Hydrock

Dorset Innovation Park LDO

Daylight and Sunlight Assessment

For Purbeck District Council

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Introduction

1.1 Purpose of Report

Hydrock has been appointed by Purbeck District Council to provide a daylight and sunlight assessment for the proposed development of Dorset Innovation Park in Wool, Wareham.

This report provides the results of a daylight and sunlight assessment that has been undertaken for the proposed development.

The development and impact has been assessed using the criteria set out in the Building Research Establishment's (BRE) 'Site layout planning for daylight and sunlight – a guide to good practice' (BR 209) (Littlefair, 2011). Whilst the guide itself states that its guidelines are not mandatory, they are those predominantly referenced for daylight and sunlight standards in the UK.

1.2 Site and Location

The development is located just outside Wool, Wareham and is shown below.

Figure 1: Site location

1.3 Development Details

Dorset Innovation Park is a new innovation park that is being developed on the site of the former Winfrith nuclear energy test facility on the edge of Wool village near Wareham. The whole development will consist of a mixture of buildings housing light industrial, research & design, industrial and distribution.

Technical assessments relating to the proposed development are based upon an Illustrative Masterplan. The Illustrative Masterplan presents one potential development scenario and is reflective of the urban design and development plot principles set out within the Design Guide. The masterplan shows a scheme of 14 plots, consisting of 26 buildings.

The development aspires to be a flagship scheme and will be expected to provide high levels of sustainable design, innovation and wellbeing for occupants.

1.4 Glossary of Terms

Average Daylight Factor - The average daylight factor is the average indoor illuminance (from daylight) on the working plane within a room, expressed as a percentage of the simultaneous outdoor illuminance on a horizontal plane. It is calculated based on a uniform overcast sky.

Glare - Glare is the sensation produced by bright areas within the visual field, such as lit surfaces, parts of the luminaires, windows and/or roof lights. Glare shall be limited to avoid errors, fatigue and accidents. Glare can be experienced either as discomfort glare or as disability glare. In interior work places disability glare is not usually a major problem if discomfort glare limits are met. Glare caused by reflections in specular surfaces is usually known as veiling reflections or reflected glare.

Illuminance - The amount of light falling on a surface per unit area, measured in lux.

Point daylight factor - A point daylight factor is the ratio between the illuminance (from daylight) at a specific point on the working plane within a room, expressed as a percentage of the illuminance received on an outdoor unobstructed horizontal plane.

Uniformity - The uniformity is the ratio between the minimum illuminance (from daylight) on the working plane within a room (or minimum daylight factor) and the average illuminance (from daylight) on the same working plan (or average daylight factor).

View of sky/no-sky line - Areas of the working plane have a view of sky when they receive direct light from the sky, i.e. when the sky can be seen from working plane height. The no-sky line divides those areas of the working plane, which can receive direct skylight, from those that cannot.

Working plane - CIBSE LG10 defines the working plane as the horizontal, vertical or inclined plane in which a visual task lies. The working plane is normally taken as 0.7m above the floor for offices and 0.85 m for industry.

Methodology

2. BACKGROUND

Overshadowing occurs when buildings are in close proximity relative to their size. This results in reduced levels of daylight and sunlight in part, or all, of the affected buildings. Daylight refers to the level of diffuse natural light coming from the surrounding sky or reflected off adjacent surfaces, whereas sunlight refers to direct sunshine. A key difference between the two is that sunlight is highly dependent on orientation, whereas orientation has no effect on daylight.

The potential for daylight at a particular point may be quantified by assessing the proportion of the sky that is 'visible' from that point, i.e. not obscured by objects such as buildings. For points located on vertical surfaces such as walls, this proportion of visible sky is termed the 'vertical sky component' or VSC.

After the VSC, the no sky line can also be used to assess daylight performance. The no sky line is the point on the working plane at which no sky can be viewed. This is often expressed as the percentage of working plane from which the sky can be viewed such as 80% or 0.8.

However, if the details of the building are known, then daylight can be more accurately quantified by calculating the average daylight factor (ADF). This gives a more precise measure of daylight, the results of which can in effect over-ride the VSC results. The ADF is generally only used to calculate daylight in new buildings.

Further, climate based modelling (CBM) techniques can be utilised to provide a more accurate assessment of predictive visual comfort within buildings. These techniques include spatial daylight autonomy (SDA), which considers percentage of time across a given year where appropriate illuminance levels are achieved, in addition to glare risk assessment.

These CBM techniques require more complex modelling and are more appropriate where the usage and task requirement of the space are known in more detail. For this reason, and the relative modern emergence of CBM modelling techniques, assessment at planning is rare.

Direct sunlight can be calculated by testing the 'annual probable sunlight hours' that a point receives. This is achieved by considering both the complete annual shading variation at the point, and the statistical sunshine averages for the location in question.

The average daylight factor, vertical sky component, no sky line and number of annual probable sunlight hours form the basis of the overshadowing assessment methodology used in the analysis. The average daylight factor is generally only relevant when the internal room layout and use is known.

To achieve objectivity in quantifying daylight and sunlight, the guidelines laid down in the widely accepted BRE guidebook 'Site layout planning for daylight and sunlight: a guide for good practice', 2nd edition, 2011 by P J Littlefair are adhered to.

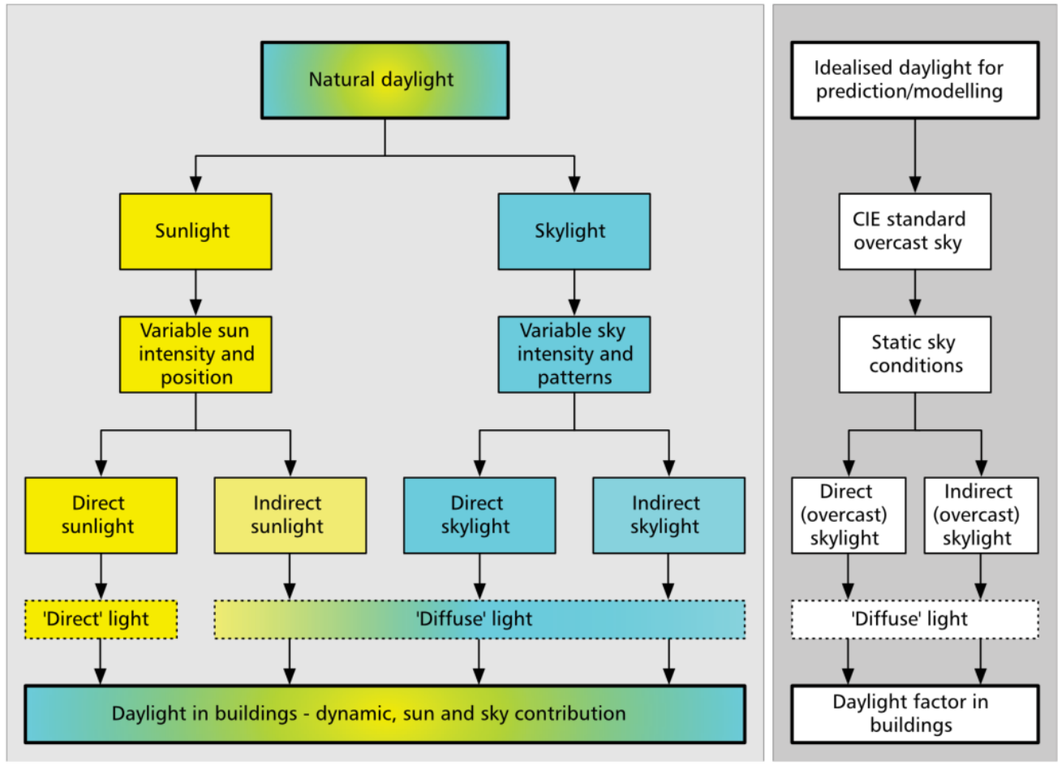

Figure 2: Natural daylight categories

3. METHODOLOGY

3.1 Daylight

The amount of useable daylight available to occupants will be seen as an important indicator of workspace quality. Unless an activity requires the exclusion of daylight, the target of any design should be to provide a view out-of-doors irrespective of its quality. However, although daylight and sunlight have positive qualities they must be carefully controlled to avoid glare.

There is little in guidance as to the standard that should be achieved or aimed for with regard to natural daylight levels, however the 'Metric Handbook: Planning and Design Data' suggests a daylight factor of 2% should be a space such as this. Further to this, for the office space, as a guideline, the British Council for Offices (BCO) defines a 'well day lit' office space as one that achieves an average daylight factor of between 2% and 5%, this translates into sufficient daylight luminance (>300 lux) for between 55% and 80% of annual working hours.

To improve the daylighting within a building, reduced building depths should be considered first. If this isn't possible, the following can be considered;

- Utilise atria and light wells,
- Ensure that electric lights remain off during daylight hours,
- Avoid dark internal surfaces, and
- If useable daylight is limited, use of splayed reveals, light shelves and prisms may be required.

3.2 Window Sunlight

To quantify the potential for sunlight, annual probable sunlight hours are calculated for working space windows, which face within 90 degrees of due south. See Appendix B for a full description. The recommendation is that:

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

3.3 Limitations

Although daylighting and sunlighting must be utilised, glare must be considered and controlled within the design.

Health and Safety (Display Screen Equipment) Regulations 1992 provides the legal requirements for control of glare. Specifically, for the BREEAM credit for 'glare control', control blinds should be installed as part of the building.

Parameter	Criteria	Acceptability Criteria	Source
Daylight	Angle to sky from horizontal	Maximum 25 degrees	BRE (Littlefair)
	No sky line	80% of room receives direct light from the sky	BRE
	Average daylight factor	Greater than 1-2% depending on room use	BRE
Sunlight	Annual probable sunlight hours	Window receives at least 25%	BRE (Littlefair)
	Winter probable sunlight hours	Window receives at least 5%	BRE (Littlefair)

Table 1: BRE daylight, sunlight and overshadowing criteria for new developments

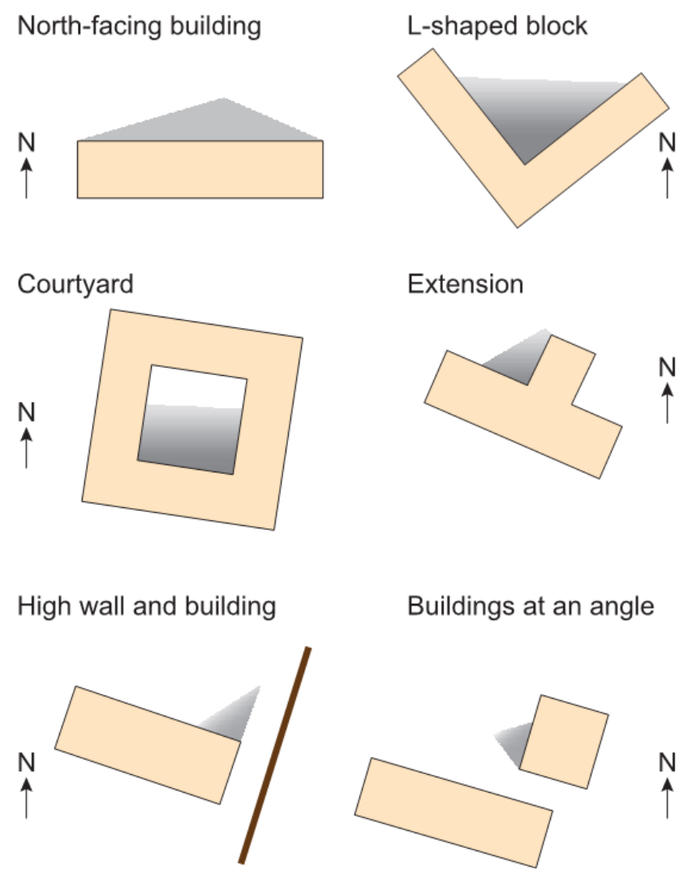

Figure 3: Layouts of buildings where poor daylighting and sunlighting would occur ground floor

Proposed Development Assessment

The impact of the proposed development on the vicinity of the site has been assessed. This has initially been undertaken using a desktop-based approach as well as a computer simulated sunlight analysis.

The layout of proposed buildings is based on the illustrative masterplan provided by the architect, building heights are based on basic storey heights and glazing ratios have been assumed.

As the proposed development is sparsely populated, only the following buildings have been assessed due to their close proximity to each other. These are stated below:

1. The Nucleus 01 & 02
2. Dragon 01 & 02
3. Zebra 02
4. Nestor 01
5. Hector 01 & 02
6. Quadrant 01 & 02

Figure 4: Masterplan showing the buildings to be assessed in darker purple

4. THE NUCLEUS

4.1 Initial Desktop Assessment

An initial desktop assessment of the surrounding buildings has been carried out. Buildings identified as being within 25 degrees of the proposed buildings have been highlighted as needing further assessment.

The Nucleus buildings are not in close proximity other surrounding buildings within the masterplan but the design could cause overshadowing for certain parts of the building itself. The 2-storey section does shadow the lower social area but only slightly as shown in Figure 6.

Therefore, further assessment required for the building will be minimal.

4.2 Initial Sunlight Assessment

Window sunlight is tested by assessing the percentage of annual probable sunlight hours that are received. Where possible dwellings should have at least one window to a main living space that achieves at least 25% of annual probable sunlight hours (APSH) and 5% of winter probable sunlight hours (WPSH).

The table below shows the sunlight performance for the buildings. The majority of areas which are not meeting the APSH criteria are those situated at lower floors within the apartment blocks and facades facing with 90° of north.

Variable	Pass rate %
Annual Possible Sunlight Hours	76%

Table 2: APSH results

Figure 5: Masterplan key

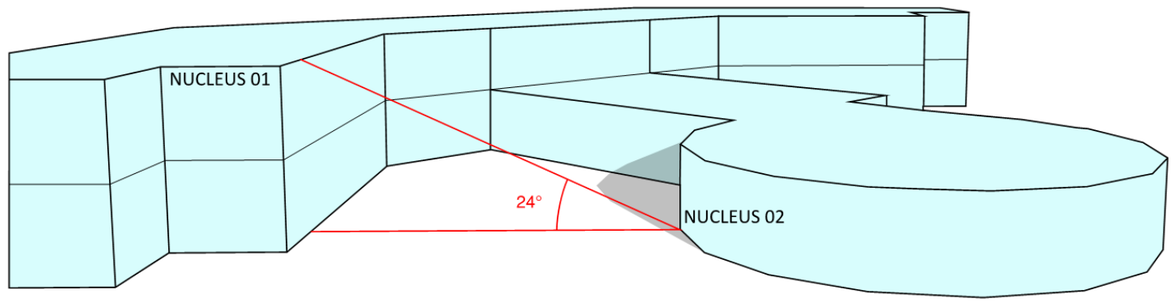

Figure 6: 25-degree check for The Nucleus

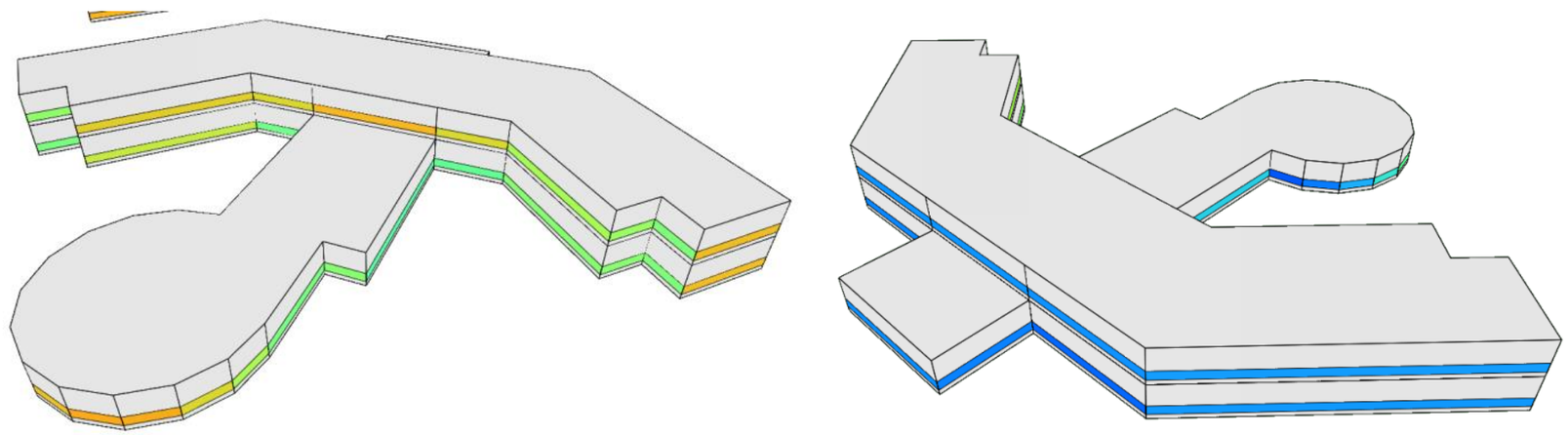

Figure 7: APSH results for south and north facades of The Nucleus buildings

5. DRAGON

5.1 Initial Desktop Assessment

The Dragon buildings are not in close proximity other surrounding buildings within the masterplan but the design could cause overshadowing for certain parts of the building itself. As the two buildings are close together, above 25° (specifically 38°), a narrow 10m space is created. This space and the associated walls may experience a reduced amount of daylight.

Therefore, further assessment will be required for the building.

5.2 Initial Sunlight Assessment

The table below shows the sunlight performance for the buildings. The majority of areas which are not meeting the APSH criteria are those situated the narrow area where the buildings meet and any facades facing with 90° of north.

Variable	Pass rate %
Annual Possible Sunlight Hours	83%

Figure 3: APSH results

Figure 8: Masterplan key

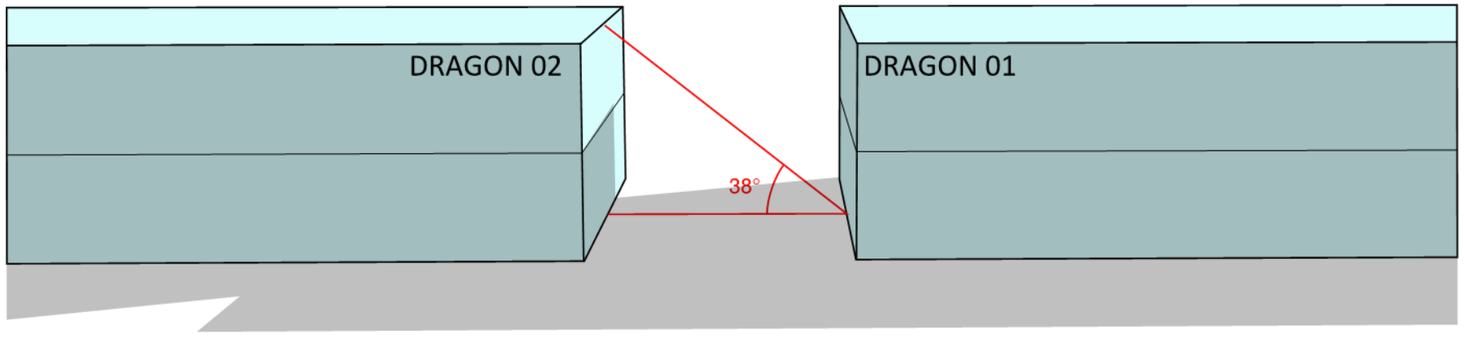

Figure 9: 25-degree check for Dragon buildings

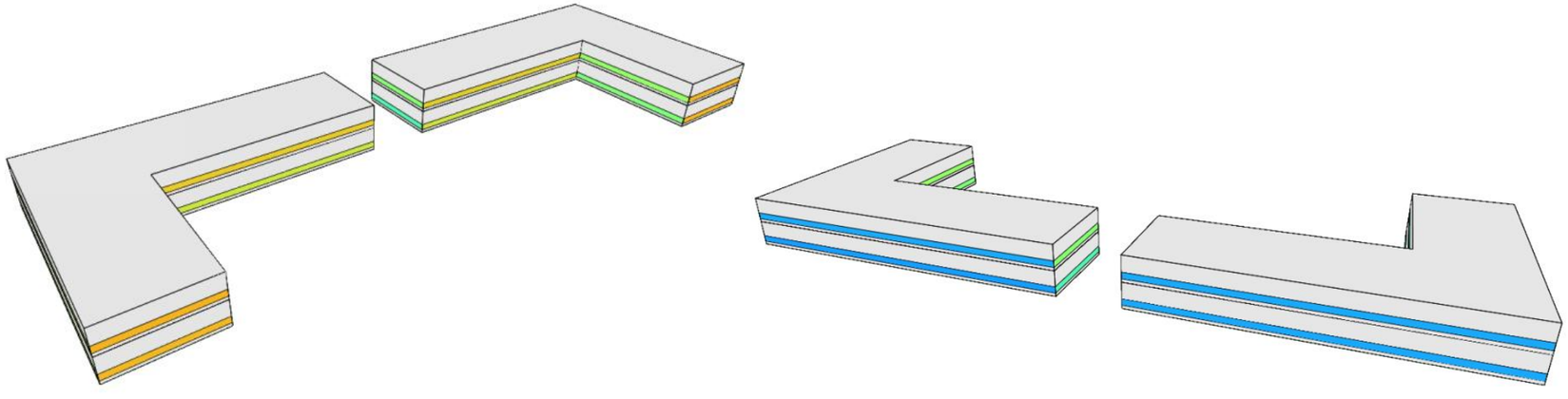

Figure 10: APSH results for south and north facades of Dragon buildings

6. ZEBRA

6.1 Initial Desktop Assessment

The Zebra buildings are not in close proximity other surrounding buildings within the masterplan but the design of Zebra 01 could cause overshadowing for certain parts of the building itself. The creation of a courtyard may reduce amount of daylight received in the lower areas of the building, although the angle of visible sky is 14°.

Therefore, further assessment required for the building will be minimal.

6.2 Initial Sunlight Assessment

The table below shows the sunlight performance for the buildings. The majority of areas which are not meeting the APSH criteria are those situated the courtyard and any facades facing with 90° of north.

Variable	Pass rate %
Annual Possible Sunlight Hours	59%

Figure 16 - APSH results

Figure 11: Masterplan key

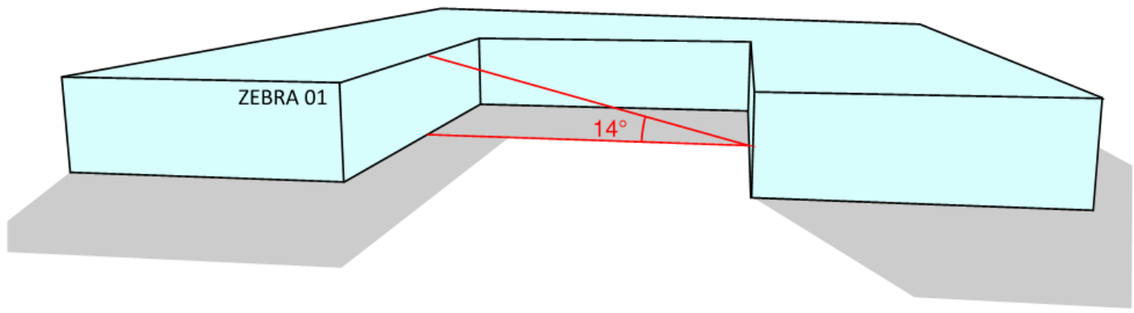

Figure 12: 25-degree check for Zebra 01 building

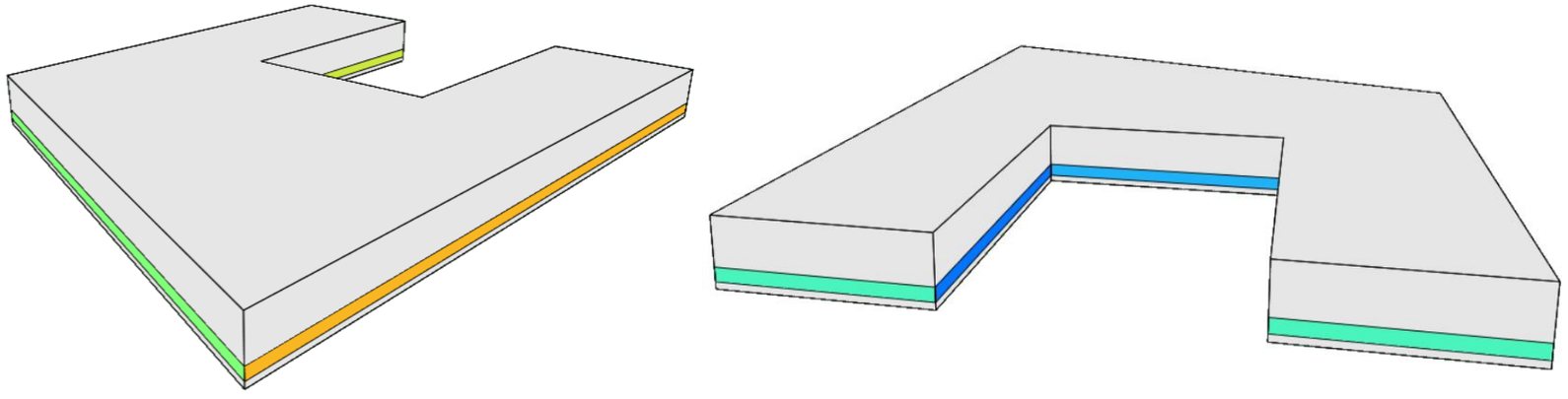

Figure 13: APSH results for south and north facades of Zebra 01 building

7. NESTOR

7.1 Initial Desktop Assessment

The Zebra buildings are not in close proximity other surrounding buildings within the masterplan but the design of Zebra 01 could cause overshadowing for certain parts of the building itself. The creation of a courtyard may reduce amount of daylight received in the lower areas of the building, although the angle of visible sky is 14°.

Therefore, further assessment will be required for the building.

7.2 Initial Sunlight Assessment

The table below shows the sunlight performance for the buildings. The majority of areas which are not meeting the APSH criteria are those situated are facades facing with 90° of north.

Variable	Pass rate %
Annual Possible Sunlight Hours	86%

Figure 17 - APSH results

Figure 14: Masterplan key

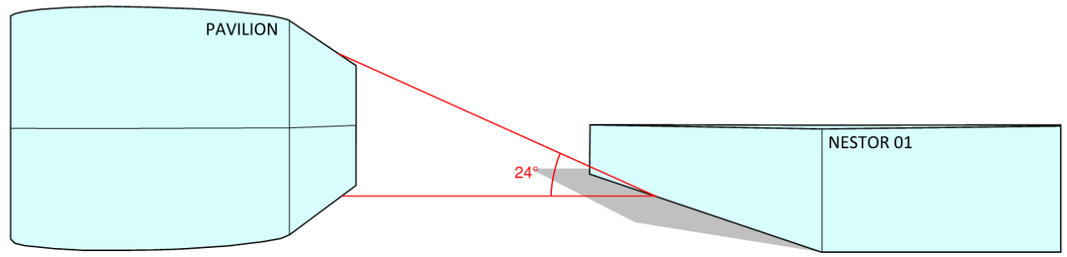

Figure 15: 25-degree check for Nestor and Pavilion buildings

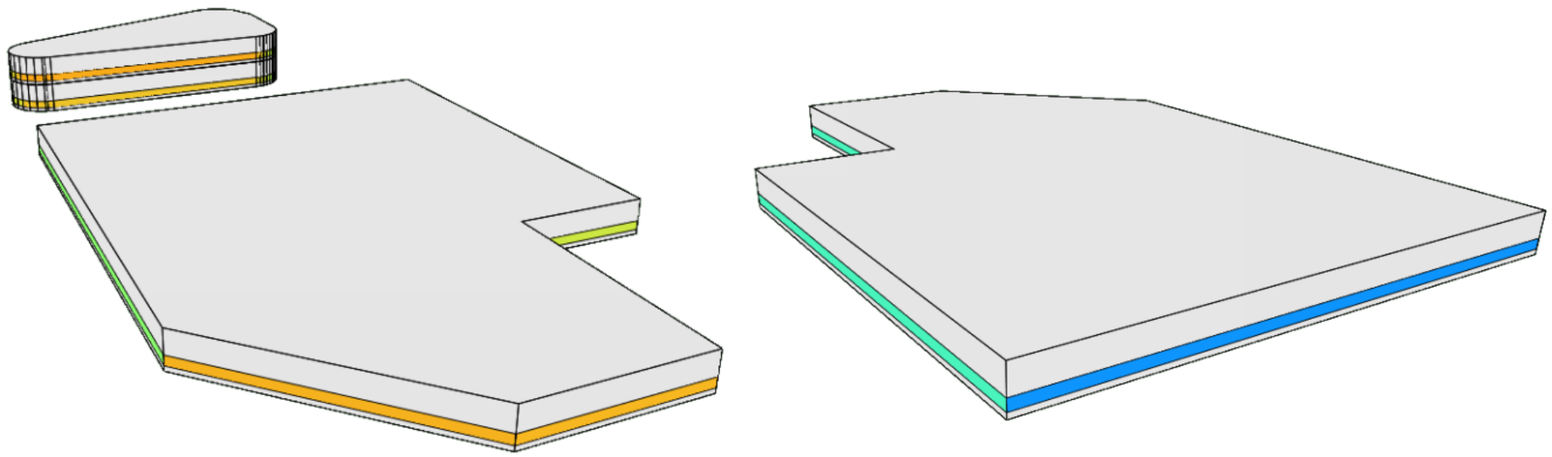

Figure 16: APSH results for south and north facades of Nestor and Pavilion buildings

8. HECTOR

8.1 Initial Desktop Assessment

The Hector building is not in close proximity other surrounding buildings within the masterplan but the design could cause overshadowing for certain parts of the building itself. The 2 storey section does shadow the lower section of the building, predominantly on the north façade.

Therefore, further assessment will be required for the building.

8.2 Initial Sunlight Assessment

The table below shows the sunlight performance for the buildings. The majority of areas which are not meeting the APSH criteria are those situated are facades facing with 90° of north.

Variable	Pass rate %
Annual Possible Sunlight Hours	79%

Figure 18 - APSH results

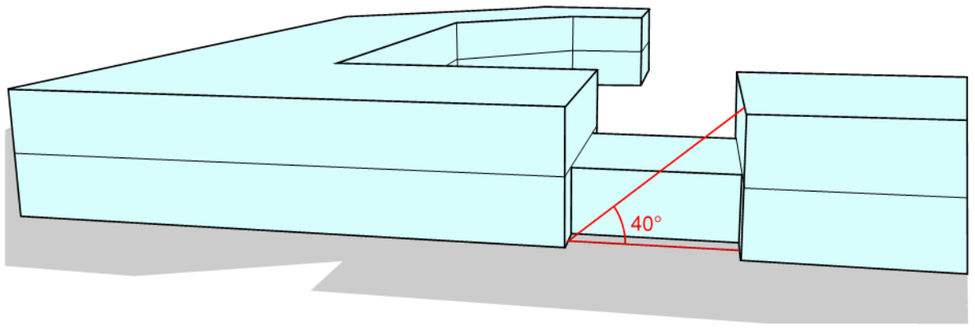

Figure 18: 25-degree check for Hector building

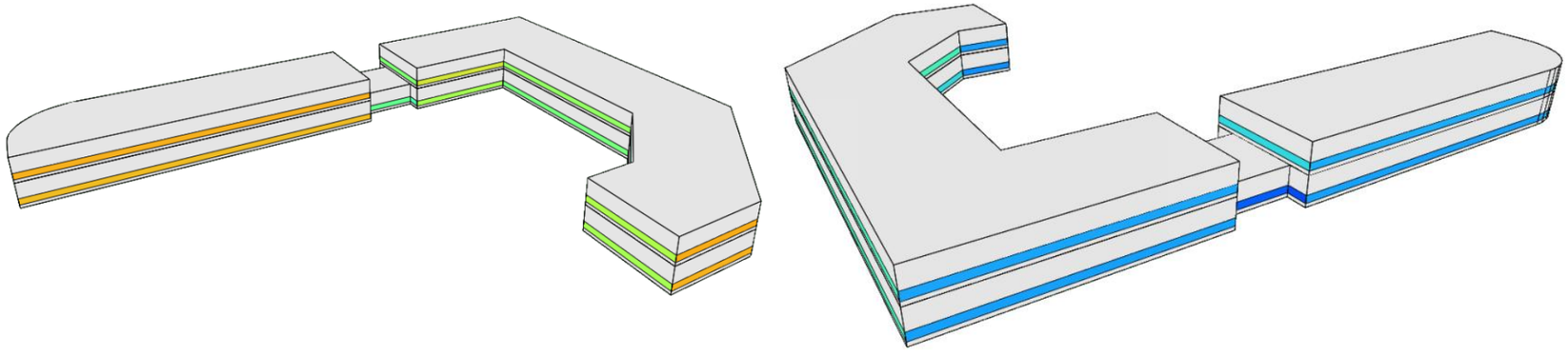

Figure 19: APSH results for south and north facades of Hector building

Figure 17: Masterplan key

9. QUADRANT

9.1 Initial Desktop Assessment

The Quadrant buildings is not in close proximity other surrounding buildings within the masterplan but the design could cause overshadowing for certain parts of the building itself. The two buildings do not shadow each, with an angle of visible sky being 8° (below 25°).

Therefore, further assessment required for the building will be minimal.

9.2 Initial Sunlight Assessment

The table below shows the sunlight performance for the buildings. The majority of areas which are not meeting the APSH criteria are those situated are facades facing with 90° of north.

Variable	Pass rate %
Annual Possible Sunlight Hours	75%

Figure 19 - APSH results

Figure 20: Masterplan key

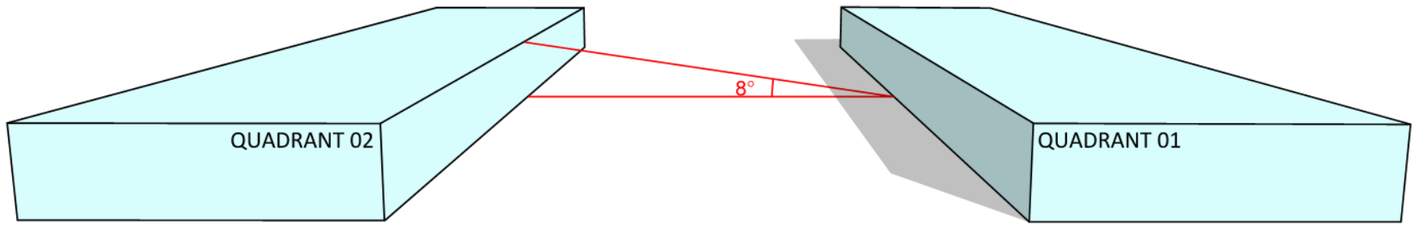

Figure 21: 25-degree check for Quadrant buildings

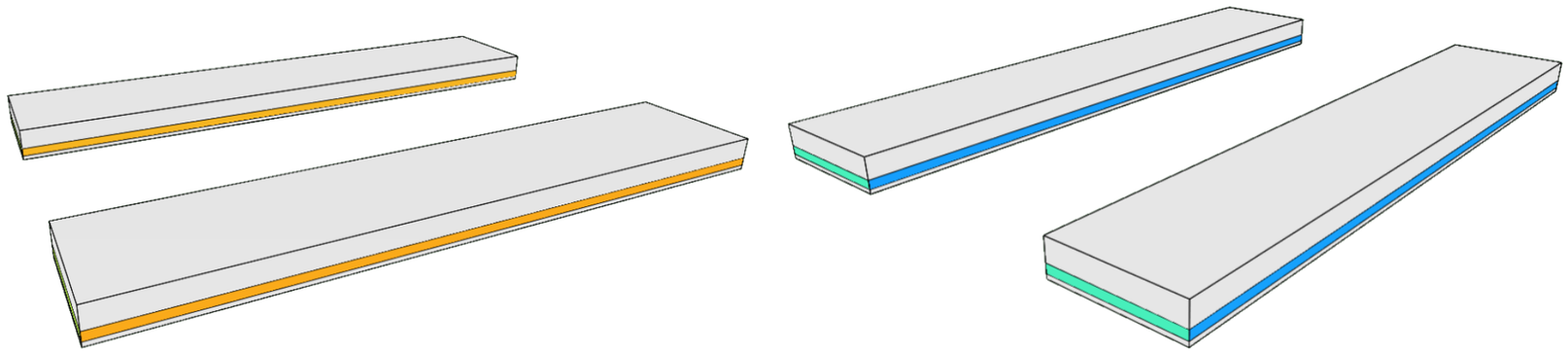

Figure 22: APSH results for south and north facades of Quadrant buildings

10. DAYLIGHTING ASSESSMENT

The daylighting has been classified according to the methodology outlined in Appendix I of BR 209. This is shown in Table 23. It is worth noting that the assessment of impact depends on a combination of factors and there is no simple rule of thumb that can be applied.

The following is given as guidance:

- **Negligible** - Where reduction in skylight is well within the guidelines set out within BR 209.
- **Minor Adverse** – Where loss of skylight only just meets guidelines or areas that fall outside of guidelines are not critical.
- **Moderate Adverse** – Where loss of skylight is marginally outside the guidelines or a large area of open space/windows are affected.
- **Major Adverse** – A large number of open space/windows are affected and the loss of skylight is substantially outlines the guidance.

11. SUMMARY

The Dorset Innovation Park development daylighting and sunlighting is generally considered acceptable.

As the design of the scheme is only illustrative and therefore still progressing, overshadowing can be kept to a minimum through development of the design. This report has shown that by following the principles outlined in the design guide, good levels of daylight and minimal overshadowing is possible.

Building	Daylighting Assessment	25-degree check required	25-degree pass	Sunlighting Pass %	Further Assessment required?
The Nucleus	Minor Adverse	Yes	Yes (margin)	76%	Further daylight assessment will be required
Pavilion	Negligible	No			
Nestor	Minor Adverse	Yes	Yes (margin)	86%	Further daylight assessment will be required
Hector	Minor Adverse	Yes	No	79%	Further daylight assessment will be required
Quadrant	Minor Adverse	Yes	Yes	75%	Further assessment will be minimal
Dragon	Minor Adverse	Yes	No	83%	Further daylight assessment will be required
Dimple	Negligible	No			
Zebra	Minor Adverse	Yes	Yes	59%	Further sunlight assessment will be required
Zenith	Negligible	No			
Chapman	Negligible	No			
Steam	Negligible	No			
Nero	Negligible	No			
Juno	Negligible	No			

Table 23: Daylight assessment