylight and Sunlight

There are a number of tools, design approaches and techniques that can be used to improve access to daylight and sunlight in new developments, but also to limit the impact to daylight and sunlight availability in surrounding existing properties. The planning authority will support developments that demonstrate evidence of how these techniques have been applied to maximise daylight and sunlight availability.

The sections below offer insight into some of these techniques, but more comprehensive guidance on designing for daylight and sunlight is given in other supporting resources [5, 11].

6.1 Massing and Placement

Massing, orientation and separation distances have a direct link to daylight and sunlight availability, both within new developments and considering how new developments will impact upon existing surrounding developments. New developments should give due attention to the size, shape and massing of proposals, along with separation distances between them and placement within the wider site. BR 209 offers guidance on a range of other considerations that will facilitate access to daylight and sunlight within new developments.

On separation distances, massing and obstruction angles, BR 209 states that with an obstruction angle of less than 25°, "conventional window design will usually give reasonable results". Where that obstruction angle changes to between 25° and 45°, BR 209 suggests that "special measures (larger windows, changes to room layout) are usually needed to provide adequate daylight". Where the obstruction angle is between 45° and 65°, BR 209 suggests that "it is very difficult to provide daylight unless very large windows are used". Once the obstruction angle goes beyond 65°, BR 209 states "it is often impossible to achieve reasonable daylight, even if the whole window wall is glazed".

Figure 1: Obstruction Angle

Managing the design of height, width and spacing between new developments will help with producing appropriate obstruction angles. The obstruction angle has a direct impact on all relevant daylight and sunlight metrics and ultimately, on the quality of daylight that is experienced within developments, either new or existing.

When obstruction angles have been given consideration, the placement of new blocks within a site should be considered. Avoiding self-obstruction to the south will increase sunlight penetration.

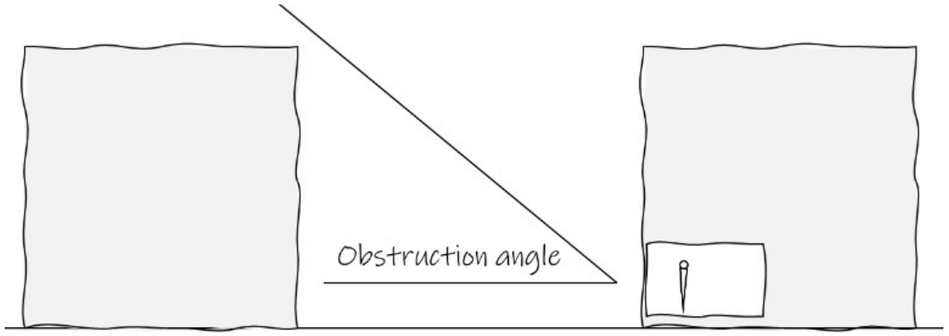
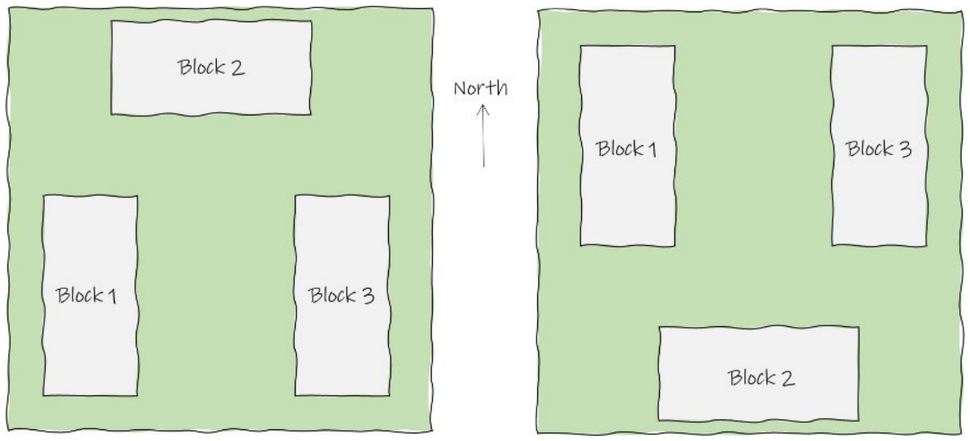


Figure 2: Obstructions to the South

Avoiding obstructions to the south can increase sunlight penetration to both amenity spaces and rooms within the new development. On the left, the site is unobstructed to the south. On the right, Block 2 in new development will obstruct sunlight to within its own site. Placement of massings needs careful consideration such that a balance is struck between improving the performance of the proposed development and not impacting on surrounding existing developments.



6.2 Layouts and Balconies

Alongside the massing, orientation and obstruction angle, layouts and balcony placement have a significant impact on both daylight quantity and daylight distribution. A room with large windows and no external obstructions will still experience poor daylight if the depth of the room is disproportionate to the width and height. BS 8206-2 outlines the room depth metric, stating:

"The uniformity of daylight is considered to be unsatisfactory if:
b) in a room lit by windows in one wall only, the depth of the room is too large in comparison with the height and the width of the windows."

Figure 3: Room Depth

BR 209 describes the room depth criteria. The formula and associated values for this are given in the sketch above. By way of example, a room with a width of 4 m, a window head height of 2.4 m and an average room surface reflectance of 50 %, the limiting depth for this room would be approximately 5 m.

Balconies significantly reduce the quantum of light entering windows below them. The placement of balconies can be delivered such that levels of daylight and sunlight to important rooms below is prioritised (e.g., in an apartment development, balconies would be placed above bedrooms below, rather than stacked above the living rooms below).

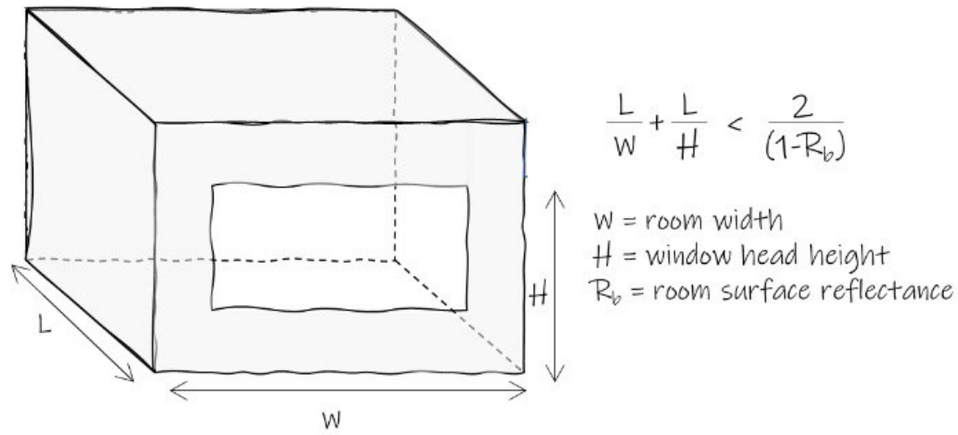


Figure 4: Balcony Layouts

Where identical apartment layouts are stacked one on top of the next, the impact of balconies off living rooms on the units below is significant (left). An improved alternative is to swap the layouts as they rise through the building (right). The outcome of this is main living rooms not having a balcony directly above them, thus experiencing better daylight and sunlight conditions within.

Beyond the room depth and balcony placement, care should be given in choosing the location of various space functions within a new development. Within residential developments, spaces that have a defined requirement for natural light (kitchens, living rooms and bedrooms) should take priority in their proximity to the facade. In apartment developments, spaces with this requirement for natural light can be arranged such that access to natural light is maximised.

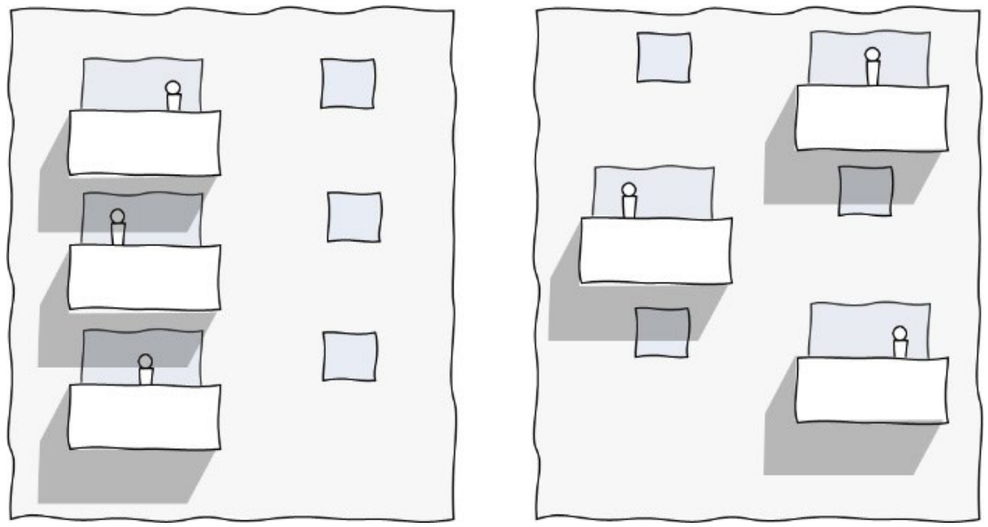
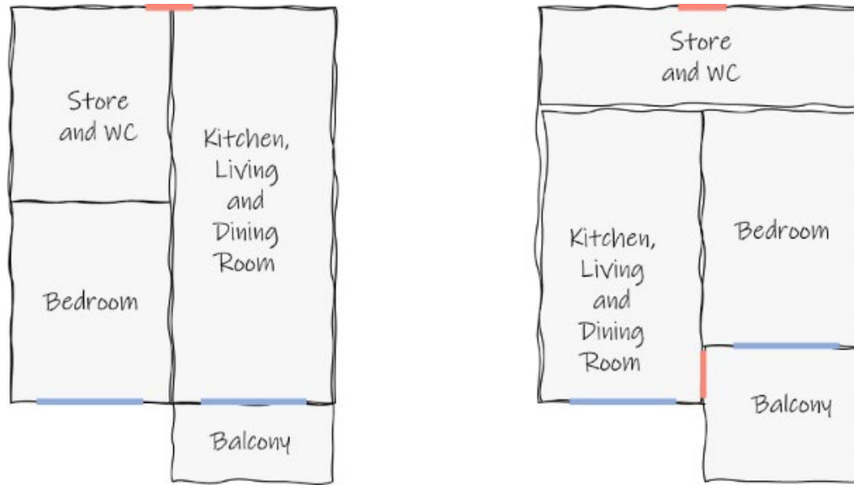


Figure 5: Balcony Access

On the left, an apartment with a long, narrow kitchen, living and dining room. The balcony is accessed directly off the living room space. Daylight distribution to the rear of this space will be poor. The store and bathroom occupy space closer to the façade than necessary. If the apartment layouts are stacked and not handed, then the balcony directly off the living space will obstruct the living room below and be obstructed by a balcony above. On the right, the store and bathroom are reorganised to occupy space furthest from the façade. The balcony is switched such that it sits in front of the bedroom and is accessed from the side. The apartments are handed such that balconies will not obstruct living rooms below. The overall depth of the kitchen, living and dining room reduces, so the distribution of daylight will improve, bringing more daylight to the rear of the room.



6.3 Optimisation Studies

How a new development impacts on the existing surrounding buildings can be approached parametrically. Optimisation tools are widely available that will define an outline massing for any given site, such that this 'optimised' massing will have a negligible impact on the surrounding properties. An optimisation study will consider all of the metrics required in assessing the impact of a new development on the existing surrounding properties.

Once an optimised massing is known within a particular site, the project architects can then choose to define a building outline that sits within the optimised massing. Following this process will ensure a negligible impact on the surrounding existing buildings.

Figure 6: Optimisation Studies

On the right, an existing development. On the left, new developments can complete optimisation studies such that outline massings (theoretical dashed red line) are produced for architects to use within their designs. If a new development is then designed to sit inside this optimised massing, the developer and project architect can be assured that the impact of any proposal will result in a negligible impact to the surrounding existing properties.

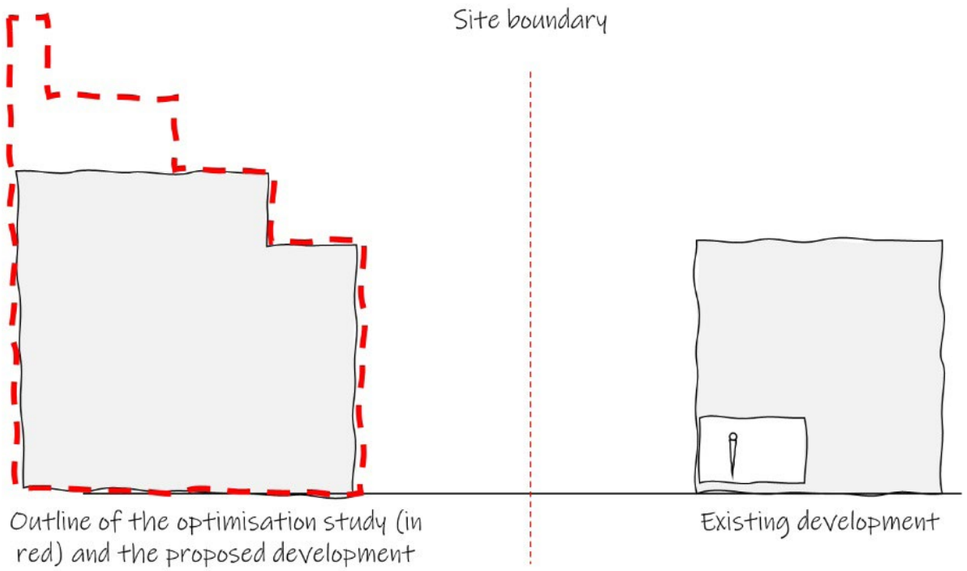
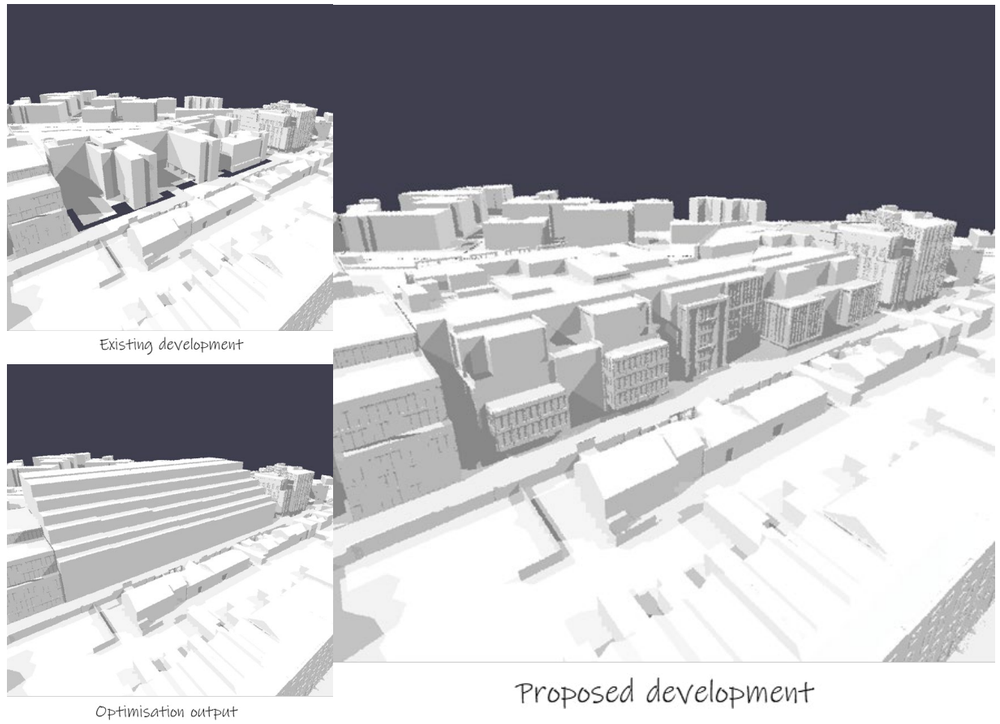


Figure 7: Optimisation Example

An example of how the optimisation process works is included below. On the left is the existing development. In the centre is the output of the optimisation study, being the largest massing possible within the site such that none of the existing surrounding buildings experience an impact to levels of daylight and sunlight availability. On the right is the final proposed massing drawn by the project architects. This sits within the optimised outline, meaning that all surrounding properties experience a negligible impact on daylight and sunlight availability.



7.0 Assessing Results

In determining the suitability of a daylight and sunlight report, the planning authority note the sentiment within BR 209 that the results presented should be interpreted with flexibility. Whilst results may be interpreted with some flexibility depending on site specific circumstances, it is the intended outcome of this guide that all reports and assessments submitted use the same methodology and metrics. This will offer direct comparability for the planning authority across any given proposal that is reviewed.

When reviewing the suitability of results, the planning authority will apply rationale and reason on a case-by-case basis. For example, it stands to reason that a high-density apartment development in the city centre will have a different expectation from an apartment development in the suburbs, and the same logic applies for a new residential development on a green field site. It also stands to reason that the levels of daylight and sunlight availability will vary in line with both the site coverage, development height and density.

Notwithstanding this, it is noted that both BS 8206-2 and BS EN 17037 present **minimum** values for residential developments, rather than best practice values. This is very clearly laid out in clause 5.6 of BS 8206-2 and clause NA.2 of BS EN 17037. These minimum values will not produce spaces that are well daylit or be considered predominantly daylit. The planning authority also acknowledge that national policy aligns with the understanding that these values are minimum provisions. In this regard, there will be a general presumption against schemes where units fall below these minimum standards and it is the expectation of the planning authority that a significant proportion of units should exceed the minimum standard in order to ensure high quality sustainable developments.

In exceptional circumstances, for example on a tightly configured urban site, where these minimum criteria cannot be achieved, the applicant should very clearly identify this and put forward a clear and robust rationale for compensatory measures applied to mitigate any shortfall in the minimum standards. From here, the planning authority will apply an exercise in discretion and balance that considers the wider impact of the development beyond matters relating to daylight and sunlight.

8.0 Independent Verification of Reports

To provide greater confidence in results and to ensure a level playing field for all applicants, the planning authority may, from time to time, commission an independent review or verification of the submitted report. Where required, this will be funded by the applicant. Independent reviews or verification are likely to be required where there is ambiguity in the submitted report or the methods, metrics, results or analysis presented could be called into question.

9.0 Other Relevant Factors

Where adverse impacts of reflected sunlight are possible, either through reflected glare or through reflected irradiance, the planning authority may request that an assessment and report addressing these matters is provided. Guidance on completing assessments is available within BR IP 3/87.

Rights to light is not covered in this guide or under the planning process. The planning authority note that the granting of any planning permission does not override a legal right to light.

10.0 References

[1] EN 17037:2018, Daylight in Buildings, ICS 91.160.01, European Committee for Standardisation, CEN-CENELES, Brussels (2018).

[2] The High Court of Ireland, Judicial Review, Atlantic Diamond Limited and An Bord Pleanála and EWR Innovation Park Limited, Judgement of Humphreys J. delivered on Friday the 14th day of May 2021, (available www.courts.ie) (2021).

[3] Boyce, PR, Humans Factors in Lighting, ISBN 9781439874882, CRC Press (2014).

[4] Knoop et al, Daylight: What makes the difference? Lighting Research and Technology, DOI - https://doi.org/10.1177/1477153519869758 (2019)

[5] Littlefair P, Site Layout Planning for Daylight and Sunlight, A guide to good practice, BR 209, ISBN 978-1-84806-178-1, BRE (2011).

[6] British Standards Institute, BS 8206-2:2008 Lighting for Buildings – Part 2: Code of Practice for Daylighting, ICS 91.060.50; 91.160.10, BSI (2008).