

REPORT

on

**DAYLIGHT & SUNLIGHT
WITHIN THE
PROPOSED DEVELOPMENT**

at

**GREEN PARK VILLAGE,
PHASE 6, READING**

REF: MC/GO/ROL7618
10 May 2017

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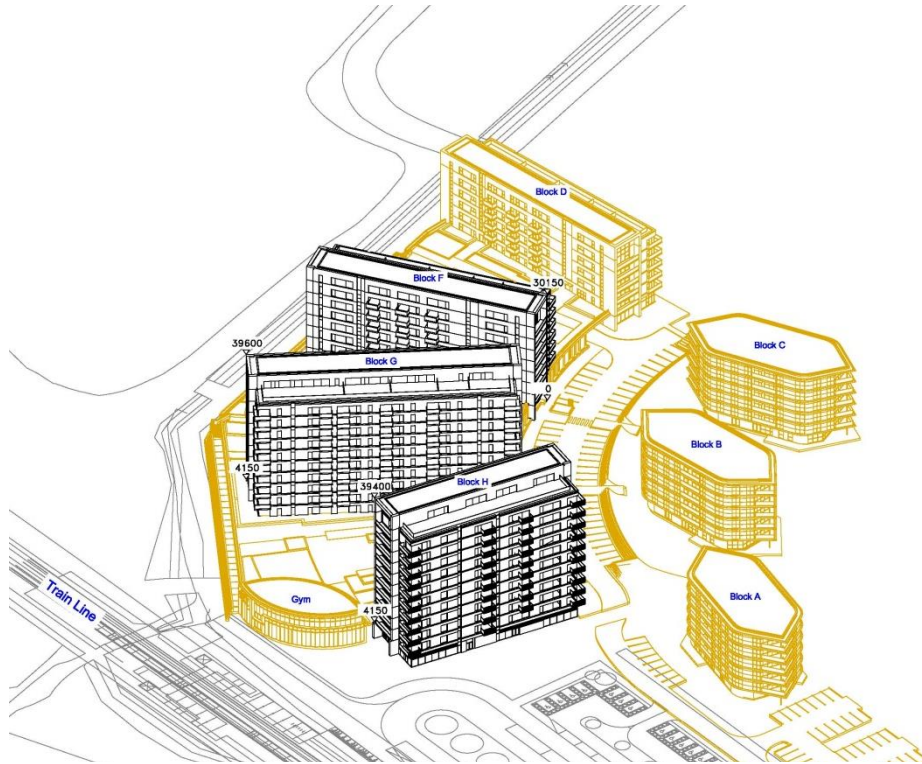


Figure 1: 3D view of computer model looking north

1. INTRODUCTION

- 1.1 St Edward Homes Ltd. is proposing a development at Green Park Village, Phase 6, Reading. The site, which is shown at Figure 1 on page ii, is a greenfield site and is part of a wider masterplan in south west Reading.
- 1.2 The proposed development is designed by Broadway Malyan and comprises several new build apartment blocks, ranging in height between six to twelve storeys.
- 1.3 Anstey Horne has been commissioned to undertake a formal technical assessment of the daylight and sunlight levels within the proposed accommodation and the sunlight to proposed amenity spaces. We have used 3D computer modelling and our specialist computer software to calculate the levels of daylight and sunlight that will be available in the proposed habitable rooms. Our 3D model of the proposed scheme is illustrated in Figure 1 at page ii and in our drawings at Appendix A.
- 1.4 There are no mandatory standards for daylight or sunlight to dwellings, but the following publications offer guidance:
 - BS8206-2: 2008, *Lighting for Buildings – Part 2: Code of practice for daylighting* (2008)
 - BRE Report 209, *Site Layout Planning for Daylight and Sunlight: A guide to good practice* (second edition, 2011)
 - CIBSE Lighting Guide 10, *Daylighting - A Guide for Designers: Lighting for the Built Environment* (SLL LG10, 2014)
- 1.5 The above guides give advice on minimum recommended average daylight factors (ADF) in habitable rooms in dwellings. They also make recommendations for sunlight to interiors, based on the percentage of annual probable sunlight hours (APSH).
- 1.6 This report summarises the relevant planning policy, the basic principles of daylighting, the methods used to assess the potential levels that will be achieved in the new accommodation, the information used in compiling our 3D computer model and the results of our technical assessment. Drawings and full tables of results of our assessment are attached in the appendices.

2. PLANNING POLICY AND GUIDANCE

National Planning Policy and Guidance

- 2.1 The National Planning Policy Framework (NPPF) (March 2012, Department for Communities and Local Government) sets out the Government's planning policies and how these are expected to be applied. It provides a framework within which councils can produce their own local plans that reflect the needs and priorities of their communities.
- 2.2 The NPPF contains a set of 12 core land-use planning principles that should underpin councils' plan-making and decision-taking. One such principle is that planning should *"always seek to secure high quality design and a good standard of amenity for all existing and future occupants of land and buildings"*.
- 2.3 The Building Research Establishment, whose aims include achieving a higher quality built environment, publish BRE Report 209, *Site Layout Planning for Daylight and Sunlight: A guide to good practice* (second edition, 2011) by PJ Littlefair. This guide gives advice on site layout planning to achieve good daylighting and sunlighting in new buildings and to retain it in existing surrounding buildings. The guide is intended for use by designers, consultants and planning officials and notes that *"The advice given here is not mandatory and this document should not be seen as an instrument of planning policy; its aim is to help rather than constrain the designer."*

Local Planning Policy and Guidance

- 2.4 The development site is located within Reading Borough Council.
- Reading Borough Local Development Framework – Core Strategy (Adopted January 2008 – alterations adopted January 2015)
- 2.5 Policy CS1: Sustainable Construction and Design makes reference to daylighting as part of its overarching sustainable strategy at paragraph 4.9:
- "The policy incorporates the use of EcoHomes and BREEAM standards. These standards cover a wide range of matters including building fabrics and materials, energy and water use, amenity areas and ecology, waste recycling, the location and accessibility of developments, daylighting, sound insulation etc. However, the current standards give high scores in urban areas to using previously developed land that is close to services, amenities and public transport routes".*

Reading Borough Local Development Framework – Sites and Detailed Policies Document
(Adopted October 2012)

- 2.6 Policy DM4: Safeguarding Amenity makes reference to daylight and sunlight as safeguarding amenity:

“DM4: SAFEGUARDING AMENITY

Development will not cause a significant detrimental impact to the living environment of existing or new residential properties, in terms of:..... Access to sunlight and daylight;”

- 2.7 Paragraph 4.4.7 of this same policy states:

“This policy applies equally to amenity levels within new residential developments. For instance, layouts should avoid locating living rooms, bathrooms and kitchens next to, above, or below proposed and neighbouring bedrooms. Another example is that ‘dual aspect’ units will help to increase access to light”.

3. METHOD OF ASSESSMENT AND NUMERICAL GUIDELINES

Daylight within new development

- 3.1 Where window positions and sizes are known, it is more informative to calculate the interior daylighting inside the building. The guidelines recommend calculating the average daylight factor (ADF), which is the mean daylight factor on the horizontal working plane inside the room and is a measure of the overall amount of daylight in a space.
- 3.2 BS8206 and BRE Report 209 recommend the following minimum values of ADF in housing:-
- 1% for bedrooms
 - 1.5% for living rooms
 - 2% for kitchens
- 3.3 BS8206-2: 2008 notes that *“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%”*.
- 3.4 There are a number of ways that the ADF can be calculated. We have followed the method described in Appendix C of the BRE guide, which uses the following equation:

$$ADF = \frac{TMA_w \theta}{A(1 - R^2)}$$

Equation 1 - ADF formula

where,

T is the diffuse visible light transmittance of the glazing;

M is the maintenance factor allowing for the effects of dirt;

A_w is the net glazed area of the window;

θ is the angle of visible sky;

A is the total area of all the room surfaces (ceilings, floors, walls and windows); and

R is the area-weighted average reflectance for the room surfaces.

- 3.5 The angle of visible sky (θ) at each window, shown in Figure 2, can be directly related to the VSC as described in Appendix C of the BRE guide. The values used in our assessment for the other parameters in the ADF formula are explained later in this report.

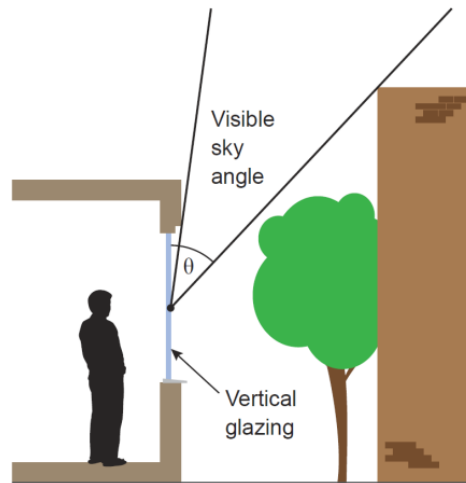


Figure 2 – Angle of visible sky, θ (Source: BRE209, 2011)

Sunlight within new development

- 3.6 Section 3.1 of the BRE guide makes recommendations concerning sunlight in new buildings. It advises that *“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. Sunlight is also required in conservatories. It is viewed as less important in bedrooms and in kitchens, where people prefer it in the mornings rather than the afternoon.”*
- 3.7 The BRE guidance advises that site layout can be used to affect the duration of sunlight in buildings. It notes that *“A dwelling with no main window wall within 90° of due south is likely to be perceived as insufficiently sunlit. This is usually an issue only 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.”*
- 3.8 The guide notes that *“The aim should be to minimise the number of dwellings whose living rooms face solely north, northeast or northwest, unless there is some corresponding factor such as an appealing view to the north.”* It also acknowledges that *“for larger developments of flats, especially those with constraints, it may not be possible to have every living room facing within 90° of due south”*.

- 3.9 Access to sunlight can be quantified: “BS8206 recommends that interiors where the occupants expect sunlight should receive at least one quarter (25%) of annual probable sunlight hours (APSH), including in the winter months between 21 September and 21 March at least 5% of APSH”.
- 3.10 ‘Probable sunlight hours’ means “the total amount 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”. The calculation uses a sunlight probability model that is based on sunlight statistics. The sunlight probability diagram is shown in Figure A.3 of BS8206-2:2008. There are 100 dots on the diagram, with each dot representing 1% of probable sunlight hours. The density of dots on the diagram is proportional to the probability of the sun shining from a particular area of sky.

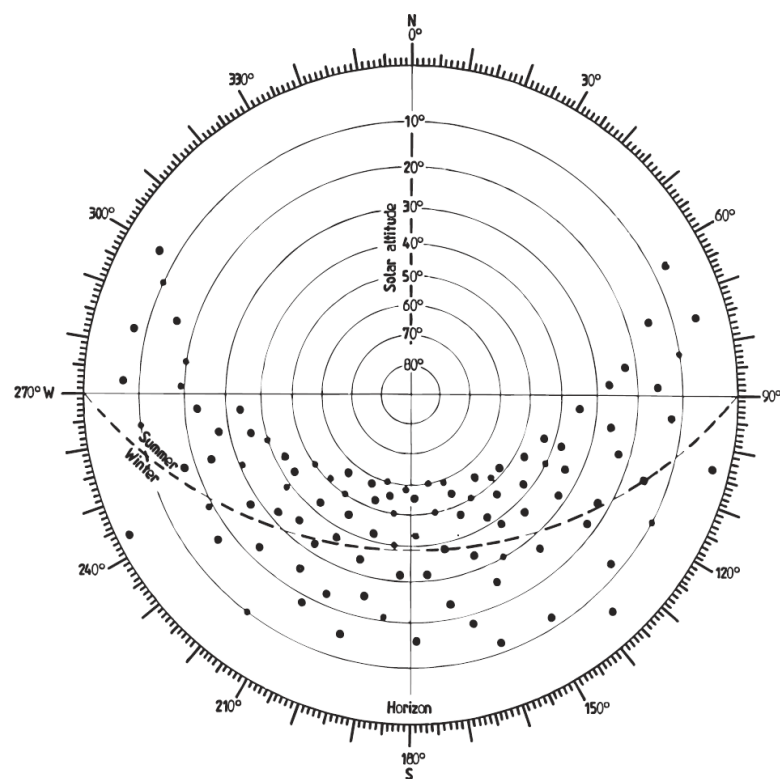


Figure 3 - Sunlight probability diagram (Source: BS8206-2:2008)

- 3.11 Where rooms are lit by more than one window it is sensible to consider the aggregate amount of sunlight reaching the room, though care should be taken to avoid double-counting. The BRE guide advises as follows: “If a room has multiple windows on the same wall or adjacent walls, the highest value APSH should be taken. If a room has two windows on opposite walls, the APSH due to each can be added together.” Our computer software accurately calculates the room-based aggregate APSH, which is a better indicator than individual results for each window.

- 3.12 Whilst the BRE guidelines may, in theory, be applied anywhere, APSH values of 25% annually and 5% in the winter months are often not possible in modern, dense, city-centre sites where it is necessary to fully optimise housing potential. Furthermore, whilst the criteria can be applied to rooms of all orientations, the guide notes that *“if a room faces significantly north of due east or west it is unlikely to be met”*.
- 3.13 BS8206 notes that *“The degree of satisfaction is related to the expectation of sunlight. If a room is necessarily north facing or if the building is in a densely-built urban area, the absence of sunlight is more acceptable than when its exclusion seems arbitrary. It is the duration of sunlight in an interior, rather than its intensity or the size of the sunny patch, which correlates best with the occupants’ satisfaction.”*
- 3.14 Whilst BS8206 is intended to give good access to sunlight in a range of situations, the BRE guide notes that in some circumstances *“the designer or planning authority may wish to choose a different target value for hours of sunlight.”*
- 3.15 In the summary the BRE guide states that a dwelling will appear reasonably sunlit provided that at least one main window wall faces within 90° of due south and the centre of at least one window to a main living room can receive 25% APSH, including at least 5% APSH in the winter months between 21 September and 21 March. Where groups of dwellings are planned, *“site layout should aim to maximise the number of dwellings with a main living room that meets the above recommendations”*.

Sunlight to proposed amenity spaces within new development

- 3.16 Section 3.3 of the BRE guide makes recommendations concerning sunlight to open spaces between buildings. It notes that sunlight into these open spaces *“is valuable for a number of reasons, to:*
- *provide attractive sunlit views (all year)*
 - *make outdoor activities like sitting out and children’s play more pleasant (mainly warmer months)*
 - *encourage plant growth (mainly spring and summer)*
 - *dry out the ground, reducing moss and slime (mainly in colder months).*
 - *melt frost, ice and snow (in winter)*
 - *dry clothes (all year). ”*

- 3.17 The BRE guide recognises that different types of amenity space can have different sunlighting requirements and that it is difficult to suggest a hard and fast rule. The equinox (21 March) can be chosen as a date for assessment. The guide recommends that *“at least half of the amenity areas ... should receive at least two hours of sunlight on 21 March. It is instructive to draw the ‘two hours sun contour’, which marks this area on plan, because the use of specific parts of a site can be planned with sunlight in mind”*.

Computer simulation

- 3.18 The appendices to the BRE guide describe various manual methods for calculating VSC and APSH and for plotting the no-sky line on the working plane. However, where the obstructions on the skyline are complex these methods can be difficult to apply and the results can be crude. We therefore prefer to use computer simulation and our specialist software, which is based on the more accurate Waldram method described in Appendix B of the BRE guide.
- 3.19 Our software calculates the VSC at each window, converts this into an equivalent angle of visible sky (θ) and uses this to calculate ADF in each room.
- 3.20 The information upon which our computer model was based is explained in the next section of this report.

4. APPLICATION OF THE BRE GUIDE

- 4.1 In its introduction BRE Report 209 states its *“main aim is ... to help ensure good conditions in the local environment considered broadly, with enough sunlight and daylight on or between the buildings for good interior and exterior conditions”*.
- 4.2 The guide notes that it *“is intended for building designers and their clients, consultants and planning officials. The advice given here is not mandatory and the guide should not be seen as an instrument of planning policy; its aim is to help rather than constrain the designer. Although it gives numerical guidelines, these should be interpreted flexibly since natural lighting is only one of many factors in site layout design.”*
- 4.3 Clearly, the BRE guide is an advisory document, not a rigid set of rules. Care must therefore be taken when applying its recommendations.
- 4.4 In theory the BRE report’s numerical guidelines may be applied to any setting, whether that is a city centre, suburban area or rural village. However, it notes, *“In special circumstances the developer or planning authority may wish to use different target values. For example, in a historic city centre, or in an area with modern high rise buildings, a higher degree of obstruction may be unavoidable if new developments are to match the height and proportions of existing buildings.”*
- 4.5 Clearly, rigid application of the BRE Report’s standard numerical guidelines may be inappropriate in a built-up urban environment where higher density affordable development may be desirable and where there simply cannot be the same expectation of light as in a suburban or rural context.

5. INFORMATION USED IN THE TECHNICAL STUDY

5.1 We undertook our technical study using a 3D computer model of the proposed scheme and its surrounding buildings, which we built from the following information:

- Proposed scheme:
 - Broadway Malyan's drawings of the proposed scheme: Drawing nos. A-P6-03-001 to 005, A-P6-04-001 to 004, A-P6-05-001 TO 005 AND 3d Model dated March 2017

5.2 The computer model is illustrated on the drawings at Appendix A.

5.3 In calculating the daylight (ADF) levels the following values were applied in the BRE / BS formula:

5.4 T (diffuse glass transmission): 0.68 for clear double glazing with a low emissivity coating;

5.5 M (maintenance factor for dirt on glass): 0.92 (i.e. 8% loss) for vertical glazing;

5.6 Aw (window aperture area): measured from 3D computer model multiplied by 0.8 for the frame correction factor;

5.7 A (total surface area of room): measured from the 3D computer model; and

5.8 R (area-weighted surface reflectance of room): calculated for each room based on the following surface finishes and reflectances:

- Ceilings: white 0.85
- Walls: pale cream 0.81
- Floors: light wood flooring 0.4

6. RESULTS OF TECHNICAL STUDY

- 6.1 We tested a representative selection of habitable rooms with a reasonable horizontal and vertical spread throughout the proposed development, these being rooms at, first, second, third, fifth and seventh floors.
- 6.2 In all we tested 395 rooms, of which 150 are living rooms, dining rooms and kitchens (or a combination thereof) and 245 are bedrooms. Where windows are set back beneath balconies serving the floor above, we have included the obstructing effect of the balcony within our model.
- 6.3 The rooms tested are shown outlined on our drawing nos. ROL7618_02_401 to 409 at Appendix D. The drawings give the use of each room and the room and window references used in our detailed tables of results.

Daylight within new development

- 6.4 The average daylight factor (ADF) results for the proposed habitable rooms tested are shown in the table at Appendix B (along with the relevant target for the room use concerned) and on the room layout drawings at Appendix D.

Block F

- 6.5 Out of the 132 rooms tested for ADF, 114 (86%) will satisfy or exceed the recommended ADF target. On a room type basis, the results can be summarised as follows:
- All 82 (100%) of the bedrooms tested would satisfy the 1% ADF target.
 - 32 of the 50 (64%), living/kitchen/diners (LKD's) will satisfy the 2% ADF target for these rooms. The remaining LKD's will have values ranging between 1.5% and 1.99% ADF, which are levels that exceed the BRE guideline target for a living room. This shows that the living areas of the LKD's will be well day lit.

Block G

- 6.6 Out of the 153 rooms tested for ADF, 129 (84%) will satisfy or exceed the recommended ADF target. On a room type basis, the results can be summarised as follows:
- All 93 (100%) of the bedrooms tested would satisfy the 1% ADF target.

- 36 of the 60 (60%) living/kitchen/diners will satisfy the 2% ADF target for these rooms of the 24 LKD's that fall below the 2.0% target, 22 rooms have ADF values in excess of 1.5%, which is the target for living rooms. The remaining 2 rooms are only just below the 1.5% target with values of 1.43% and 1.48%. This shows that the living areas of these rooms will be well day lit.

Block H

- 6.7 Out of the 110 rooms tested for ADF, 94 (85%) will satisfy or exceed the recommended ADF target. On a room type basis, the results can be summarised as follows:
- 69 (99%) of the 70 bedrooms would satisfy the 1% ADF target. The one remaining bedroom only just falls below the BRE guidelines with an ADF value of 0.97%.
 - 25 of the 40 (62.5%), living/kitchen/diners will satisfy the 2% ADF target for these rooms. Of the 15 LKD's that fall below the 2% target, 4 have ADF values in excess of 1.5%, which is the target for living rooms. The remaining 11 rooms have ADF values ranging between 0.98% and 1.48% and one limited by the provision of the balcony.
- 6.8 Balconies provide much-needed private amenity space, but there is always a trade-off with daylight because they necessarily limit the available daylight. Where LKD's are below the guideline they are located beneath projecting balconies, which inevitably blinker the view of sky. The level of adherence to the guidelines would otherwise be better, but the occupants will have the benefit of amenity space.

Sunlight within new development

- 6.9 The focus of the BRE sunlight guidelines is on main living rooms, rather than bedrooms and kitchens, which the guide views as less important. The guide recommends that *"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 ... Where possible, living rooms should face the southern or western parts of the sky and kitchens towards the north or east."*
- 6.10 The three blocks of F, G and H are orientated northwest to southeast on the development site. Due to site constraints and the need to increase the density of housing on development land, it is not always possible to orientate all living areas 90 degrees of due south. Approximately half of the elevations of blocks F, G and H are orientated 90 degrees of due south and these are the windows reported on in this report.
- 6.11 The results show 211 (82%) out of the 258 windows tested, meet or exceed the annual sunlight target of 25% APSH. Of these same windows, 201 (78%) of the windows meet the winter sunlight target of 5% APSH.

6.12 These results per block are further broken as follows:

Block F

6.13 The results show that out of the 74 windows tested, 49 (66%) of the windows meet or exceed the annual sunlight target of 25% APSH. Of these same windows, 39 (53%) of the windows meet or exceed the winter sunlight target of 5% APSH.

Block G

6.14 The results show that out of the 99 windows tested, 89 (90%) of the windows meet or exceed the annual sunlight target of 25% APSH. Of these same windows, 80 (81%) of the windows meet or exceed the winter sunlight target of 5% APSH.

Block H

6.15 The results show that out of the 85 windows tested, 73 (86%) of the windows meet or exceed the annual sunlight target of 25% APSH. Of these same windows, 82 (96%) of the windows meet or exceed the winter sunlight target of 5% APSH.

Sunlight to proposed amenity spaces

6.16 The results for sunlight to the amenity spaces within the proposed development are shown on our drawing at Appendix E. Areas that will be able to receive at least two hours of sunlight on 21 March are shown cross-hatched yellow and areas that will receive sunlight for a shorter duration are cross-hatched grey. The proportion of each space achieving the two-hour guideline on 21 March is expressed as a percentage on the drawing and in [the second column of] Table 1 below. The BRE target is 50% of a space.

Table 1 - Percentage of each amenity area receiving at least two hours of sunlight on 21 March

Amenity Area	Percentage of area in sunlight on 21 March for ≥ 2 hrs
Gardens between Blocks D, F and H	81.8%

6.17 The two-hour sun contour results show that the shared courtyard podium area between blocks F, G and H exceeds the BRE guideline target for sunlight with 81.8% of its area receiving two hours of sun or more on March 21st.

6.18 The two hour sun contour plot is shown on drawing ROL7618_02_301 at Appendix E

7. SUMMARY AND CONCLUSION

- 7.1 There are no mandatory standards for daylight or sunlight provision within dwellings. Reading's planning policy seeks to provide good living conditions for residents of new housing developments. The BRE Report 209, *Site Layout Planning for Daylight and Sunlight: A guide to good practice* provides useful guidance on the subject.
- 7.2 We assessed daylight and sunlight to 395 habitable rooms, testing intermediate floors throughout blocks F, G and H at first, second, third, fifth and seventh floor levels. We also assessed sunlight to all windows on these floors, as well as sunlight availability to the courtyard between blocks F, G and H. The summary of the findings are as follows:-
- 7.2.1 In terms of daylight, out of the 395 habitable rooms assessed, 337 (85%) of rooms meet the BRE guidelines. Of the rooms falling below the target these relate to living/kitchen/dining rooms. It is the provision of the balconies that affect the daylight availability but it is clear that 91% of the LKD's will receive a value of 1.5% ADF or more, which shows that the living areas of these rooms will receive good daylight. We consider that this is a good level of adherence when balancing the need for amenity provision.
- 7.2.2 For sunlight, 82% of all south facing windows assessed meet or exceed the annual sunlight target of 25% APSH or more. Out of these same windows, 78% meet the winter sunlight target of 5% APSH or more.
- 7.2.3 The courtyard amenity area exceeds the two hour sun target of 50% on March 21st, achieving 81.8%.
- 7.3 In conclusion, we consider the proposals have met Reading's policies for daylight and sunlight provision for new housing developments.



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10 May 2017

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