

DAYLIGHT AND SUNLIGHT ASSESSMENT
FOR
PROPOSED APARTMENT DEVELOPMENT
AT
BLACKWOOD SQUARE
NORTHWOOD AVENUE
SANTRY

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| V06 | 19-Nov-19 | Full report for planning application |

Disclaimer

This report has been prepared with all reasonable skill, care and diligence. Information reported herein is based on the interpretation of the data collected and has been accepted in good faith as being accurate and valid.

The assessment is based on the drawings and specifications provided. Should any changes be made to these documents or to the design for of the proposed scheme, the results and conclusions in this report may not be valid.

Summary

An assessment of sunlight and daylight has been carried out on the proposed development at Blackwood Square in support of the SHD planning application. The development comprises 331 apartments, commercial units and a childcare facility, spread across four 8-storey blocks with central and surrounding open areas.

The report outlines best practice guidelines for the provision of daylight and sunlight, local and national planning guidelines, the assessment methods and analysis of the results.

The following assessments are presented in this report:

- Daylight access to neighbouring residences
- Sunlight access to neighbouring residences
- Daylight levels within the proposed scheme
- Sunlight access within the proposed amenity areas

Background

A number of assessments of the proposed development were undertaken as the design developed over the last 4-5 months. These assessments highlighted some opportunities to improve daylighting and sun lighting performance and the design team subsequently revised the design in response.

The design revisions included: (a) Changes to some apartment layouts and increased window sizes including taller windows to all ground floor apartments (July 2019); (b) Adjustment of buildings' positions on-site and remodelling north end of Block D (Oct 2019); (c) Changing of internal finishes' specifications.

This report is based on the design incorporating the above changes.

The assessment has been carried out in accordance with the methods described in the approved planning guidance documents: Building Research Establishment (BRE) 2011 "Site Planning for Daylight and Sunlight: A Guide to Good Practice", and Code of Practice for Daylighting BS 8206-2: 2008.

Assessment Overview

Effect of the proposed development on existing buildings to the north

The impact the proposed development will have on the relevant neighbouring dwellings has been considered in terms of access to sunlight and daylight. The relevant dwellings are those locating directly north in the existing Bridgefield and Pappan Grove apartment scheme, facing the proposed development – a total of 29 dwellings. The houses to the east (Cedar view) locate in excess of 55m from the proposed buildings and on the other side of a north-south bank of mature trees and are therefore generally unaffected.

Sunlight levels at the 29 relevant dwellings to the north will be largely unaffected. The calculations show that all relevant dwellings will comfortably exceed the guidelines and continue to receive excellent levels of direct sunshine throughout the year.

With regard to daylight levels in the 29 relevant dwellings to the north, the majority (18) will continue to receive daylight (ADF) levels above the minimum guidelines, 9 will fall marginally below the threshold while 2 are well below. Having regard to the largely unaffected sunlight penetration and to the need to achieve the appropriate density in the proposed scheme, we feel this limited shortfall should be acceptable.

Sun lighting and daylighting within the proposed development

The sunlight analysis shows that the amenity areas associated with the proposed scheme including the childcare facility will receive good levels of sunlight throughout the year.

An initial screening exercise, using established assessment methods, was carried out to identify those units in the proposed scheme which might have the potential to experience poor daylight levels and which should be analysed in detail. Those units are termed “worst case”. Units not identified as “worst case” can be regarded as not having the potential to experience poor levels of daylight and sunlight.

As a result of this screening exercise, 59 dwellings were identified as “worst case”. Our subsequent calculations showed that 41 of these 59 dwellings either meet or greatly exceed the guidelines. Given that the balance of dwellings in the scheme, the other 272 non-worst-case dwellings, should exceed the ADF threshold, we can therefore safely conclude that 313 (being 41 + 272) of all proposed dwellings will meet or exceed the guidelines. This represents an overall pass rate of 95%.

Of the remaining dwellings from the 59 analysed, 8 are marginally below the guidelines and the remaining 10 (3% of the entire scheme) fall below 1.25% ADF. These dwellings enjoy living environment compensatory factors including aspects towards the attractive courtyard and landscaped areas, vistas of light-coloured brickwork, windows and doors continuing down to floor level and opening to large private-use balconies with glazed balustrading delivering practically uninterrupted views. The design team has sought to find an acceptable compromise between the need to maximise daylight levels and other relevant factors such as density, building form, overheating risk, privacy and the provision of balconies. With these considerations in mind, we feel that the low percentage of dwellings below the guidelines should be acceptable.

Potential overshadowing from the existing trees along the east side of the development has also been considered and these are not likely to have a negative impact on the dwellings at the same elevation.

Overall, we are satisfied that daylight and sunlight provisions were a prior concern and a design development concern of the design team and that the occupants will enjoy a high standard of accommodation in this regard.

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1 Introduction

Geraghty Energy Consultants have been appointed by the Cosgrave Developments Ltd. to assess daylight and sunlight performance in support of the planning application for the proposed apartment development.

The report is structured as follows:

- Overview of the Proposed Scheme
- Policy Guidelines
- Assessment Methodology
- Impact on neighbouring residences
- Daylight and sunlight within the proposed scheme
- Sunlight to Open Areas within the proposed scheme

The report is supplemented with the following appendices:

1. Appendix A1: Architectural Drawing Schedule
2. Appendix A2: Tree Survey Documents
3. Appendix B1: Floor layout drawings with room references within the Existing Blocks
4. Appendix B2: Floor Layout Drawings with Room References for the Proposed Scheme
5. Appendix C1: Average Daylight Factors within the Existing Blocks
6. Appendix C2: Sunlight Hours at windows in Existing Blocks facing the Proposed Scheme
7. Appendix C3: Shadow Path Diagram for Existing Blocks (Closeup View)
8. Appendix D1: Average Daylight Factors for Rooms in the Proposed Scheme
9. Appendix D2: Shadow Path Diagrams for Proposed Scheme
10. Appendix D3: Shadow Path Diagrams for Proposed Scheme with Existing Trees
11. Appendix E: Three-Dimensional Model for Daylight and Sunlight Analysis
12. Appendix F: References

2 Overview of the Proposed Scheme

The development comprises 331 apartments, commercial dwellings and a childcare facility, spread across four 8-storey blocks with central open areas and is located in Santry. Figure 2.1 below shows a layout of the existing site which include Gulliver’s commercial park to the west, and a local centre to the south which, in addition to larger commercial outlets, accommodate neighbourhood shopping and café facilities. The site is bounded to the east by swift square office accommodation, Bridgefield and Pappan Grove apartment development to the north.



Figure 2-1 Proposed site layout boundary with existing trees (existing neighbouring dwellings to the north not shown)

The proposed layout for the apartment blocks and open amenity areas is shown in the site layout below:



Figure 2-2 Proposed site plan with Block A, B, C and D with site boundary (Existing apartment blocks to the north and existing trees also shown)

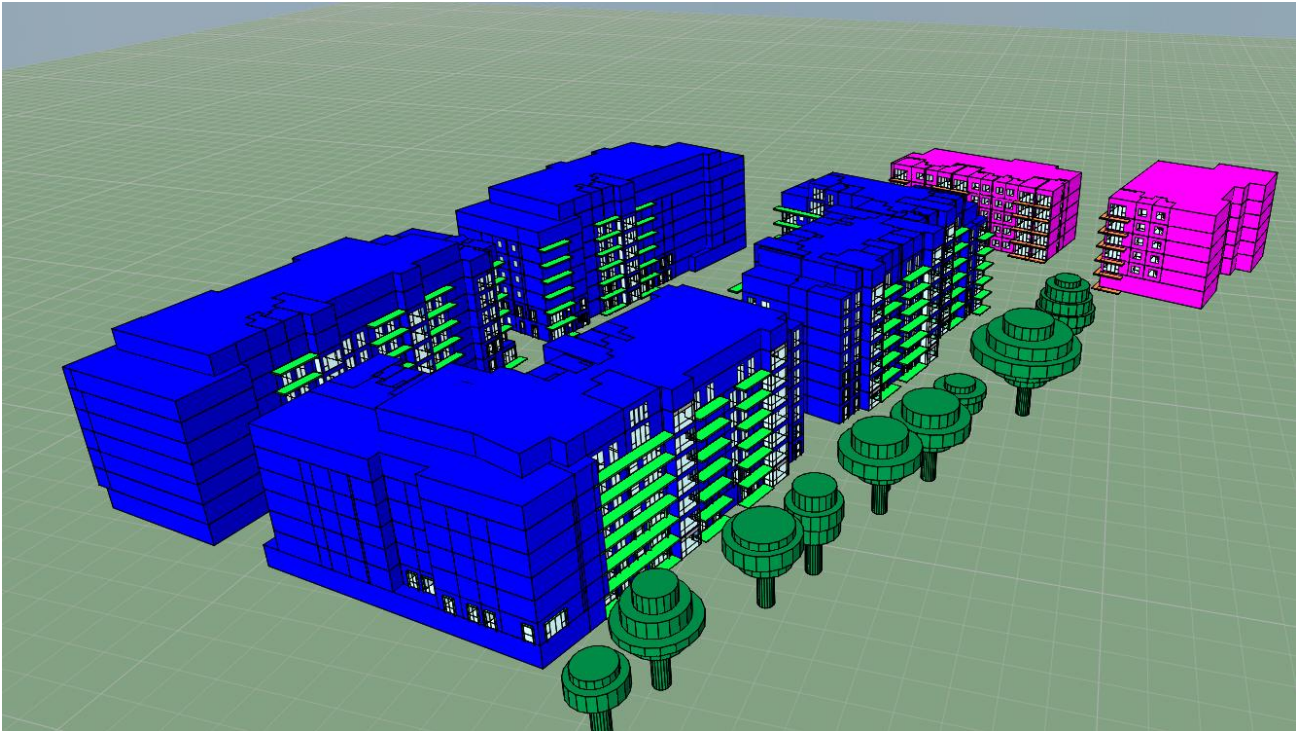


Figure 2-3 Model view of the proposed scheme including existing apartment blocks (highlighted in pink) and existing trees

3 Planning Policy and Guidelines

This section reviews the planning policy and guideline documents in relation to daylight, sunlight and overshadowing.

3.1 National and Local Planning Policy

3.1.1 Urban Development and Building Heights - 2018 [1]

The recently adopted, Section 28 Guidelines, Urban Development and Building Heights Guidelines for Planning Authorities (December 2018) published by the Department of Housing, Planning and Local Government identify that as reflected in *'the National Planning Framework that there is significant scope to accommodate anticipated population growth and development needs, whether for housing, employment or other purposes, by building up and consolidating the development of our existing urban areas'* and that *'securing compact and sustainable urban growth means focusing on reusing previously developed 'brownfield' land, building up infill sites (which may not have been built on before) and either reusing or redeveloping existing sites and buildings, in well-serviced urban locations, particularly those served by good public transport and supporting services, including employment opportunities'*.

The Guidelines reference NPO 13 (from the NPF) which states that *'in urban areas, planning and related standards, including in particular building height and car parking will be based on performance criteria that seek to achieve well-designed high-quality outcomes in order to achieve targeted growth. These standards will be subject to a range of tolerance that enables alternative solutions to be proposed to achieve stated outcomes, provided public safety is not compromised and the environment is suitably protected'*.

One of the key performance indicators identified in these statutory guidelines relates to daylight and sunlight standards. Section 3.0 of the Urban Building Height Guidelines provide guidance for Planning Authorities and An Bord Pleanála in considering development proposals for buildings taller than prevailing building heights in pursuit of the Guidelines. In respect of the site/buildings scale the guidelines require consideration of:

- *The form, massing and height of proposed developments should be carefully modulated so as to maximise access to natural daylight, ventilation and views and minimise overshadowing and loss of light.*
- *Appropriate and reasonable regard should be taken of quantitative performance approaches to daylight provision outlined in guides like the Building Research Establishment's 'Site Layout Planning for Daylight and Sunlight (2nd Edition or BS 8206-2:2008 – 'Lighting for Buildings- Part Local Planning Policy and Guidelines*

3.1.2 Sustainable Urban Housing: Design Standards for New Apartments - 2018 [2]

Sustainable Urban Housing: Design Standards for Apartment Guidelines, Guidelines for Planning Authorities: The Department of Housing, Planning and Local Government published this guideline which sets out apartment design parameters for the Planning Authorities to consider.

The Sustainable Urban Housing: Design Standards for Apartment Guidelines, Guidelines for Planning Authorities states the following points which relate to daylight and sunlight provision within such buildings: *“balconies should adjoin and have a functional relationship with the main living areas of the apartment. The guidelines require a minimum depth of 1.5 metres for balconies and while deeper balconies might be desirable in certain cases, this has to be balanced against the need to avoid overshadowing. The guidance continues that it is preferable that balconies be primarily accessed from living rooms”*.

Clause 3.36 states: *“Balconies should adjoin and have a functional relationship with the main living areas of the apartment. In certain circumstances, glass-screened ‘winter gardens’ may be provided. The minimum required areas for private amenity space are set out in Appendix 1”*.

Having regard for the above, it is noted that a balance must be achieved between providing usable balcony depths and achieving sufficient levels of daylight. A level of compromise between these factors is required to ensure a high level of residential amenity.

3.1.3 Local Policy: Fingal Development Plan

The “Fingal Development Plan 2017-2023 - Chapter 12: Development Management Standards addresses the local planning policy and guidelines for the area.

This document states: *“The internal layout of residential units should be designed to maximise the use of natural daylight and sunlight.”*

The key objective from the Development Plan of relevance to this assessment is as follows:

- Objective DMS30:
Ensure all new residential units comply with the recommendations of Site Layout Planning for Daylight and Sunlight: A Guide to Good Practice (B.R.E. 1991) and B.S. 8206 Lighting for Buildings, Part 2 2008: Code of Practice for Daylighting or other updated relevant documents.

As such, the 2011 (Second Edition) of this document has been considered in this report, Building research Establishment *“Site Layout Planning for Daylight and Sunlight: A Guide to Good Practice”* by PJ Littlefair, 2011 Second Edition.

3.2 Guidance Documents for Daylight and Sunlight

Guidance on daylight and sunlight provision is contained in British Standard 8206-2:2008 ‘Code of Practice for Daylighting’, with supplementary guidance in the BRE Report: Site Layout Planning for Daylight and Sunlight: A guide to good practice.

3.3 BRE 209: Site Layout Planning for Daylight and Sunlight: A guide to good practice (2011)

The second edition of BRE 209, published in 2011 contains guidance on how to design developments, whilst minimising the impacts on existing buildings from overshadowing and reduced levels of daylight and sunlight. In addition, The BRE report provides advice on how to design buildings to ensure that good practice levels of daylight and sunlight are provided.

As well as advice, the report contains a methodology to assess levels of daylight, sunlight and overshadowing, and specifies criteria to determine the potential impacts of new development on surrounding buildings, and also to determine whether new developments are well lit internally.

The BRE Report states that its own numerical guidelines 'should be interpreted flexibly since natural lighting is only one of many factors in site layout design. In special circumstances, the developer or planning authority may wish to use different target values. For example, in a historic city centre, a higher degree of obstruction may be unavoidable if new developments are to match the height and proportions of existing buildings.

3.4 British Standard BS8206-2:2008 Lighting for Buildings – Part 2: Code of Practice for Daylighting

The British Standard 8206 provides recommendations for daylight standards in dwellings. The document states: *"Daylighting gives to a building a unique variety and interest. An interior which looks gloomy, or which does not have a satisfactory view to the outside which could reasonably be expected, will be considered unsatisfactory by its users"*.

3.4.1 Daylight provision

BS 8206 Part 2 contains guidance on daylight and sunlight for new dwellings, including recommended minimum values for Average Daylight Factor (ADF).

For daylight provision in new dwellings, the British Standard recommends the following minimum values for ADF:

- Bedrooms 1.0%
- Living rooms 1.5%
- Kitchens 2.0%

These are minimum values. Where a room has a shared use, the British Standard states that the higher minimum value should apply.

The Standard also states that if a space has an ADF of 5%, it will not normally need supplementary electric lighting provided the uniformity is satisfactory, and that an ADF of 2-5% will normally need supplementary electric lighting.

4 Methodology

The section reviews the calculation procedure and numerical guidelines for the assessment of daylight and sunlight.

4.1 Loss of Daylight to Existing Windows

To assess the impact on the amount of diffuse daylighting entering existing buildings, and sunlight where relevant, the Report first recommends the measurement or calculation of obstruction angle. This is the angle to the horizontal subtended by the new development at the centre of the lowest window in each affected window wall, in a plane perpendicular to it. If this angle is less than 25° for the whole of the development, then the new building would not have a substantial effect on the diffuse skylight (or sunlight) enjoyed by the existing building.

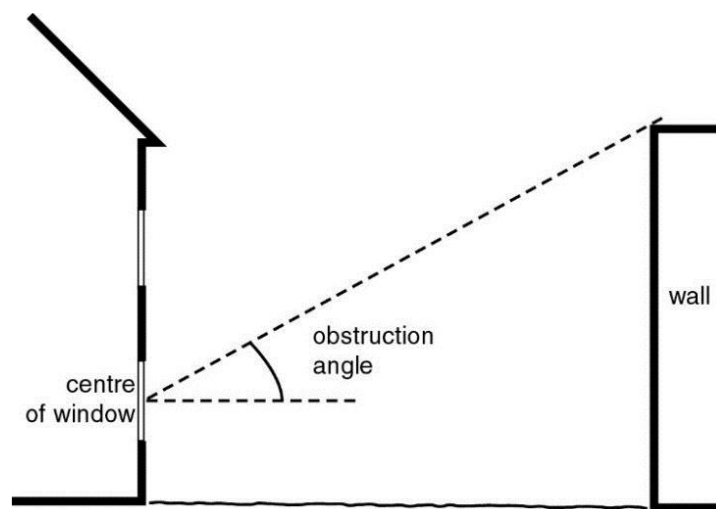


Figure 4-1 Example of obstruction angle

Where the obstruction angle exceeds 25°, a calculation is needed to assess the impact on the amount of diffuse daylighting entering existing buildings. The Report recommends the calculation of the vertical sky component (VSC)., therefore, is the ratio of the direct sky illuminance falling on the outside of a window, to the simultaneous horizontal illuminance under an unobstructed sky. The standard CIE Overcast Sky is used, and the ratio is usually expressed as a percentage. The maximum value is almost 40% for a completely unobstructed vertical wall. The vertical sky component on a window is a good measure of the amount of daylight entering it.

The BRE report sets out the following two guidelines for VSC:

- Where the VSC at the centre of the existing window exceeds 27% with the new development in place, then enough skylight should still be reaching the existing window.
- Where the VSC with the new development is both less than 27% and less than 0.8 times its former value, then the area lit by the window is likely to appear gloomier, and electric lighting will be needed for more of the time.

Although BRE advocates the VSC method to assess the impact on daylight within existing buildings, we have adopted the ADF method because it assesses actual light distribution within defined room

areas whereas VSC considers potential light. The ADF method takes account of window size, glass transmissivity, room size and internal surface reflectances.

A summary of input data for the ADF calculation is detailed in the following table.

Table 4-1 Table of ADF Input parameters used for the dwellings in the existing scheme

| Element | Value | Source / Description |
|--|------------------|-------------------------------------|
| Sky conditions | CIE Overcast Sky | Software climate file |
| | | |
| Light reflectance values (LRV): | | |
| Ceiling | 82% | BS 00E55 White |
| Internal Walls | 80% | White |
| Floors | 40% | Light wood veneer |
| External Ground | 40% | Paving |
| External Walls | 40% | Brickwork |
| | | |
| Window properties: | | |
| Visible light transmission | 75% | - |
| Outdoor reflectance | 15% | - |
| Indoor reflectance | 15% | - |
| Average frame thickness | 0.05m | As per window drawings |
| Window reveals depth | - | As per drawings |
| | | |
| Working plane height | 0.85 m | BS8206 Part 2: 2008 |
| Area of interest (perimeter border depth) | 0.50 m | CIBSE Code for Interior Lighting |
| | | |
| Window surface maintenance factor for cleaning | 0.90 | CIBSE Society of Light and Lighting |
| | | |
| Obstructions due to curtains and furniture | Excluded | - |
| | | |
| Grid size for assessment area | 0.50 m | - |

4.2 Loss of Sunlight to Existing Windows

The BRE Report recommends that loss of sunlight should be checked for main living rooms of dwellings, and conservatories if they have a window facing within 90° of due south.

According to the BRE Report, if the centre of the window can receive more than one-quarter of annual probable sunlight hours, including at least 5% of annual probable sunlight hours in the winter months between 21 September and 21 March, then the room should still receive enough sunlight. If the window already receives less than this, a reduction to less than 0.8 times its current value and a reduction of more than 4% of annual probable sunlight hours over the year may lead to the room it serves appearing colder and less cheerful and pleasant.

Sunlight levels at existing windows in the existing neighbouring buildings were calculated using the Annual Probable Sunlight Hours (APSH) method. The annual probable sunlight hour is the total number of hours in a year that direct sunshine is expected to reach a surface and depends on the location of the receiving environment and physical surroundings.

4.3 Overshadowing of Existing Outdoor Amenity Areas

If as a result of new development less than half of an existing garden or amenity area receives two hours of sunlight on 21 March, and the area that does is reduced to less than 0.8 times its former value, then the loss of sunlight is likely to be noticeable.

Shadow path diagrams have been generated for 21 March, the spring equinox in order to identify the average level of overshadowing experienced at the balconies in the existing residences. Overshadowing at the existing residences is very limited and is confined to dwellings at the lower levels from 3 pm on the equinox, as detailed in appendix C3.

4.4 Daylight Provision to New Dwellings

Although BS 8206-2 recommends that ADF levels in shared rooms should meet the higher ADF level, the lower threshold of 1.5% has been applied to kitchen-dining-living rooms in this development. This is because, in practice, the principal use of rooms designed as kitchen-dining-living rooms is as living rooms approximately.

An initial screening exercise, using established assessment methods, was carried out to identify those units in the proposed scheme which might have the potential to experience poor daylight levels and which should, therefore, be analysed in detail. Those units are termed “worst case”. Units not identified as “worst case” can be regarded as not having the potential to experience poor levels.

As a result of this screening exercise, 59 dwellings were identified as “worst case”. Our subsequent calculations showed that 41 of these 59 dwellings either meet or greatly exceed the guidelines. Given that the other 272 non-worst-case dwellings should exceed the ADF threshold, we can therefore safely conclude that 313 (being 41 + 272) of the 331 proposed dwellings will meet or exceed the guidelines, which represents 95%.

ADF levels were calculated using the digital model and daylight analysis software program. This method of assessment takes account of the total area of the room’s surfaces, the light reflection properties of the room surfaces and the net glazing area, i.e. less window frames.

The average daylight factor is calculated using the formula:

$$D = T W \theta M / [A(1 - R2)] \%$$

Where:

T = transmittance of glass

W = net area of window glass (not including frames).

M = maintenance factor, allowing for effects of dirt. For a window in a suburban area without a significant overhang and which is cleaned regularly, this would be 0.96.

A = total area of indoor surfaces: floor + ceiling + walls including windows.

R = average reflectance of area (A).

θ = visible sky angle, measured from the centre of the window in the vertical plane normal to the window. This must be expressed in degrees. The BRE Report 'Site layout planning for daylight and sunlight: a guide to good practice', Appendix C, gives a method to calculate an equivalent θ from the vertical sky component where obstructions are discontinuous.

A summary of input data for the ADF calculation is detailed in the following table.

Table 4-2 Table of ADF Input parameters used for the dwellings in the proposed scheme

| Element | Value | Source / Description |
|--|------------------|-------------------------------------|
| Sky conditions | CIE Overcast Sky | Software climate file |
| Light reflectance values (LRV): | | |
| Ceiling | 82% | BS 00E55 White |
| Internal Walls | 71% | BS 08B15 Off White |
| Floors | 40% | Light wood veneer |
| External Ground | 40% | Paving |
| External Walls | 40% | Brickwork |
| Window properties: | | |
| Visible light transmission | 75% | - |
| Outdoor reflectance | 15% | - |
| Indoor reflectance | 15% | - |
| Average frame thickness | 0.05m | As per window drawings |
| Window reveals depth | - | As per drawings |
| Working plane height | 0.85 m | BS8206 Part 2: 2008 |
| Area of interest (perimeter border depth) | 0.50 m | CIBSE Code for Interior Lighting |
| Window surface maintenance factor for cleaning | 0.90 | CIBSE Society of Light and Lighting |
| Obstructions due to curtains and furniture | Excluded | - |
| Grid size for assessment area | 0.50 m | - |

4.5 Overshadowing of Outdoor Amenity Areas in Proposed Scheme

For outdoor amenity areas, the 2011 edition of the BRE Report 'Site layout planning for daylight and sunlight: a guide to good practice' recommends that at least half of the space should receive at least two hours of sunlight on 21 March. Sunlight at an altitude of 10° or less does not count.

In order to assess sunlight and overshadowing of amenity areas within the new scheme, sunlight exposure charts were developed using the sun path analysis software program and digital model. Sunlight exposure charts are used to identify areas on the ground which are capable of receiving different periods of sunlight on any given day of the year.

4.6 Analysis Software

The daylight and sunlight analysis have been carried out using the following 3-D simulation programs:

- IESVE 2019 Model-It to create the digital models
- IESVE 2019 SunCast to analyse sunlight
- IESVE 2019 Radiance to calculate daylight factors

The IESVE software program meets the following international standard:

- CIBSE TM33: Tests for Software for Software Accreditation and Verification

Three-dimensional digital models were created to represent the physical layout of the proposed scheme and neighbouring residences in accordance with the drawings provided by the architects.

All assessed rooms have been modelled to take account of the total floor area including the area occupied by kitchen worktops. Window frames and window reveals have also been accounted for.

The existing trees along the east side of the proposed scheme have been modelled to account for overshadowing.

4.7 Mitigation Measures to Improve Daylight and Sunlight

A number of assessments of the proposed development were undertaken as the design developed over the last 4-5 months. These assessments highlighted some opportunities to improve daylighting and sun lighting performance and the design team subsequently revised the design in response.

A summary of the design changes which were made to the scheme in order to maximise daylight and sunlight levels for both the existing and proposed scheme are outlined below:

1. Blocks A, B and D have moved 2 meters, whereas block C has moved 1 meter all to the west.
2. Block B has been rotated from the southeast by 1 meter away from block A to enlarge the gap between block B and A.
3. Block A has been adjusted to align with block B's south elevation/axis due to enlargement of the Gym and dwellings on the first floor.

4. Unit A1/47 (Penthouse unit of block A) has been shifted towards the south of the block.
5. Block B's commercial units have been recessed at GF level by 1.6m (East to West) which increased Block B's dwelling area.
6. Block D's sixth floor has been setback by 8 metres in order to minimise the impact of the proposed scheme on existing neighbouring Block A1 and A4.
7. A number of windows have been increased in size and additional windows have been incorporated in gable dwellings with related adjustments to apartment layouts.

5 Results

5.1 Daylight within the Existing Residences

All dwellings which could be affected by the new scheme have been assessed using the ADF method. This assessment comprised 25 no. dwellings in Pappan Grove (Block A1) and 4 no. dwellings in Bridgefield (Block A4), a total of 29.

The majority (18) will continue to receive daylight (ADF) levels above the minimum guidelines, 9 will fall marginally below the threshold while 2 are well below. Having regard to the largely unaffected sunlight penetration (as detailed in the next section of this report) and to the need to achieve the appropriate density in the proposed scheme, we feel this limited shortfall should be acceptable.

The calculated Average Daylight Factor levels for all assessed units in the existing buildings are contained in appendix C1. A summary of the ADF results for Existing Blocks is presented in the following table:

Table 5-1 Summary of the Average daylight factor for the Existing Blocks

| Block | Room Type | Quantity | ADF Target (%) | ADF Result | | % Above ADF Target |
|-------------------|-----------------------|-----------|----------------|------------|-----------|--------------------|
| | | | | Above | Below | |
| A1 (Pappan Grove) | Kitchen/Dining/Living | 25 | 1.5 | 14 | 11 | 56.0 |
| A4 (Bridgefield) | Kitchen/Dining/Living | 4 | 1.5 | 4 | 0 | 100.0 |
| Total | | 29 | - | 18 | 11 | 62.1 |

5.2 Sunlight Levels at Existing Residences

The annual probable sun hours assessment which measures the amount of direct sunlight at each window shows that the dwellings will comfortably exceed the guidelines and therefore receive excellent levels of sunshine throughout the year, including the winter months when the sun is at the lowest altitude.

High levels of sunlight access are achieved due to the southerly orientation of the main windows, an appropriate separation distance between the existing and proposed blocks, and also the new set-back which has been incorporated into Block D at level 7.

A summary of the calculated Annual Probable Sunlight Hours for KDL rooms in the existing buildings is presented in the following table:

Table 5-2 Summary of the Annual Probable Sunlight Hours results in the Existing Blocks

| Block | Room Type | Total no. of dwellings | No. of dwellings within 90° of South | % of dwellings exceeding recommended sunlight levels |
|-------------------|-----------------------|------------------------|--------------------------------------|--|
| A1 (Pappan Grove) | Kitchen/Dining/Living | 20 | 20 | 100 |
| A4 (Bridgefield) | Kitchen/Dining/Living | 4 | 4 | 100 |

The Annual Probable Sunlight Hours for each window in the existing blocks are detailed in appendix C2.

5.3 Overshadowing of Existing Residences

Shadow path diagrams were produced to identify the extent of overshadowing at the existing residences. Overshadowing at the existing residences is very limited and is confined to dwellings at the lower levels from 3 pm on the equinox, as detailed in appendix C3.

5.4 Daylight within the Proposed Scheme

Of the 59 units which were assessed using the ADF method, 41 were found to either meet or exceed the minimum guidelines. Given that the other 272 non-worst-case dwellings should exceed the ADF threshold, we can therefore safely conclude that 313 (being 41 + 272) of the 331 proposed dwellings will meet or exceed the guidelines. This represents an overall pass rate of 95%.

Of the remaining assessed units, 8 achieve an ADF of between 1.25% and 1.50%, while just 7 units (2% of the entire scheme) were found to achieve ADF levels of between 1.00% and 1.25%. Only three units are below 1.0 % ADF which is less than 1% of the whole scheme. These dwellings enjoy living environment compensatory factors including aspects towards the attractive courtyard and landscaped areas, vistas of light-coloured brickwork, windows and doors continuing down to floor level and opening to large private-use balconies with glazed balustrading delivering practically uninterrupted views.

The calculated ADF levels for all assessed rooms are contained in appendix D1 and a summary of the results is shown in the following table:

Table 5-3 Summary of the Average daylight factor for the Proposed Scheme

| L0 | | Level - Ground Floor | | | | |
|--------------|-----------------------|----------------------|----------------|------------|----------|--------------------|
| Block | Room Type | Quantity | ADF Target (%) | ADF Result | | % Above ADF Target |
| | | | | Above | Below | |
| A | Kitchen/Dining/Living | 9 | 1.5 | 7 | 2 | 77.8 |
| B | Kitchen/Dining/Living | 4 | 1.5 | 3 | 1 | 75.0 |
| C | Kitchen/Dining/Living | 3 | 1.5 | 1 | 2 | 33.3 |
| D | Kitchen/Dining/Living | 12 | 1.5 | 9 | 3 | 75.0 |
| Total | | 28 | - | 20 | 8 | 71.4 |

| L1 | | Level - First Floor | | | | |
|--------------|-----------------------|---------------------|----------------|------------|----------|--------------------|
| Block | Room Type | Quantity | ADF Target (%) | ADF Result | | % Above ADF Target |
| | | | | Above | Below | |
| A | Kitchen/Dining/Living | 12 | 1.5 | 10 | 2 | 83.3 |
| B | Kitchen/Dining/Living | 11 | 1.5 | 11 | 0 | 100.0 |
| C | Kitchen/Dining/Living | 11 | 1.5 | 11 | 0 | 100.0 |
| D | Kitchen/Dining/Living | 12 | 1.5 | 9 | 3 | 75.0 |
| Total | | 46 | - | 41 | 5 | 89.1 |

| L2 | | Level - Second Floor | | | | |
|--------------|-----------------------|-----------------------------|-----------------------|-------------------|--------------|---------------------------|
| Block | Room Type | Quantity | ADF Target (%) | ADF Result | | % Above ADF Target |
| | | | | Above | Below | |
| A | Kitchen/Dining/Living | 12 | 1.5 | 12 | 0 | 100.0 |
| B | Kitchen/Dining/Living | 11 | 1.5 | 11 | 0 | 100.0 |
| C | Kitchen/Dining/Living | 11 | 1.5 | 11 | 0 | 100.0 |
| D | Kitchen/Dining/Living | 12 | 1.5 | 10 | 2 | 83.3 |
| Total | | 46 | - | 44 | 2 | 95.7 |

| L3 | | Level - Third Floor | | | | |
|--------------|-----------------------|----------------------------|-----------------------|-------------------|--------------|---------------------------|
| Block | Room Type | Quantity | ADF Target (%) | ADF Result | | % Above ADF Target |
| | | | | Above | Below | |
| A | Kitchen/Dining/Living | 12 | 1.5 | 12 | 0 | 100.0 |
| B | Kitchen/Dining/Living | 11 | 1.5 | 11 | 0 | 100.0 |
| C | Kitchen/Dining/Living | 11 | 1.5 | 11 | 0 | 100.0 |
| D | Kitchen/Dining/Living | 12 | 1.5 | 11 | 1 | 91.7 |
| Total | | 46 | - | 45 | 1 | 97.8 |

| | | | | | |
|---------------------------|-----------|----------|-----------|-----------|-------------|
| Total Assessed KDL | 59 | - | 41 | 18 | 69.5 |
|---------------------------|-----------|----------|-----------|-----------|-------------|

| | | | | | |
|-------------------------------|------------|----------|------------|----------|------------|
| Total non-Assessed KDL | 272 | - | 272 | 0 | 100 |
|-------------------------------|------------|----------|------------|----------|------------|

| | | | | | |
|----------------------------------|------------|----------|------------|-----------|-------------|
| Total number of dwellings | 331 | - | 313 | 18 | 94.6 |
|----------------------------------|------------|----------|------------|-----------|-------------|

The design team has sought to find an acceptable compromise between the need to maximise daylight levels and other relevant factors such as density, building form, overheating risk, privacy and the provision of balconies. With these considerations in mind, we feel that the low percentage of dwellings below the guidelines should be acceptable.

5.5 Sunlight Access to Open Areas in the Proposed Scheme

The sunlight analysis of open areas was conducted for the proposed scheme and covered three areas as follows:

- Childcare facility
- Courtyard and surrounding areas

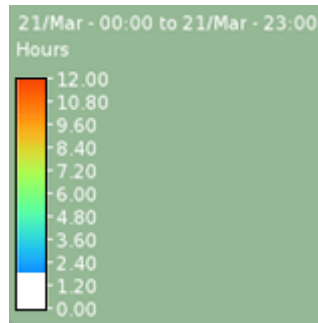


Figure 5-1 Sun-hours Exposure scale

The sun exposure diagrams use 1m² grids to show the duration of sun hours on the ground. All coloured grids receive at least 2 hours of sunshine whereas grids with no colour receive less than 2 hours.

5.5.1 Childcare Facility

The sunlight analysis shows that the play area will enjoy more than adequate levels of sunlight throughout the year.

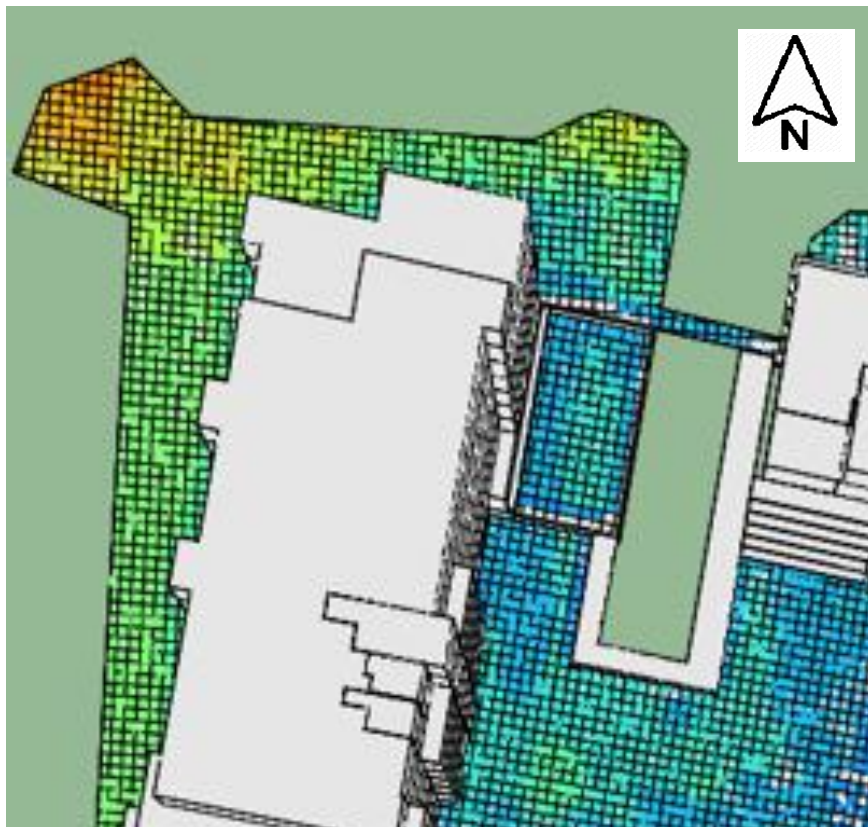


Figure 5-2 Sunlight Availability within Crèche areas of the Proposed Scheme (1 m² cell)

5.5.2 Courtyard and Surrounding Areas

As shown in the sun exposure diagram below, a significant area of the internal courtyard will receive more than adequate levels of sunlight. The total area designated for public and communal open space occupies 14,409 m² and 89% of this space will meet or greatly exceed the minimum threshold of 2 hours of sunshine on 21 March. Since the surrounding areas receive very high levels of sunshine, we feel that the open area as a whole is satisfactory. The public realm link at the west of the development which measures about 282 m² is excluded from solar exposure assessment.



Figure 5-3 Sunlight exposure levels for amenity areas in the proposed Scheme (1 m² cell)

6 Overshadowing from the Existing Trees

Shadow path diagrams were also produced to identify the extent of shading caused by the existing trees along the east side of the development site. The Shadow path diagrams in Appendix D3 shows that shading will be limited to very short periods in the morning.

Furthermore, ADF calculations carried out for dwellings on the east elevation show that the majority of the rooms greatly exceed the minimum guidelines in terms of daylight.

Overall, we are satisfied that daylight and sunlight provision was a prior concern and a design development concern of the design team and that the occupants will enjoy a high standard of accommodation in this regard.

7 Conclusions

The report has assessed the following:

1. Sunlight access to neighbouring dwellings
 2. Daylight access to neighbouring dwellings
 3. Sunlight access within the proposed scheme
 4. Daylight levels within the proposed scheme
- Sunlight levels at the 29 relevant neighbouring dwellings to the north will be largely unaffected. The calculations show that all relevant dwellings will comfortably exceed the guidelines and continue to receive excellent levels of direct sunshine throughout the year.
 - With regard to daylight levels in the relevant neighbouring dwellings to the north, the majority (18) will continue to receive daylight (ADF) levels above the minimum guidelines, 9 will fall only marginally below the threshold while 2 are well below. Having regard to the largely unaffected sunlight penetration and to the need to achieve the appropriate density in the proposed scheme, we feel this limited shortfall should be acceptable.
 - Sunlight exposure calculations for the proposed scheme have determined that a significant area of the proposed internal courtyard will receive more than adequate levels of sunlight. The majority of outdoor open space will achieve or greatly exceed the minimum of 2 hours of sunshine on 21 March. The surrounding areas receive very high levels of sunshine and we feel that the open area as a whole is satisfactory.
 - With regard to daylight levels within the proposed scheme, we conclude that 313 of the 331 proposed dwellings will meet or exceed the guidelines, which represents 95%. Of the remaining 18 dwellings, 8 are marginally below the guidelines and the remaining 10 (3% of the entire scheme) are well below. These dwellings, however, enjoy living environment compensatory factors including aspects towards the attractive courtyard and landscaped areas, vistas of light-coloured brickwork, windows and doors

continuing down to floor level and opening to large private-use balconies with glazed balustrading delivering practically uninterrupted views.

- Potential overshadowing from the existing trees along the east side of the development has also been considered and these are not likely to have a negative impact on the dwellings at the same elevation.

Overall, we are satisfied that daylight and sunlight provisions for the proposed scheme and the daylight and sunlight effects of the proposed scheme on neighbouring dwellings were a prior concern and a design development concern of the design team.

The design team has sought to find an acceptable compromise between the need to maximise daylight levels and other relevant factors such as density, building form, overheating risk, privacy and the provision of balconies.

We are satisfied that occupants will enjoy a high standard of accommodation in this regard.

8 Appendix A1: Architectural Drawing Schedule

The architectural drawing schedule is listed below:

Table 8-1 Architectural drawing schedule

| DRAWING REGISTER AND ISSUE SHEET - October'19 | | | | | | | | | |
|--|---------------|--|--------|------|-----|--|--|---------|--|
| Project Title : Blackwood Square, Santry | | | | | | | | 14030.7 | |
| DRAWING NO. | DRAWING TITLE | | SCALE | SIZE | REV | | | | |
| PLANNING | | | | | | | | | |
| SITE PLANS | | | | | | | | | |
| PL | 01 | Site Location Map | 1:2500 | A2 | ✓ | | | | |
| PL | 02 | OVERALL SITE PERMEABILITY | 1:2500 | A1 | ✓ | | | | |
| PL | 03 | Site Layout Plan 1 | 1:500 | A1 | ✓ | | | | |
| PL | 04 | Site Layout Plan 2 | 1:1000 | A1 | ✓ | | | | |
| APARTMENTS | | | | | | | | | |
| PL | 05 | BASEMENT PLAN | 1:200 | A1 | ✓ | | | | |
| PL | 06 | GROUND FLOOR PLAN | 1:200 | A1 | ✓ | | | | |
| PL | 07 | FIRST FLOOR PLAN | 1:200 | A1 | ✓ | | | | |
| PL | 08 | SECOND - FIFTH FLOOR PLANS | 1:200 | A1 | ✓ | | | | |
| PL | 09 | SIXTH FLOOR PLAN | 1:200 | A1 | ✓ | | | | |
| PL | 10 | SEVENTH FLOOR PLAN | 1:200 | A1 | ✓ | | | | |
| PL | 11 | ROOF PLAN | 1:200 | A1 | ✓ | | | | |
| PL | 15 | WEST & SOUTH ELEVATIONS | 1:200 | A1 | ✓ | | | | |
| PL | 16 | EAST & NORTH ELEVATIONS | 1:200 | A1 | ✓ | | | | |
| PL | 17 | SECTIONS A-A & B-B | 1:200 | A1 | ✓ | | | | |
| PL | 18 | SECTIONS C-C, D-D & E-E | 1:200 | A1 | ✓ | | | | |
| PL | 19 | SECTIONS F-F | 1:200 | A1 | ✓ | | | | |
| CONTEXT DRAWINGS | | | | | | | | | |
| PL | 20 | West & East Context Elevations | 1:200 | A0 | ✓ | | | | |
| PL | 24 | Phasing Plans | 1:500 | A1 | ✓ | | | | |
| PL | 25 | Open Space Plan | NTS | A1 | ✓ | | | | |
| PL | 26 | Private Public Space Plan | NTS | A1 | ✓ | | | | |
| PL | 27 | PART V, Block C, Floor Plans | 1:200 | A1 | ✓ | | | | |
| PL | 30 | SUB-STATION. GENERAL ARRANGEMENT | 1:50 | A1 | ✓ | | | | |
| PL | 31 | Shop Unit Facade & Surface Bike Stands with Canopy | 1:50 | A1 | ✓ | | | | |
| PL | 32 | Raised Ventilation Housing for Basement | 1:50 | A1 | ✓ | | | | |
| Codes: SK=Sketch P=Preliminary C=for Comment I=Information FC=Fire Certificate PL=Planning CT=Contract CN=Construction T=Tender | | | | | PL | | | | |

9 Appendix A2: Tree Survey Documents

| | Report Title | Associated Drawing Title | Date Issued. |
|---|-----------------------------------|--------------------------|--------------|
| 1 | Arboricultural Report - July 2019 | D1-TCP-Santry-07-19 | 25/07/2019 |
| | | D2-AIA-Santry-07-19 | 25/07/2019 |
| | | D3-TPP-Santry-07-19 | 25/07/2019 |

10 Appendix B1: Floor layout drawings with room references within the Existing Blocks

The room references of the apartments in the existing neighbouring residences(Block A1 and A4), facing the proposed scheme are shown below:

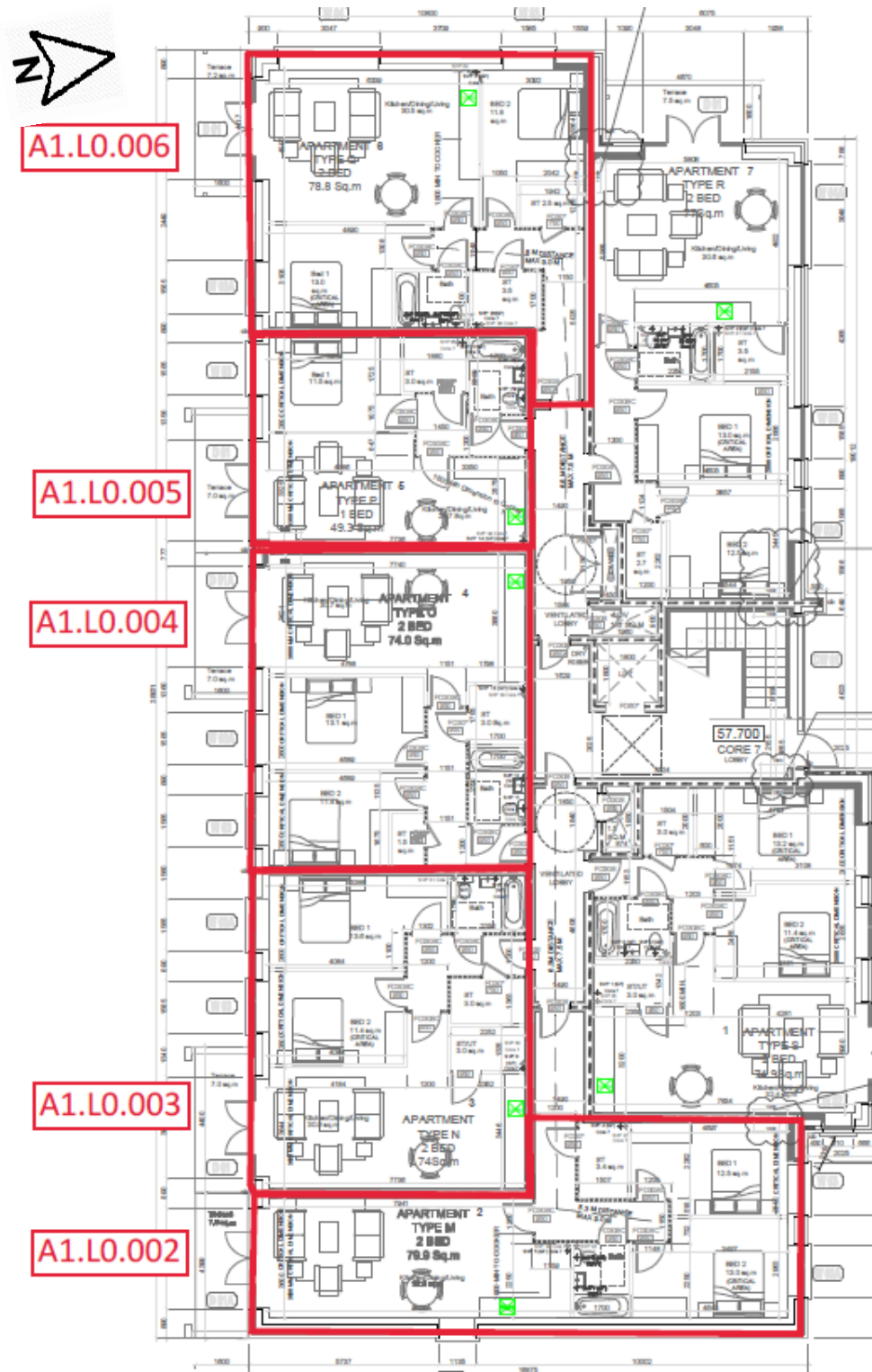


Figure 10-1 Floor Layout of the Existing Block A1 (Pappan Grove) – Ground Floor

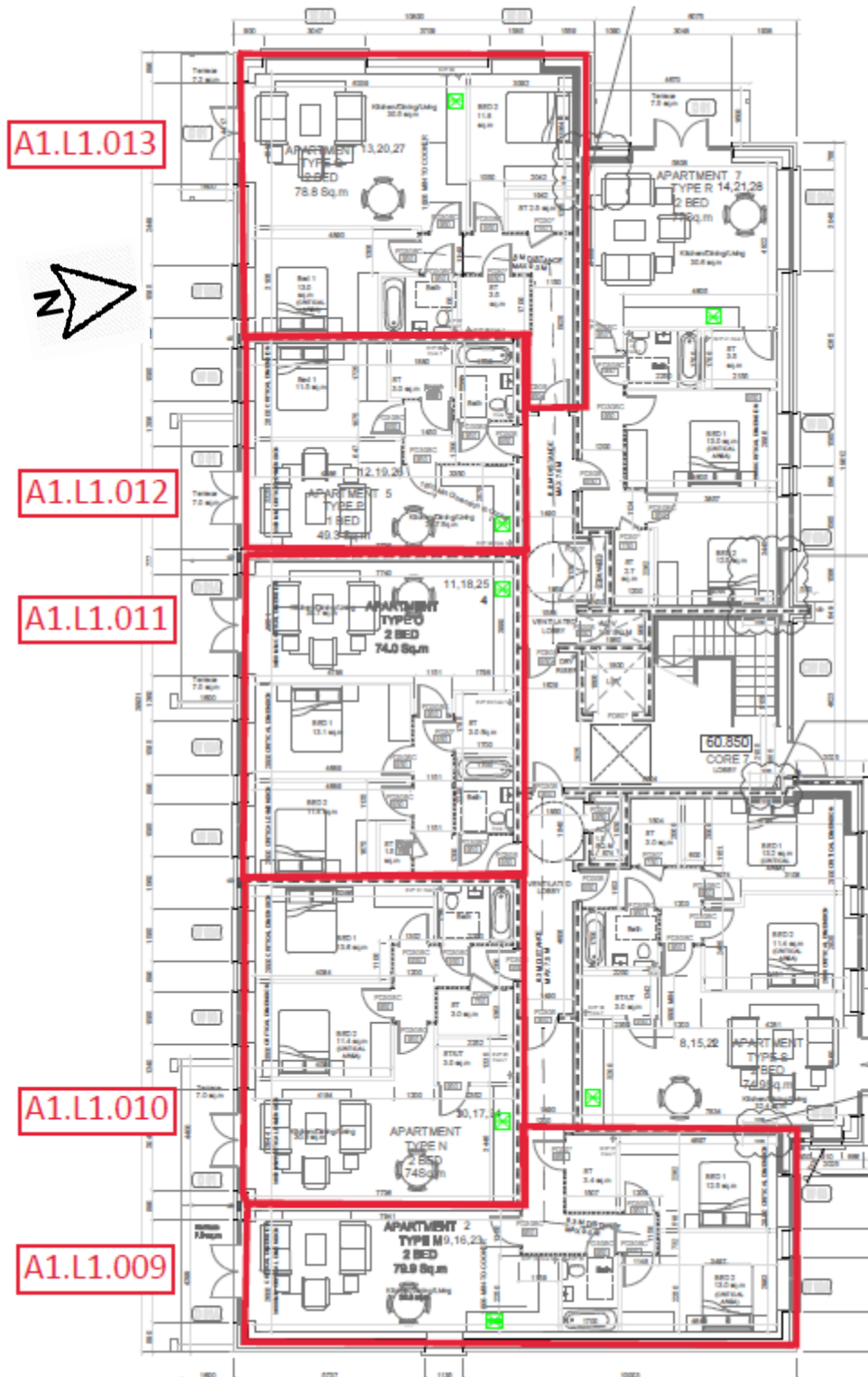


Figure 10-2 Floor Layout of the Existing Block A1 (Pappan Grove) – First Floor

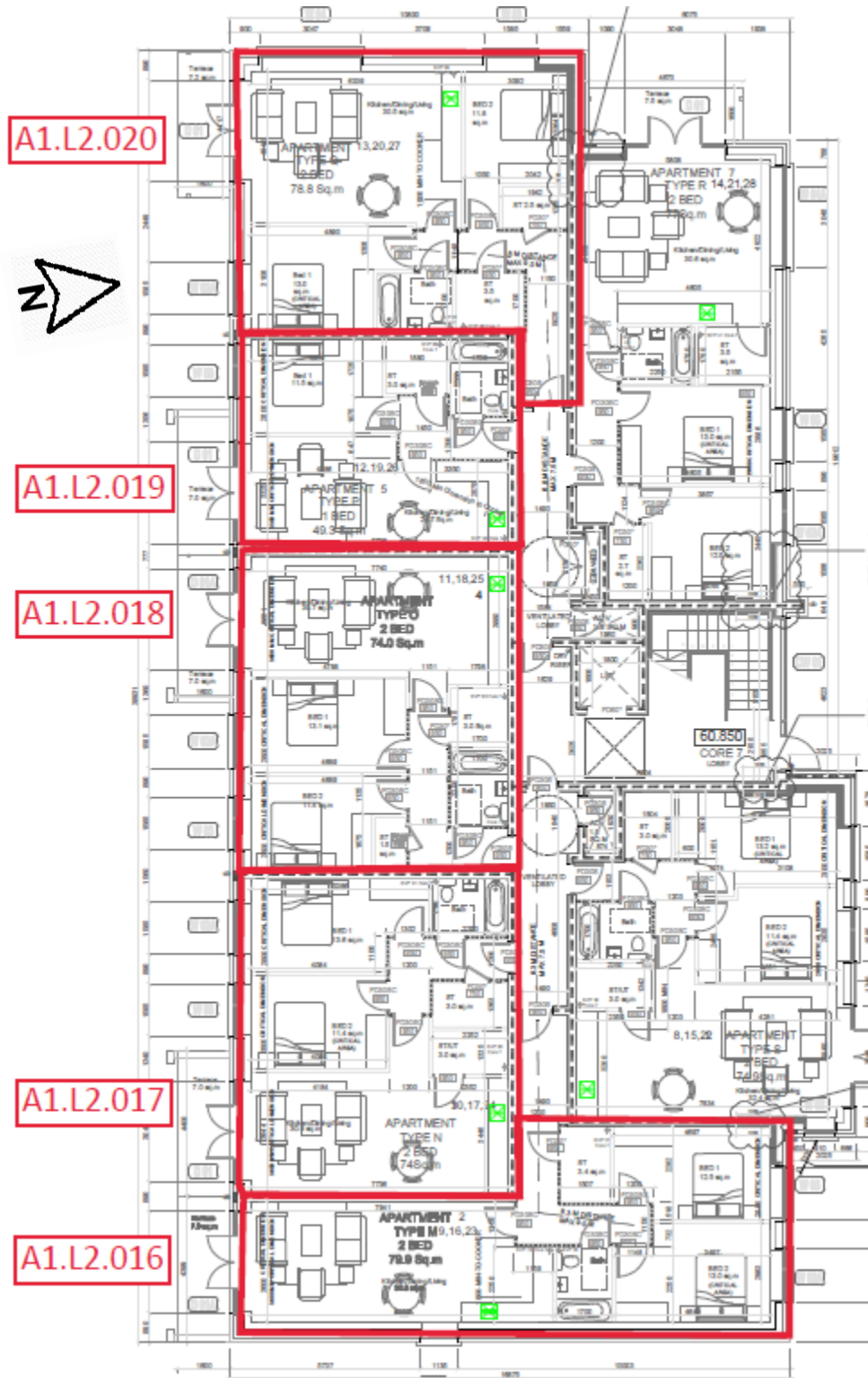


Figure 10-3 Floor Layout of the Existing Block A1 (Pappan Grove) – Second Floor

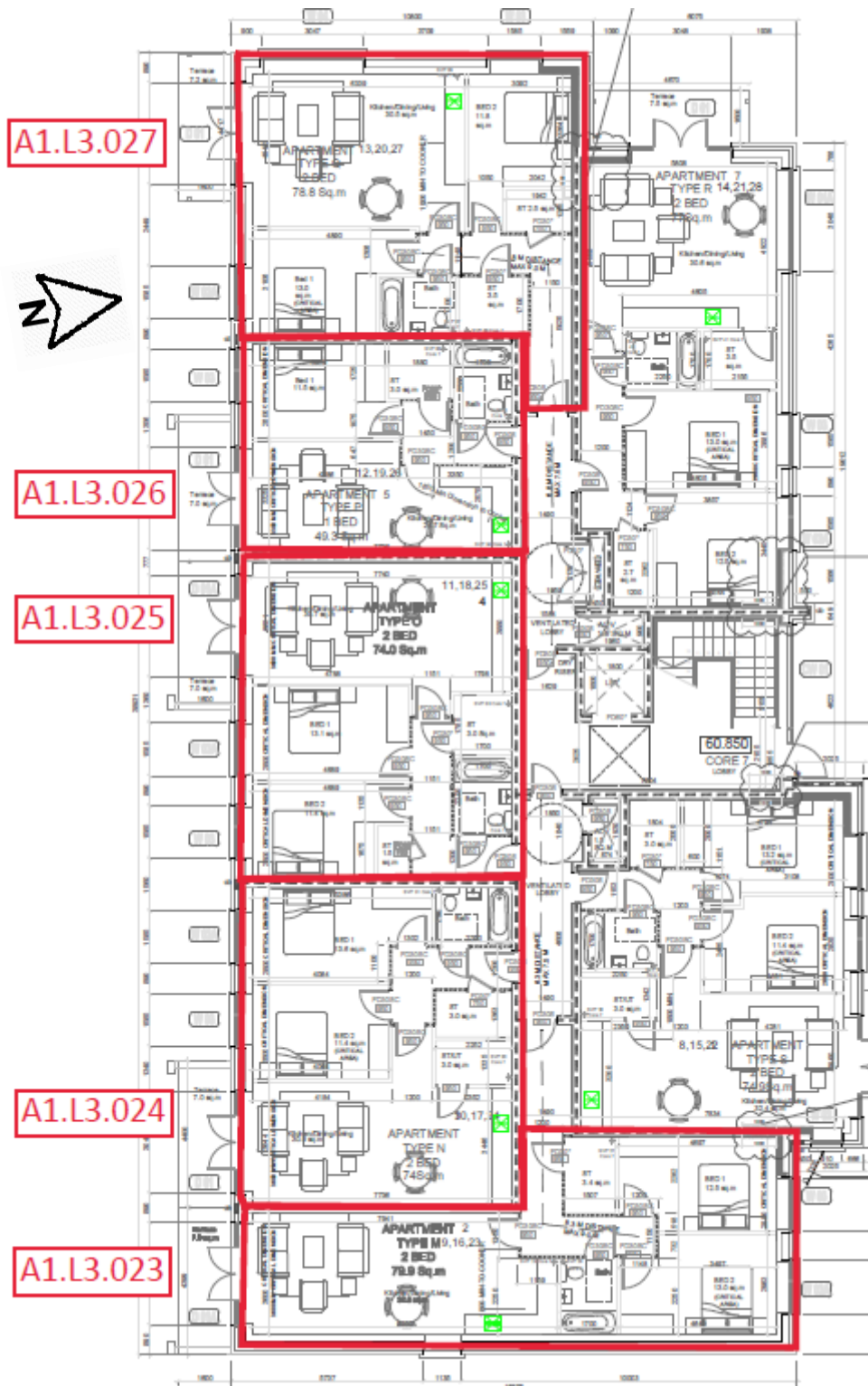


Figure 10-4 Floor Layout of the Existing Block A1 (Pappan Grove) – Third Floor

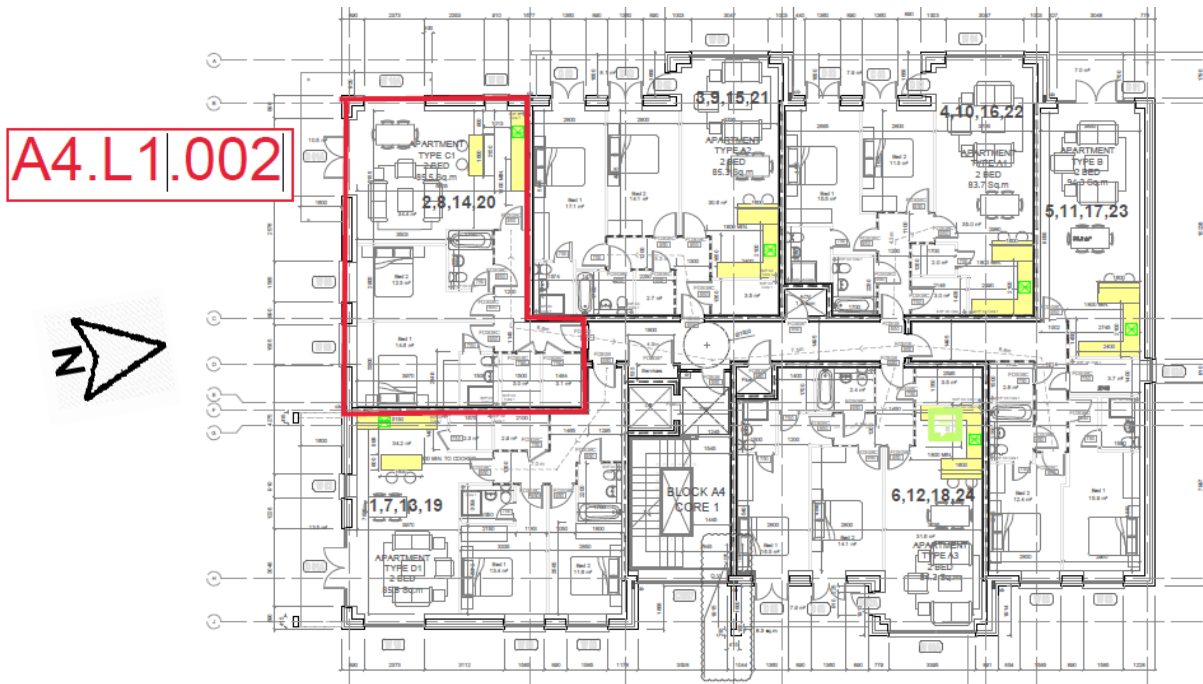


Figure 10-5 Floor Layout of the Existing Block A4 (Bridgefield) – First Floor

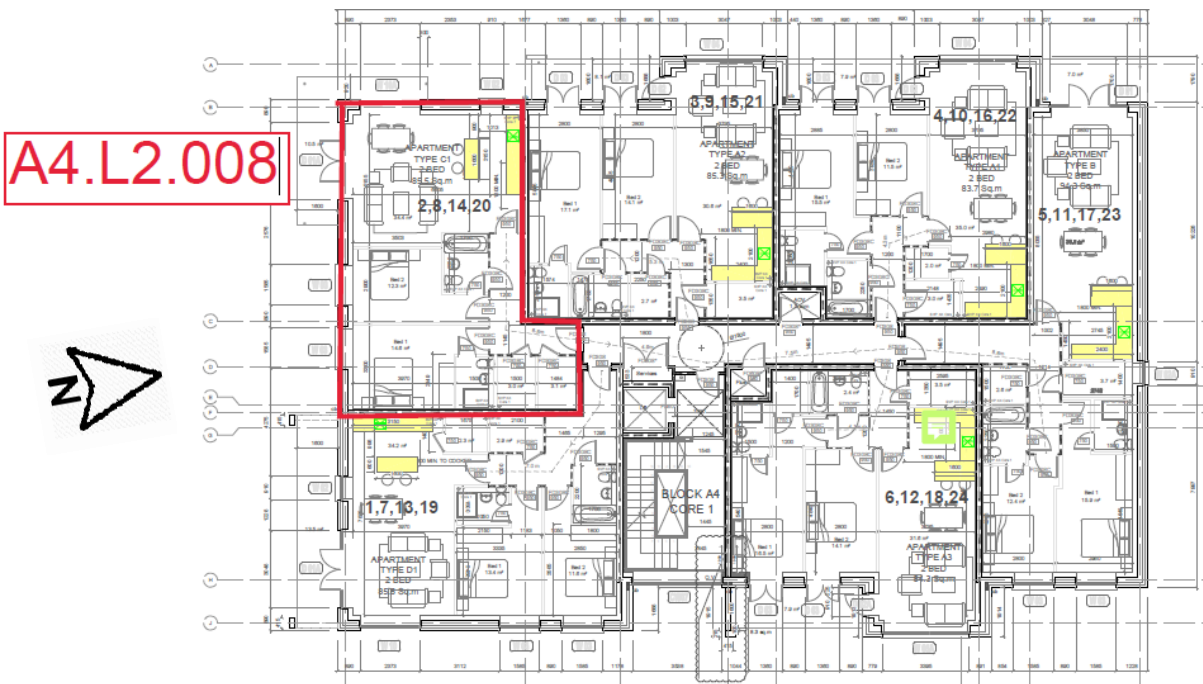


Figure 10-6 Floor Layout of the Existing Block A4 (Bridgefield) – Second Floor

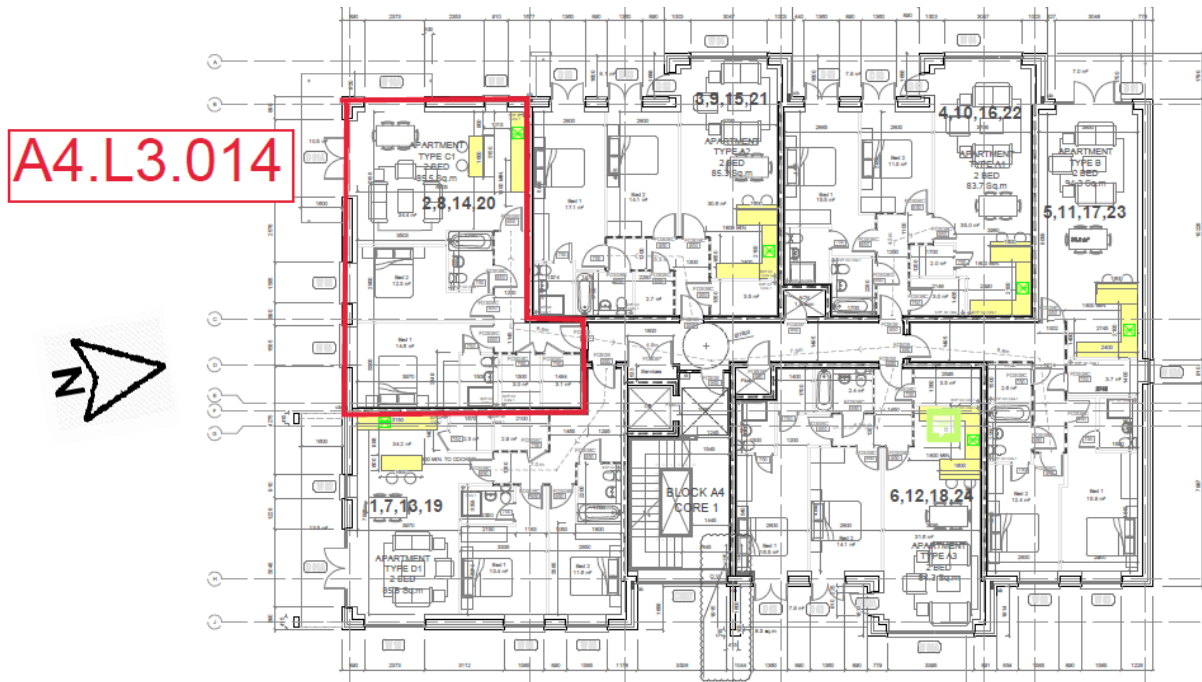


Figure 10-7 Floor Layout of the Existing Block A4 (Bridgefield)– Third Floor



Figure 10-8 Floor Layout of the Existing Block A4 (Bridgefield)– Fourth Floor

11 Appendix B2: Floor Layout Drawings with Room References for the Proposed Scheme

The room references of the apartments of the proposed scheme are represented on each floor layout drawings:



Figure 11-1 Floor Layout of the Proposed Scheme Block A – Ground Floor

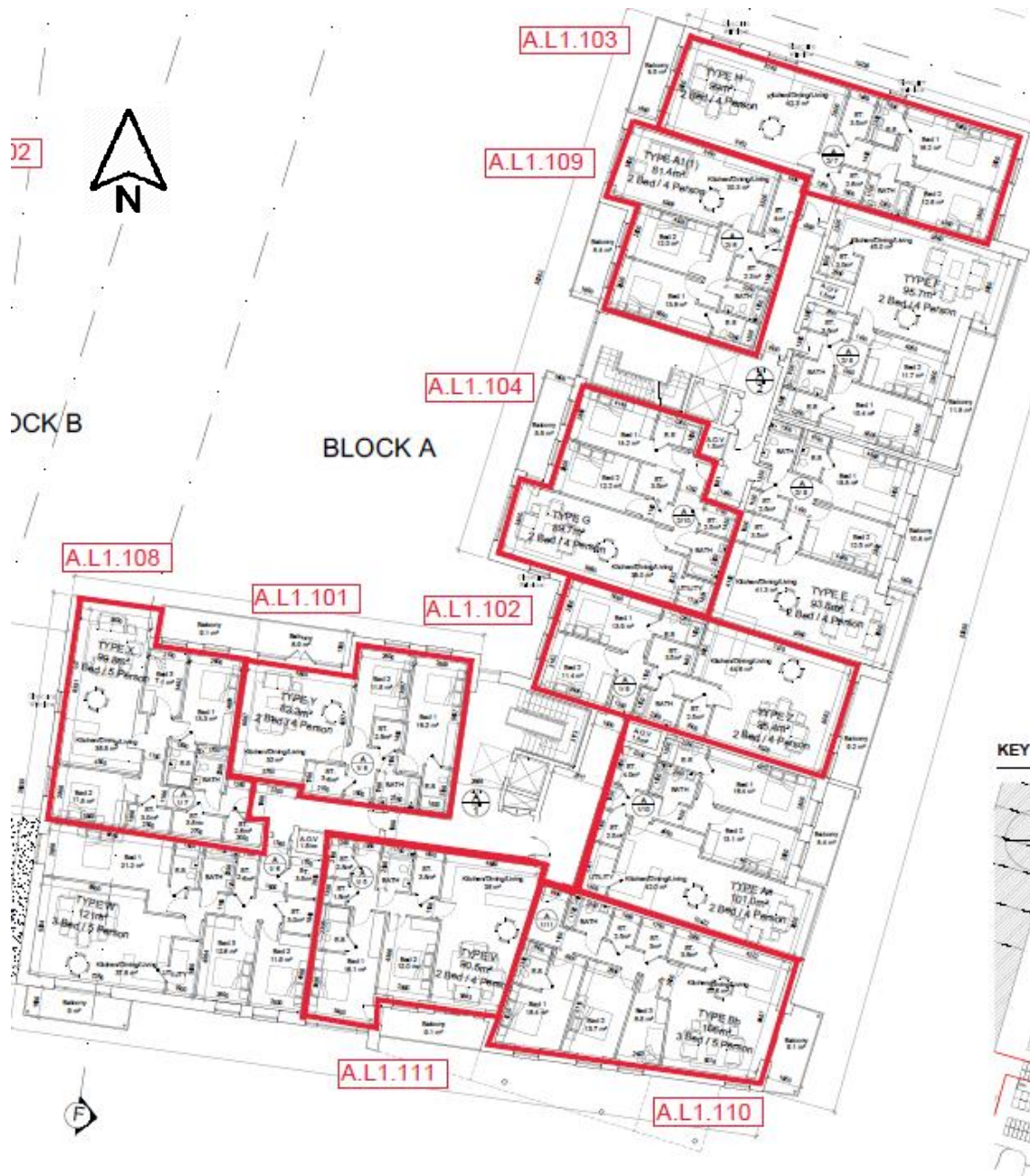


Figure 11-2 Floor Layout of the Proposed Scheme Block A – First Floor

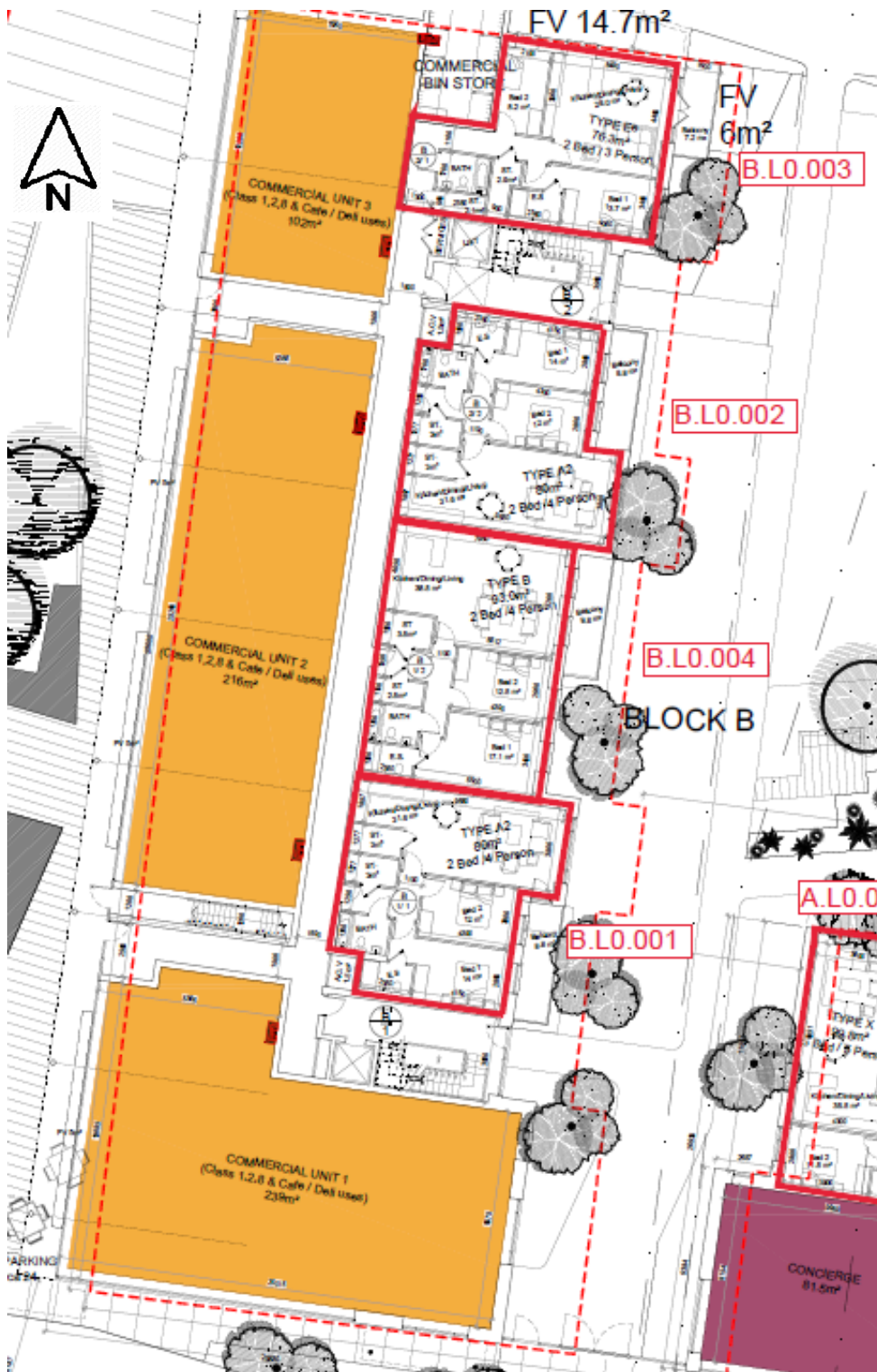


Figure 11-3 Floor Layout of the Proposed Scheme Block B – Ground Floor

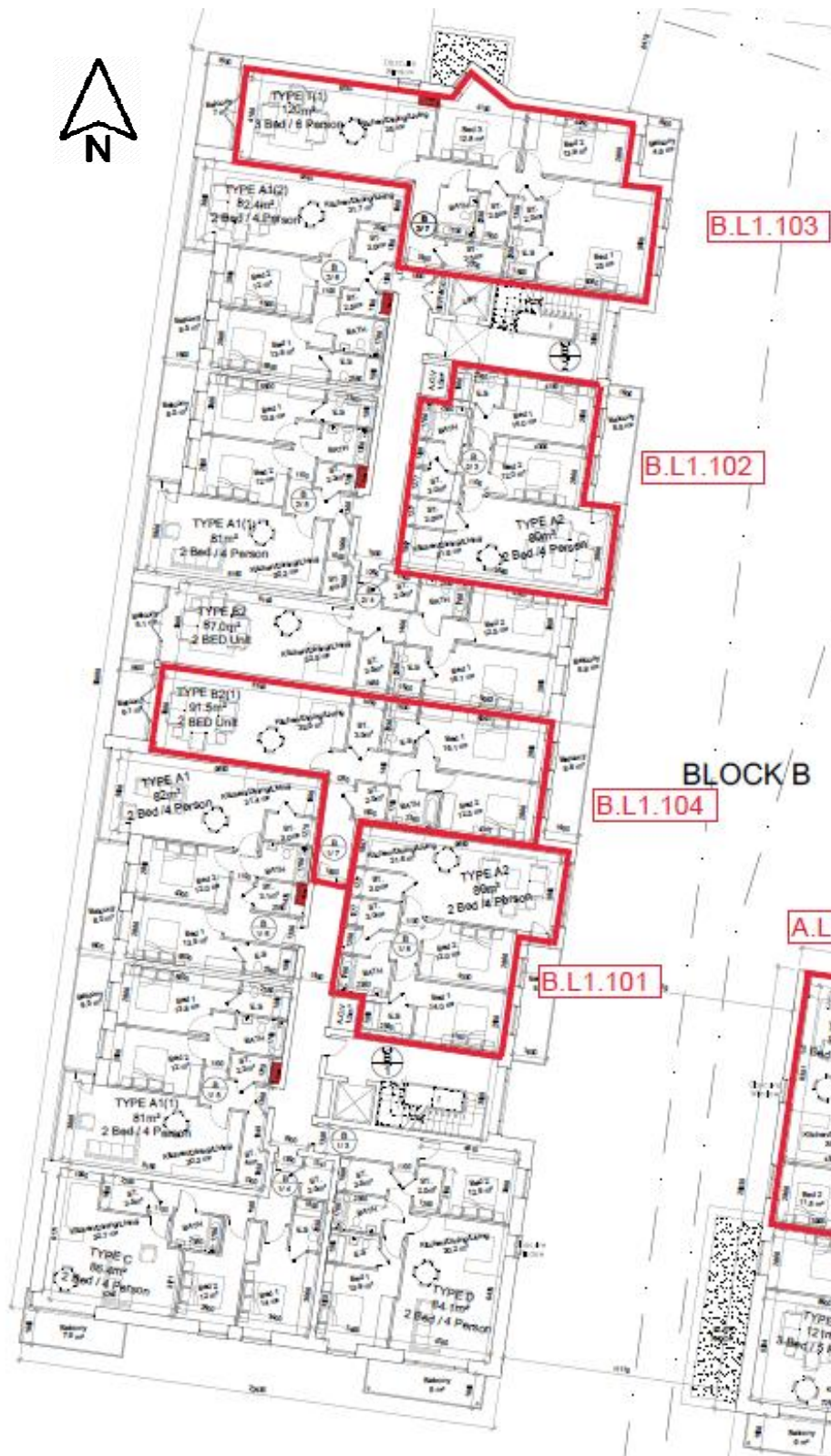


Figure 11-4 Floor Layout of the Proposed Scheme Block B – First Floor

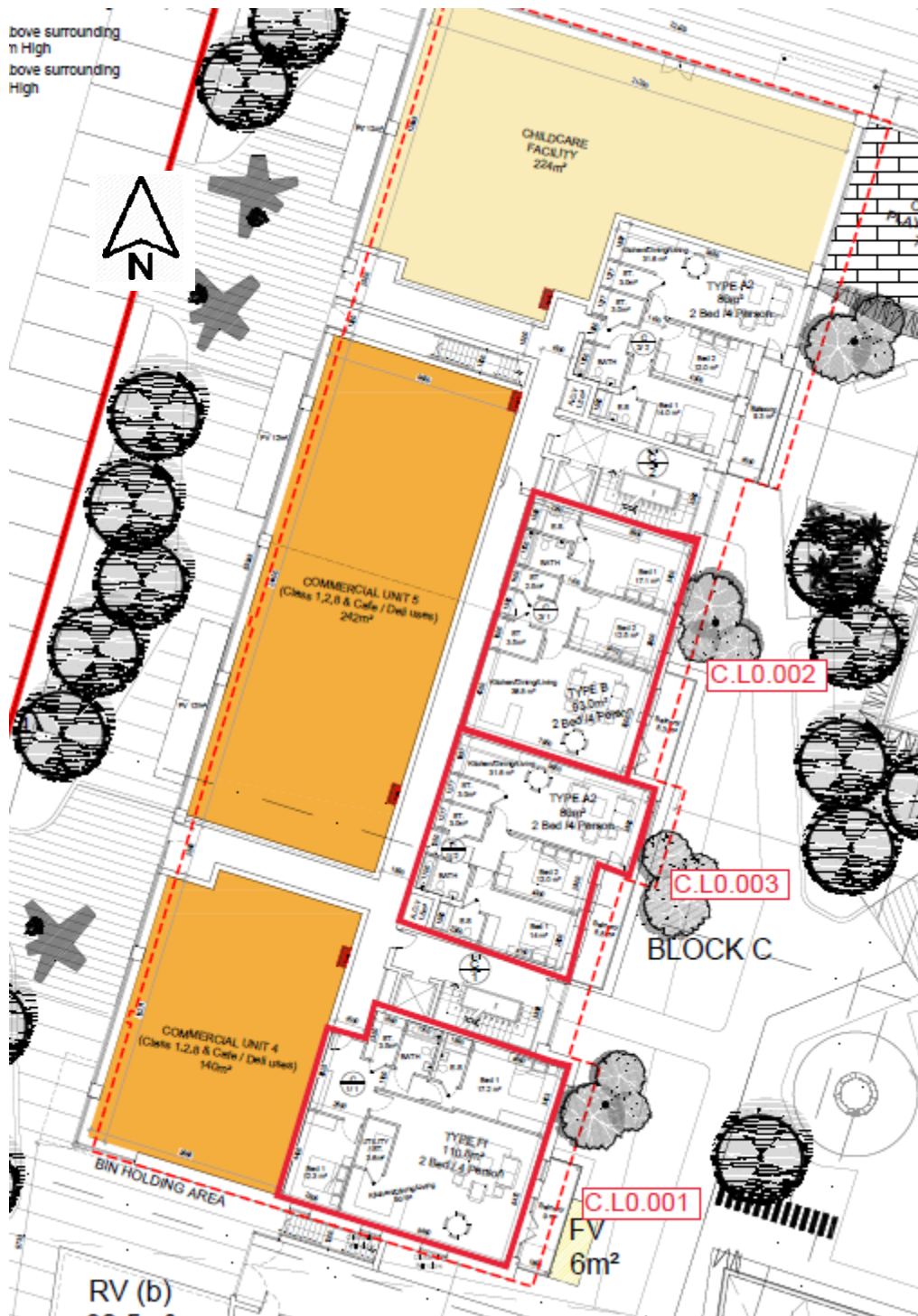


Figure 11-5 Floor Layout of the Proposed Scheme Block C – Ground Floor

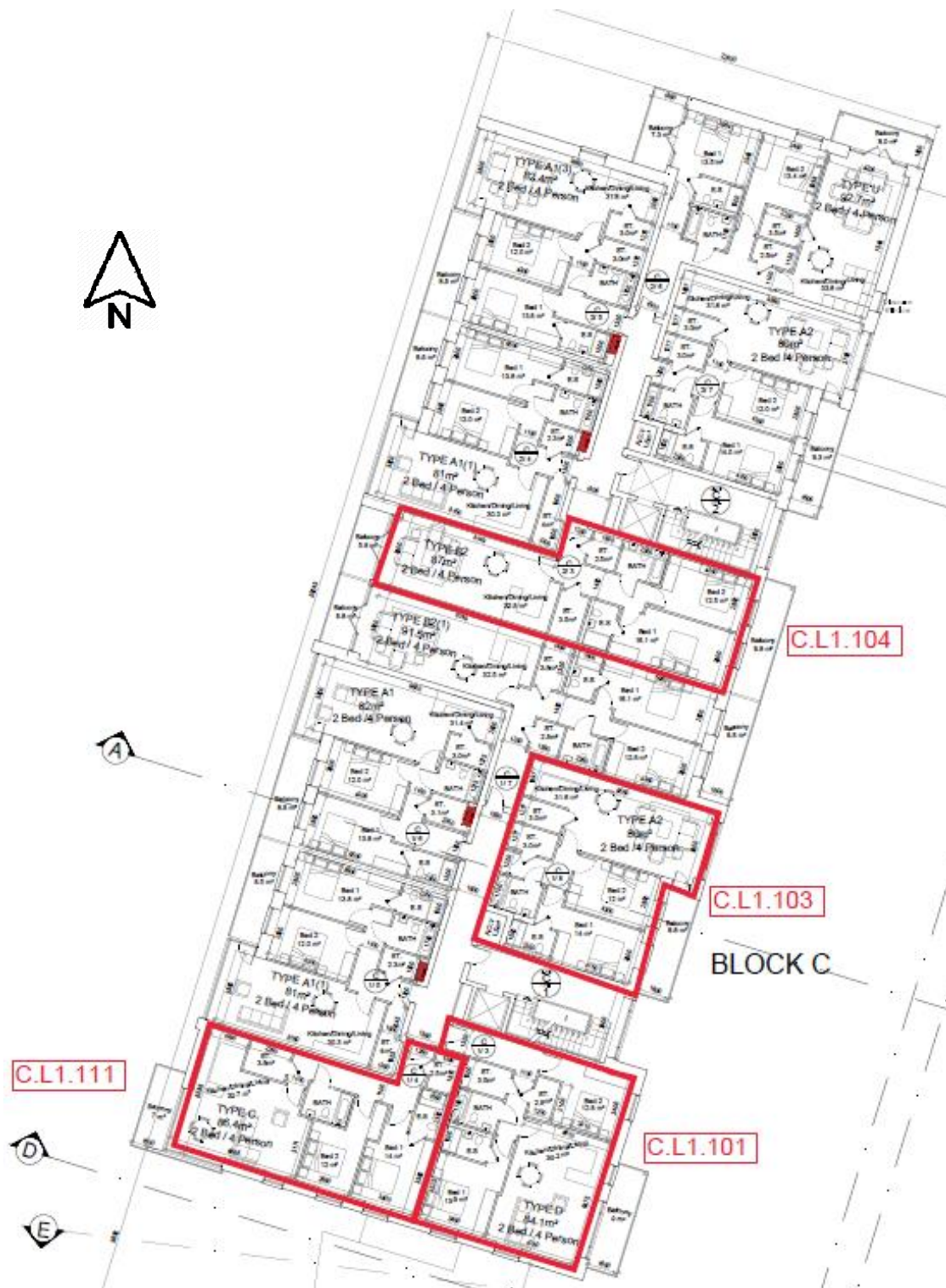


Figure 11-6 Floor Layout of the Proposed Scheme Block C– First Floor



Figure 11-7 Floor Layout of the Proposed Scheme Block D – Ground Floor

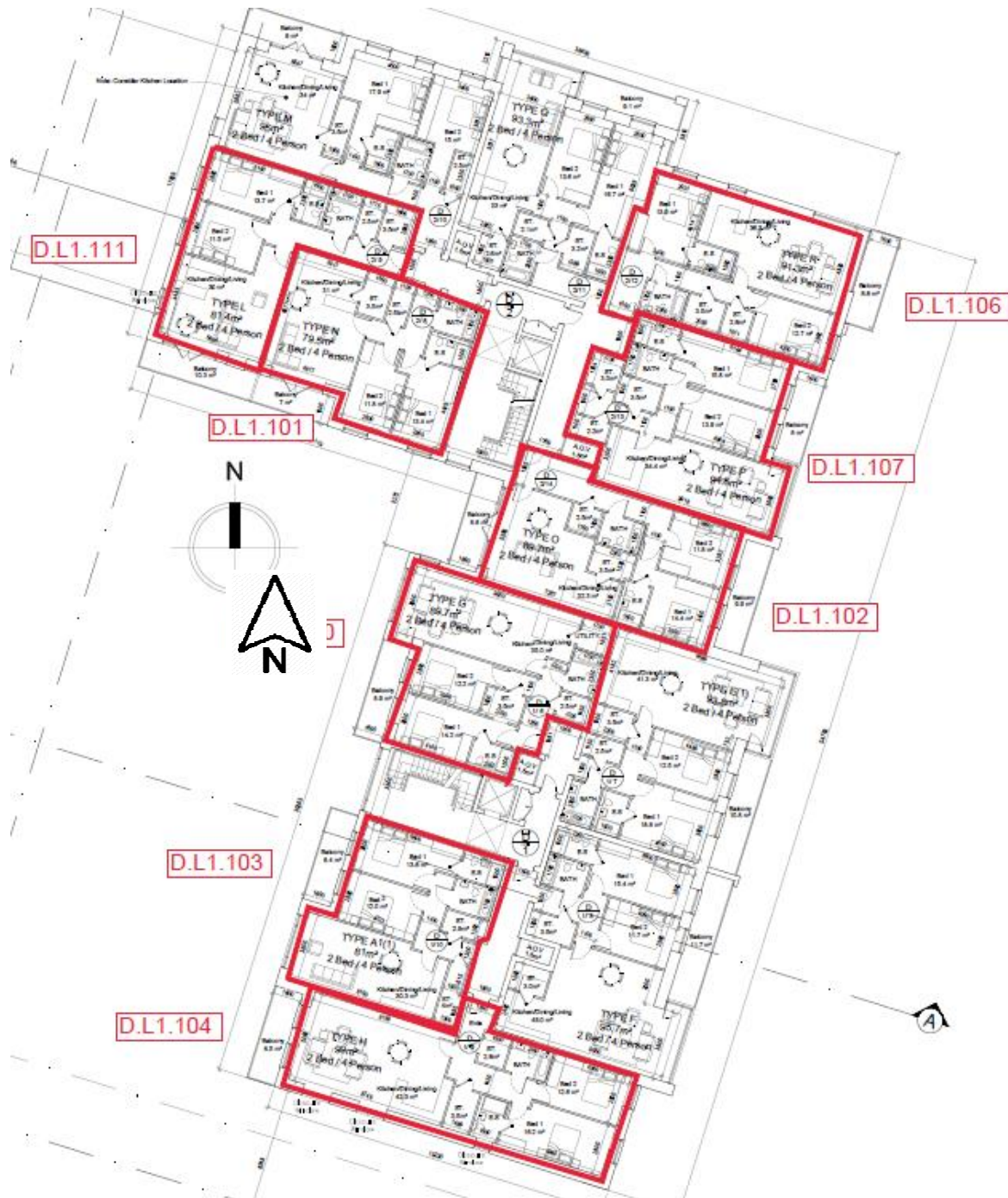


Figure 11-8 Floor Layout of the Proposed Scheme Block D – First Floor

12 Appendix C1: Average Daylight Factors within the Existing Blocks

The Average Daylight Factor results for the assessed rooms within the existing Blocks A1 and A4 are presented below:

Table 12-1 ADF Results of Existing Block A1 (Pappan Grove)

| Room Reference / Room Type | Floor Level | Floor Area (m2) | Area-weighted Average Daylight Factor (%) | | Conclusion |
|---------------------------------|-------------|-----------------|---|------------|------------------------|
| | | | Target ADF | ADF Result | Above/Below ADF Target |
| Existing Block A1 | | | | | |
| A1.L0.002 Kitchen/Dining/Living | 0 | 28.8 | 1.5 | 1.69 | Below |
| A1.L0.003 Bedroom 01 | 0 | 12.9 | 1.0 | 2.36 | Above |
| A1.L0.003 Bedroom 02 | 0 | 10.7 | 1.0 | 2.18 | Above |
| A1.L0.003 Kitchen/Dining/Living | 0 | 26.4 | 1.5 | 1.25 | Below |
| A1.L0.004 Bedroom 01 | 0 | 11.1 | 1.0 | 2.25 | Above |
| A1.L0.004 Bedroom 02 | 0 | 13.5 | 1.0 | 1.98 | Above |
| A1.L0.004 Kitchen/Dining/Living | 0 | 26.7 | 1.5 | 1.01 | Below |
| A1.L0.005 Bedroom 01 | 0 | 13.0 | 1.0 | 2.35 | Above |
| A1.L0.005 Bedroom 02 | 0 | 11.0 | 1.0 | 2.11 | Above |
| A1.L0.005 Kitchen/Dining/Living | 0 | 21.3 | 1.5 | 1.26 | Below |
| A1.L0.006 Kitchen/Dining/Living | 0 | 27.7 | 1.5 | 1.38 | Below |
| A1.L1.009 Kitchen/Dining/Living | 1 | 28.8 | 1.5 | 1.79 | Above |
| A1.L1.010 Bedroom 01 | 1 | 12.9 | 1.0 | 2.68 | Above |
| A1.L1.010 Bedroom 02 | 1 | 10.7 | 1.0 | 2.51 | Above |
| A1.L1.010 Kitchen/Dining/Living | 1 | 26.4 | 1.5 | 1.27 | Below |
| A1.L1.011 Bedroom 01 | 1 | 11.1 | 1.0 | 2.59 | Above |
| A1.L1.011 Bedroom 02 | 1 | 13.5 | 1.0 | 2.25 | Above |
| A1.L1.011 Kitchen/Dining/Living | 1 | 26.7 | 1.5 | 1.10 | Below |
| A1.L1.012 Bedroom 01 | 1 | 13.0 | 1.0 | 2.68 | Above |
| A1.L1.012 Bedroom 02 | 1 | 11.0 | 1.0 | 2.41 | Above |
| A1.L1.012 Kitchen/Dining/Living | 1 | 21.3 | 1.5 | 1.31 | Below |
| A1.L1.013 Kitchen/Dining/Living | 1 | 27.7 | 1.5 | 1.41 | Below |

| Room Reference / Room Type | Floor Level | Floor Area (m2) | Area-weighted Average Daylight Factor (%) | | Conclusion |
|---------------------------------|-------------|-----------------|---|------------|------------------------|
| | | | Target ADF | ADF Result | Above/Below ADF Target |
| A1.L2.016 Kitchen/Dining/Living | 2 | 28.8 | 1.5 | 1.98 | Above |
| A1.L2.017 Bedroom 01 | 2 | 12.9 | 1.0 | 2.88 | Above |
| A1.L2.017 Bedroom 02 | 2 | 10.7 | 1.0 | 2.71 | Above |
| A1.L2.017 Kitchen/Dining/Living | 2 | 26.4 | 1.5 | 1.39 | Below |
| A1.L2.018 Bedroom 01 | 2 | 11.1 | 1.0 | 2.81 | Above |
| A1.L2.018 Bedroom 02 | 2 | 13.5 | 1.0 | 2.42 | Above |
| A1.L2.018 Kitchen/Dining/Living | 2 | 26.7 | 1.5 | 1.24 | Below |
| A1.L2.019 Bedroom 01 | 2 | 13.0 | 1.0 | 2.86 | Above |
| A1.L2.019 Bedroom 02 | 2 | 11.0 | 1.0 | 2.60 | Above |
| A1.L2.019 Kitchen/Dining/Living | 2 | 21.3 | 1.5 | 1.49 | Above |
| A1.L2.020 Kitchen/Dining/Living | 2 | 27.7 | 1.5 | 1.55 | Above |
| A1.L3.023 Kitchen/Dining/Living | 3 | 28.8 | 1.5 | 2.19 | Above |
| A1.L3.024 Bedroom 01 | 3 | 12.9 | 1.0 | 3.07 | Above |
| A1.L3.024 Bedroom 02 | 3 | 10.7 | 1.0 | 2.90 | Above |
| A1.L3.024 Kitchen/Dining/Living | 3 | 26.4 | 1.5 | 1.51 | Above |
| A1.L3.025 Bedroom 01 | 3 | 11.1 | 1.0 | 3.01 | Above |
| A1.L3.025 Bedroom 02 | 3 | 13.5 | 1.0 | 2.59 | Above |
| A1.L3.025 Kitchen/Dining/Living | 3 | 26.7 | 1.5 | 1.38 | Below |
| A1.L3.026 Bedroom 01 | 3 | 13.0 | 1.0 | 3.03 | Above |
| A1.L3.026 Bedroom 02 | 3 | 11.0 | 1.0 | 2.77 | Above |
| A1.L3.026 Kitchen/Dining/Living | 3 | 21.3 | 1.5 | 1.67 | Above |
| A1.L3.027 Kitchen/Dining/Living | 3 | 27.7 | 1.5 | 1.68 | Above |

| Room Reference / Room Type | Floor Level | Floor Area (m2) | Area-weighted Average Daylight Factor (%) | | Conclusion |
|---------------------------------|-------------|-----------------|---|------------|------------------------|
| | | | Target ADF | ADF Result | Above/Below ADF Target |
| A1.L4.030 Kitchen/Dining/Living | 4 | 28.8 | 1.5 | 3.68 | Above |
| A1.L4.031 Bedroom 01 | 4 | 12.9 | 1.0 | 3.25 | Above |
| A1.L4.031 Bedroom 02 | 4 | 10.7 | 1.0 | 3.18 | Above |
| A1.L4.031 Kitchen/Dining/Living | 4 | 26.4 | 1.5 | 2.98 | Above |
| A1.L4.032 Bedroom 01 | 4 | 11.1 | 1.0 | 3.19 | Above |
| A1.L4.032 Bedroom 02 | 4 | 13.5 | 1.0 | 2.88 | Above |
| A1.L4.032 Kitchen/Dining/Living | 4 | 26.7 | 1.5 | 2.91 | Above |
| A1.L4.033 Bedroom 01 | 4 | 13.0 | 1.0 | 3.21 | Above |
| A1.L4.033 Bedroom 02 | 4 | 11.0 | 1.0 | 3.09 | Above |
| A1.L4.033 Kitchen/Dining/Living | 4 | 21.3 | 1.5 | 3.45 | Above |
| A1.L4.034 Kitchen/Dining/Living | 4 | 27.7 | 1.5 | 3.24 | Above |

Table 12-2 ADF Results of Existing Block A4 (Bridgefield)

| Room Reference / Room Type | Floor Level | Floor Area (m2) | Area-weighted Average Daylight Factor (%) | | Conclusion |
|---------------------------------|-------------|-----------------|---|------------|------------------------|
| | | | Target ADF | ADF Result | Above/Below ADF Target |
| Existing Block A4 | | | | | |
| A4.L1.002 Bedroom 01 | 1 | 14.4 | 1.0 | 2.95 | Above |
| A4.L1.002 Bedroom 02 | 1 | 13.4 | 1.0 | 2.94 | Above |
| A4.L1.002 Kitchen/Dining/Living | 1 | 33.1 | 1.5 | 2.43 | Above |
| A4.L2.008 Bedroom 01 | 2 | 14.4 | 1.0 | 3.01 | Above |
| A4.L2.008 Bedroom 02 | 2 | 13.4 | 1.0 | 3.03 | Above |
| A4.L2.008 Kitchen/Dining/Living | 2 | 33.1 | 1.5 | 2.65 | Above |
| A4.L3.014 Bedroom 01 | 3 | 14.4 | 1.0 | 3.07 | Above |
| A4.L3.014 Bedroom 02 | 3 | 13.4 | 1.0 | 3.10 | Above |
| A4.L3.014 Kitchen/Dining/Living | 3 | 33.1 | 1.5 | 2.88 | Above |
| A4.L4.020 Bedroom 01 | 4 | 14.4 | 1.0 | 3.11 | Above |
| A4.L4.020 Bedroom 02 | 4 | 13.4 | 1.0 | 3.17 | Above |
| A4.L4.020 Kitchen/Dining/Living | 4 | 33.1 | 1.5 | 3.04 | Above |

13 Appendix C2: Sunlight Hours at windows in Existing Blocks facing the Proposed Scheme

The results of the sunlight analysis for the existing windows of each space facing the proposed scheme is shown in the following tables.

Table 13-1 Available sunlight hours results of the Existing Block A1 (Pappan Grove)

| Room Reference / Room Type | Surface | Opening | Orientation | APSH (%/year) | APSH >25% | Winter PSH (%/year) | Winter PSH >5% | Overall Results |
|---------------------------------|---------|---------|-------------|---------------|-----------|---------------------|----------------|-----------------|
| A1.L0.002 Kitchen/Dining/Living | 4 | 1 | 197.75 | 31.21 | Pass | 16.78 | Pass | Pass |
| A1.L0.003 Bedroom 01 | 3 | 1 | 197.75 | 46.41 | Pass | 16.78 | Pass | Pass |
| A1.L0.003 Bedroom 02 | 3 | 1 | 197.75 | 49.65 | Pass | 16.08 | Pass | |
| A1.L0.003 Kitchen/Dining/Living | 3 | 1 | 197.75 | 35.22 | Pass | 17.48 | Pass | |
| A1.L0.004 Bedroom 01 | 3 | 1 | 197.75 | 47.55 | Pass | 16.08 | Pass | Pass |
| A1.L0.004 Bedroom 02 | 3 | 1 | 197.75 | 42.02 | Pass | 14.69 | Pass | |
| A1.L0.004 Kitchen/Dining/Living | 3 | 1 | 197.75 | 30.35 | Pass | 14.69 | Pass | |
| A1.L0.005 Bedroom 01 | 3 | 1 | 197.75 | 42.66 | Pass | 14.69 | Pass | Pass |
| A1.L0.005 Bedroom 02 | 3 | 1 | 197.75 | 43.84 | Pass | 13.99 | Pass | |
| A1.L0.005 Kitchen/Dining/Living | 3 | 1 | 197.75 | 32.10 | Pass | 13.99 | Pass | |
| A1.L0.006 Kitchen/Dining/Living | 3 | 1 | 197.75 | 36.41 | Pass | 16.78 | Pass | Pass |
| A1.L1.009 Kitchen/Dining/Living | 4 | 1 | 197.75 | 30.62 | Pass | 17.84 | Pass | Pass |
| A1.L1.010 Bedroom 01 | 3 | 1 | 197.75 | 47.65 | Pass | 17.48 | Pass | Pass |
| A1.L1.010 Bedroom 02 | 3 | 1 | 197.75 | 51.02 | Pass | 17.48 | Pass | |
| A1.L1.010 Kitchen/Dining/Living | 3 | 1 | 197.75 | 35.42 | Pass | 19.22 | Pass | |
| A1.L1.011 Bedroom 01 | 3 | 1 | 197.75 | 41.96 | Pass | 16.78 | Pass | Pass |
| A1.L1.011 Bedroom 02 | 3 | 1 | 197.75 | 51.05 | Pass | 18.18 | Pass | |
| A1.L1.011 Kitchen/Dining/Living | 3 | 1 | 197.75 | 29.85 | Pass | 17.15 | Pass | |
| A1.L1.012 Bedroom 01 | 3 | 1 | 197.75 | 45.45 | Pass | 16.78 | Pass | Pass |
| A1.L1.012 Bedroom 02 | 3 | 1 | 197.75 | 44.40 | Pass | 16.08 | Pass | |
| A1.L1.012 Kitchen/Dining/Living | 3 | 1 | 197.75 | 31.35 | Pass | 15.38 | Pass | |
| A1.L1.013 Kitchen/Dining/Living | 3 | 1 | 197.75 | 35.06 | Pass | 19.58 | Pass | Pass |

| Room Reference / Room Type | Surface | Opening | Orientation | APSH (%/year) | APSH >25% | Winter PSH (%/year) | Winter PSH >5% | Overall Results |
|---------------------------------|---------|---------|-------------|---------------|-----------|---------------------|----------------|-----------------|
| A1.L2.016 Kitchen/Dining/Living | 4 | 1 | 197.75 | 31.38 | Pass | 18.58 | Pass | Pass |
| A1.L2.017 Bedroom 01 | 3 | 1 | 197.75 | 50.41 | Pass | 20.28 | Pass | Pass |
| A1.L2.017 Bedroom 02 | 3 | 1 | 197.75 | 53.10 | Pass | 19.58 | Pass | |
| A1.L2.017 Kitchen/Dining/Living | 3 | 1 | 197.75 | 36.85 | Pass | 20.62 | Pass | |
| A1.L2.018 Bedroom 01 | 3 | 1 | 197.75 | 44.06 | Pass | 18.88 | Pass | Pass |
| A1.L2.018 Bedroom 02 | 3 | 1 | 197.75 | 51.75 | Pass | 18.88 | Pass | |
| A1.L2.018 Kitchen/Dining/Living | 3 | 1 | 197.75 | 31.61 | Pass | 18.88 | Pass | |
| A1.L2.019 Bedroom 01 | 3 | 1 | 197.75 | 48.25 | Pass | 18.88 | Pass | Pass |
| A1.L2.019 Bedroom 02 | 3 | 1 | 197.75 | 47.71 | Pass | 19.37 | Pass | |
| A1.L2.019 Kitchen/Dining/Living | 3 | 1 | 197.75 | 34.88 | Pass | 18.18 | Pass | |
| A1.L2.020 Kitchen/Dining/Living | 3 | 1 | 197.75 | 37.19 | Pass | 20.98 | Pass | Pass |
| A1.L3.023 Kitchen/Dining/Living | 4 | 1 | 197.75 | 34.75 | Pass | 21.34 | Pass | Pass |
| A1.L3.024 Bedroom 01 | 3 | 1 | 197.75 | 58.72 | Pass | 21.68 | Pass | Pass |
| A1.L3.024 Bedroom 02 | 3 | 1 | 197.75 | 53.12 | Pass | 22.25 | Pass | |
| A1.L3.024 Kitchen/Dining/Living | 3 | 1 | 197.75 | 39.77 | Pass | 23.07 | Pass | |
| A1.L3.025 Bedroom 01 | 3 | 1 | 197.75 | 57.34 | Pass | 23.07 | Pass | Pass |
| A1.L3.025 Bedroom 02 | 3 | 1 | 197.75 | 48.25 | Pass | 22.38 | Pass | |
| A1.L3.025 Kitchen/Dining/Living | 3 | 1 | 197.75 | 36.27 | Pass | 23.08 | Pass | |
| A1.L3.026 Bedroom 01 | 3 | 1 | 197.75 | 49.81 | Pass | 21.49 | Pass | Pass |
| A1.L3.026 Bedroom 02 | 3 | 1 | 197.75 | 53.85 | Pass | 21.68 | Pass | |
| A1.L3.026 Kitchen/Dining/Living | 3 | 1 | 197.75 | 37.60 | Pass | 20.98 | Pass | |
| A1.L3.027 Kitchen/Dining/Living | 3 | 1 | 197.75 | 40.45 | Pass | 23.77 | Pass | Pass |
| A1.L4.030 Kitchen/Dining/Living | 4 | 1 | 197.75 | 62.24 | Pass | 23.78 | Pass | Pass |
| A1.L4.031 Bedroom 01 | 3 | 1 | 197.75 | 64.33 | Pass | 25.87 | Pass | Pass |
| A1.L4.031 Bedroom 02 | 3 | 1 | 197.75 | 63.64 | Pass | 25.18 | Pass | |
| A1.L4.031 Kitchen/Dining/Living | 3 | 1 | 197.75 | 65.03 | Pass | 26.57 | Pass | |
| A1.L4.032 Bedroom 01 | 3 | 1 | 197.75 | 64.33 | Pass | 25.87 | Pass | Pass |
| A1.L4.032 Bedroom 02 | 3 | 1 | 197.75 | 65.74 | Pass | 27.27 | Pass | |
| A1.L4.032 Kitchen/Dining/Living | 3 | 1 | 197.75 | 64.34 | Pass | 25.88 | Pass | |
| A1.L4.033 Bedroom 01 | 3 | 1 | 197.75 | 66.43 | Pass | 27.97 | Pass | Pass |
| A1.L4.033 Bedroom 02 | 3 | 1 | 197.75 | 67.13 | Pass | 28.67 | Pass | |
| A1.L4.033 Kitchen/Dining/Living | 3 | 1 | 197.75 | 65.04 | Pass | 26.57 | Pass | |
| A1.L4.034 Kitchen/Dining/Living | 3 | 1 | 197.75 | 65.73 | Pass | 27.27 | Pass | Pass |

Table 13-2 Available sunlight hours results of the Existing Block A4 (Bridgefield)

| Room Reference / Room Type | Surface | Opening | Orientation | APSH (%/year) | APSH >25% | Winter PSH (%/year) | Winter PSH >5% | Overall Results |
|---------------------------------|---------|---------|-------------|---------------|-----------|---------------------|----------------|-----------------|
| A4.L1.002 Bedroom 01 | 3 | 1 | 198.07 | 62.23 | Pass | 27.27 | Pass | Pass |
| A4.L1.002 Bedroom 02 | 3 | 1 | 198.07 | 56.43 | Pass | 27.27 | Pass | |
| A4.L1.002 Kitchen/Dining/Living | 4 | 1 | 198.07 | 31.25 | Pass | 25.48 | Pass | |
| A4.L2.008 Bedroom 01 | 3 | 1 | 198.07 | 62.94 | Pass | 27.97 | Pass | Pass |
| A4.L2.008 Bedroom 02 | 3 | 1 | 198.07 | 57.13 | Pass | 27.97 | Pass | |
| A4.L2.008 Kitchen/Dining/Living | 4 | 1 | 198.07 | 31.89 | Pass | 25.45 | Pass | |
| A4.L3.014 Bedroom 01 | 3 | 1 | 198.07 | 65.74 | Pass | 29.37 | Pass | Pass |
| A4.L3.014 Bedroom 02 | 3 | 1 | 198.07 | 59.20 | Pass | 28.67 | Pass | |
| A4.L3.014 Kitchen/Dining/Living | 4 | 1 | 198.07 | 33.35 | Pass | 26.19 | Pass | |
| A4.L4.020 Bedroom 01 | 3 | 1 | 198.07 | 65.99 | Pass | 29.62 | Pass | Pass |
| A4.L4.020 Bedroom 02 | 3 | 1 | 198.07 | 59.90 | Pass | 29.37 | Pass | |
| A4.L4.020 Kitchen/Dining/Living | 4 | 1 | 198.07 | 35.40 | Pass | 27.56 | Pass | |

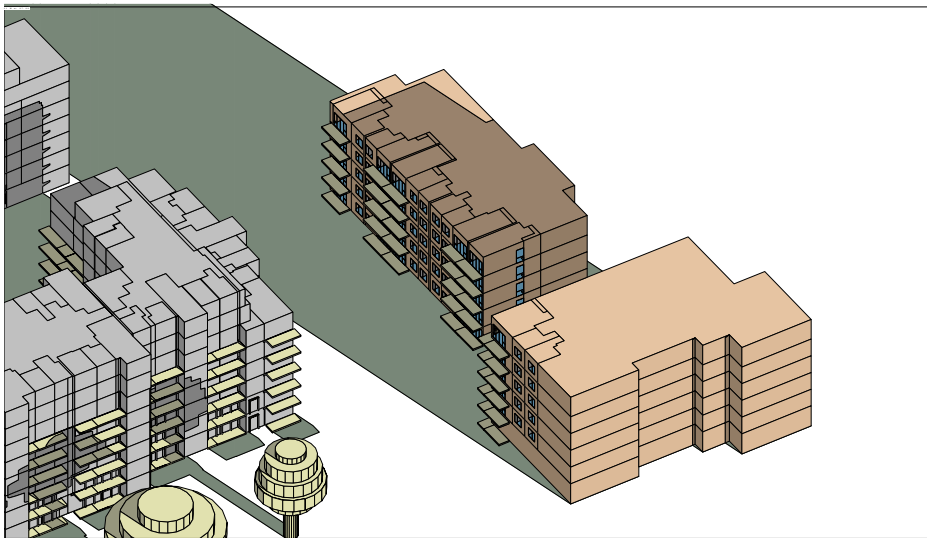
14 Appendix C3: Shadow Path Diagram for Existing Blocks (Closeup View)

The shadow path diagrams from 07:00 to 18:00 on 21 March for the Existing blocks (Closeup view) are represented below:

Figure 14-1 Shadow Path Diagram for Existing Blocks (Closeup view) from 07:00 to 18:00 on 21 March

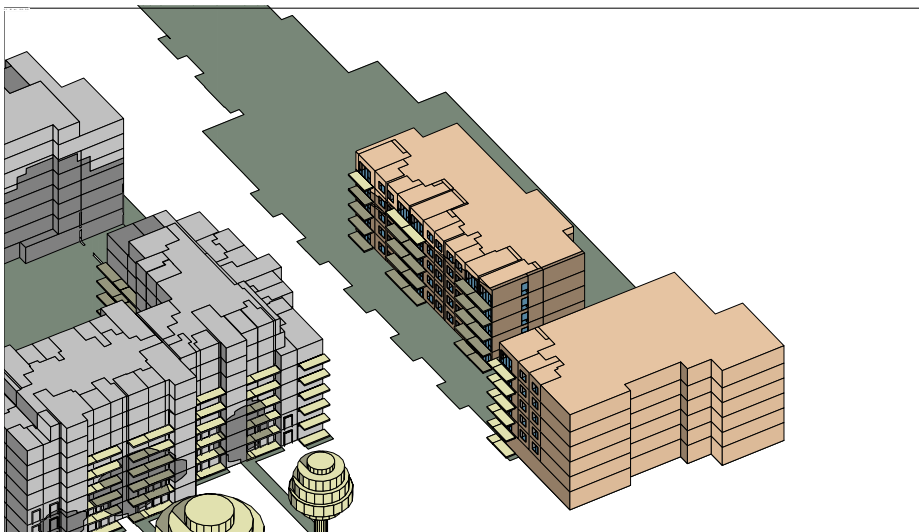
Suncast image:

View time = 21 Mar 07:00
Site Latitude = 53.42
Longitude diff. = -6.27
Model Bearing = 9.00
Sun: azi = 95.69 alt = 3.70
Eye: azi = 140.00 alt = 40.00



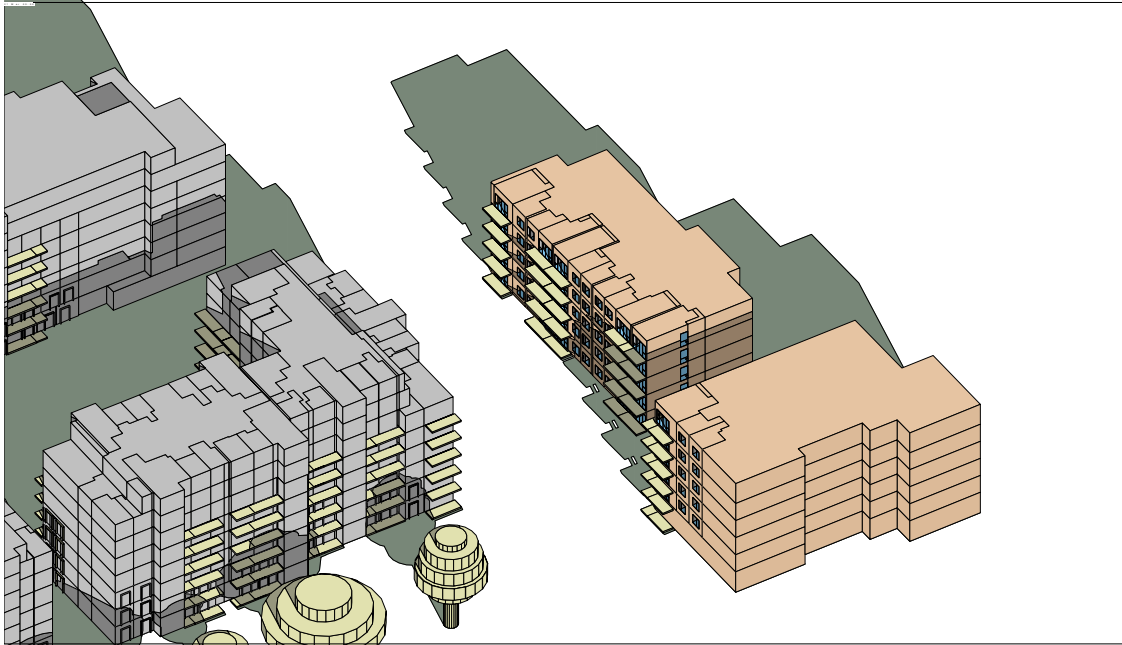
Suncast image:

View time = 21 Mar 08:00
Site Latitude = 53.42
Longitude diff. = -6.27
Model Bearing = 9.00
Sun: azi = 108.02 alt = 12.43
Eye: azi = 140.00 alt = 40.00



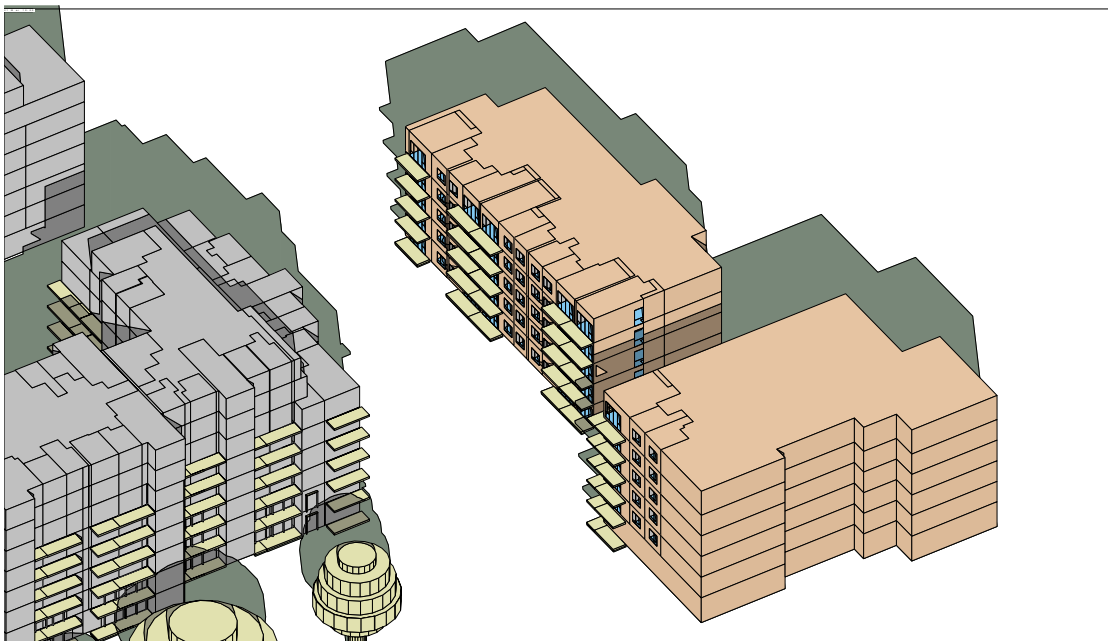
Suncast image:

View time = 21 Mar 09:00
Site Latitude = 53.42
Longitude diff. = -6.27
Model Bearing = 9.00
Sun: azi = 121.19 alt = 20.55
Eye: azi = 140.00 alt = 40.00



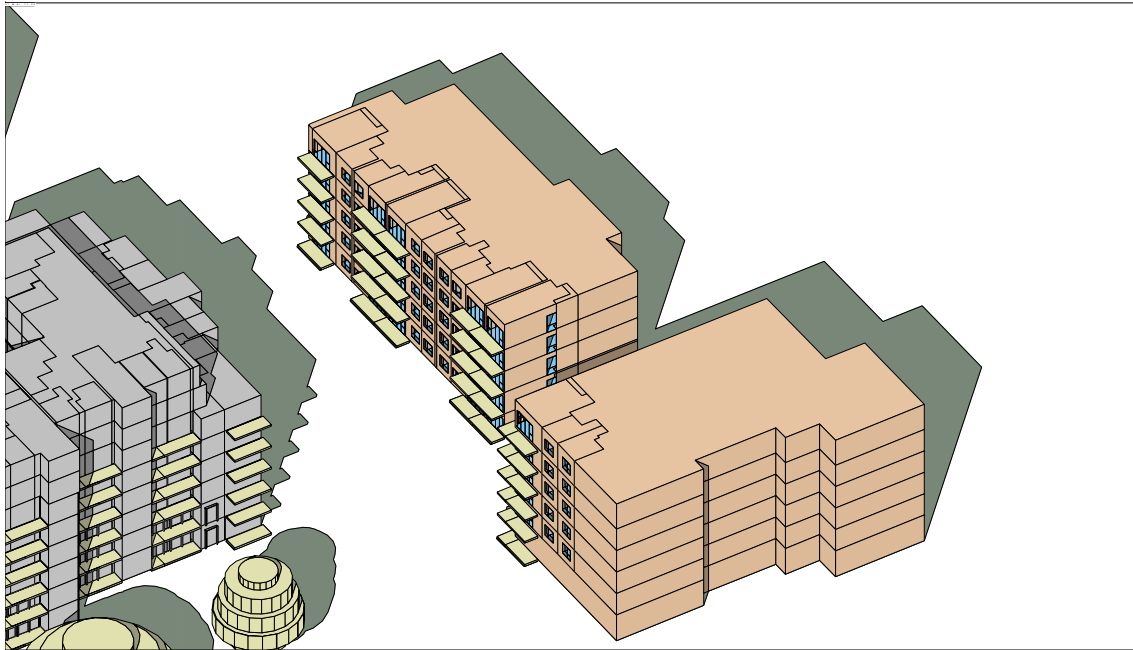
Suncast image:

View time = 21 Mar 10:00
Site Latitude = 53.42
Longitude diff. = -6.27
Model Bearing = 9.00
Sun: azi = 135.74 alt = 27.54
Eye: azi = 140.00 alt = 40.00



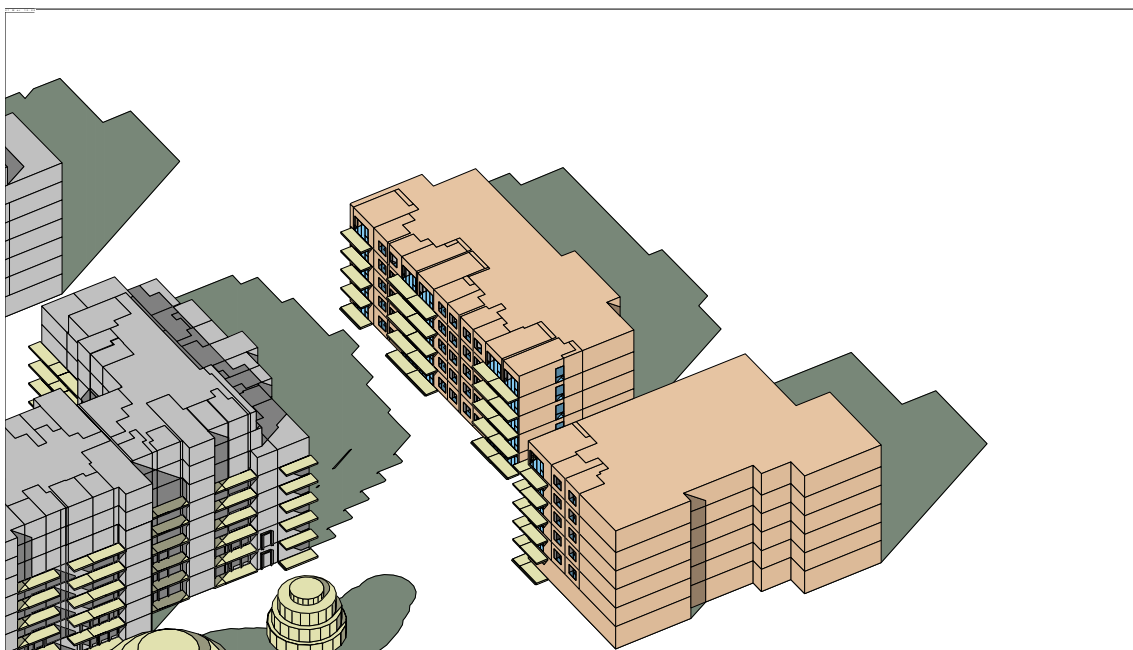
Suncast image:

View time = 21 Mar 11:00
Site Latitude = 53.42
Longitude diff. = -6.27
Model Bearing = 9.00
Sun: azi = 152.01 alt = 32.81
Eye: azi = 140.00 alt = 40.00



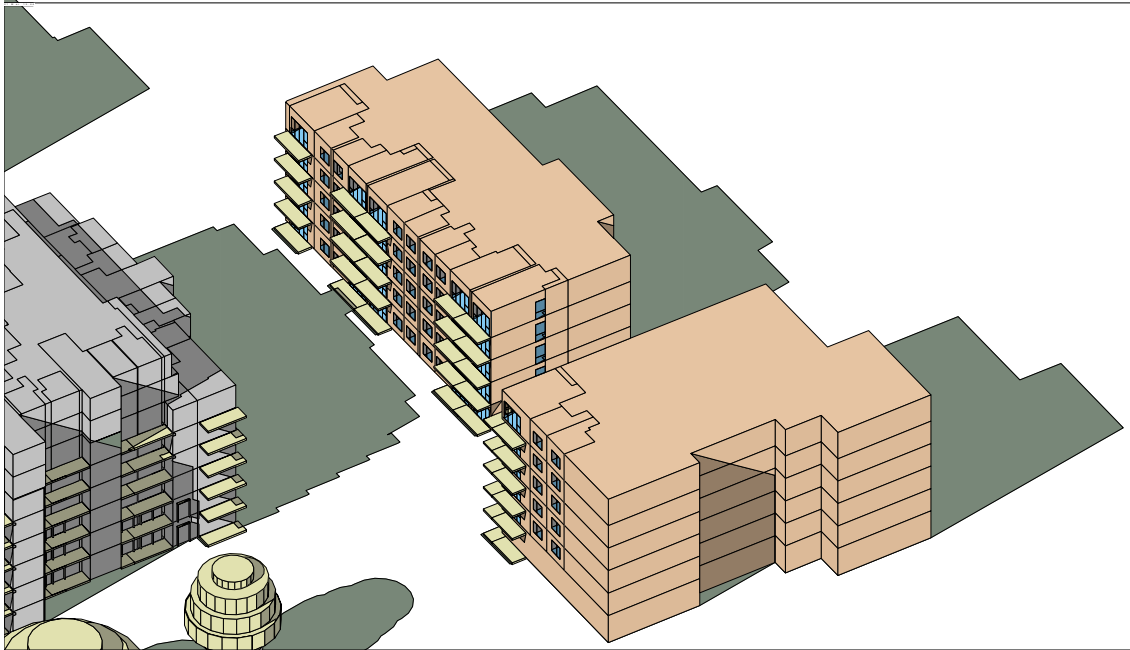
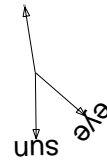
Suncast image:

View time = 21 Mar 12:00
Site Latitude = 53.42
Longitude diff. = -6.27
Model Bearing = 9.00
Sun: azi = 169.84 alt = 35.74
Eye: azi = 140.00 alt = 40.00



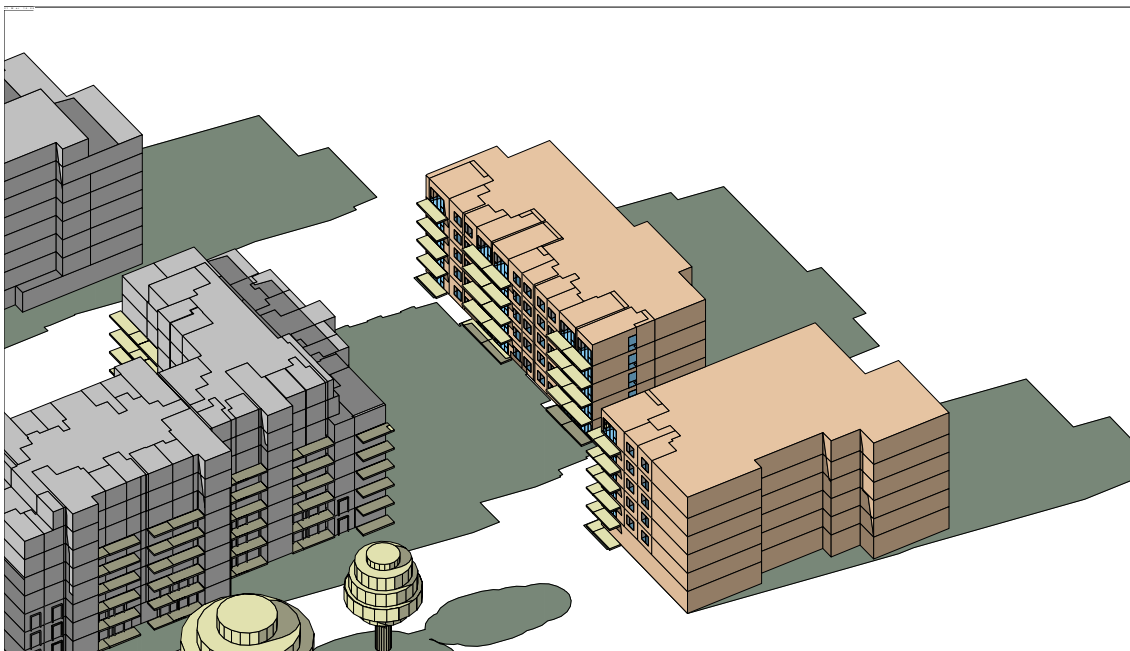
Suncast image:

View time = 21 Mar 13:00
Site Latitude = 53.42
Longitude diff. = -6.27
Model Bearing = 9.00
Sun: azi = 188.36 alt = 35.88
Eye: azi = 140.00 alt = 40.00



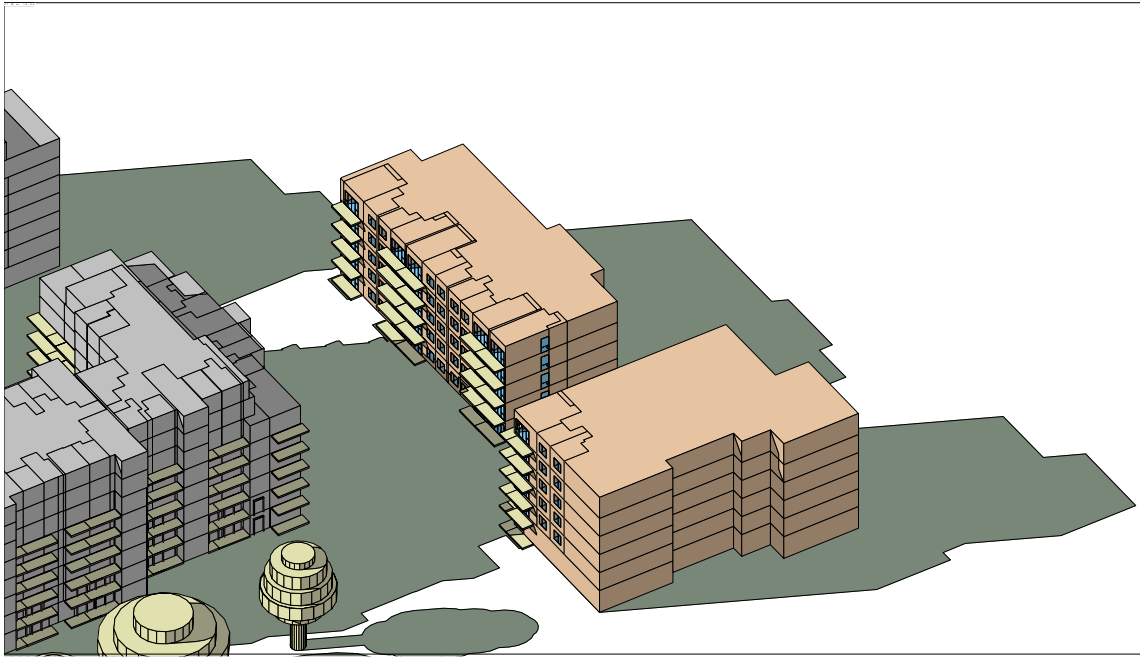
Suncast image:

View time = 21 Mar 14:00
Site Latitude = 53.42
Longitude diff. = -6.27
Model Bearing = 9.00
Sun: azi = 206.31 alt = 33.21
Eye: azi = 140.00 alt = 40.00



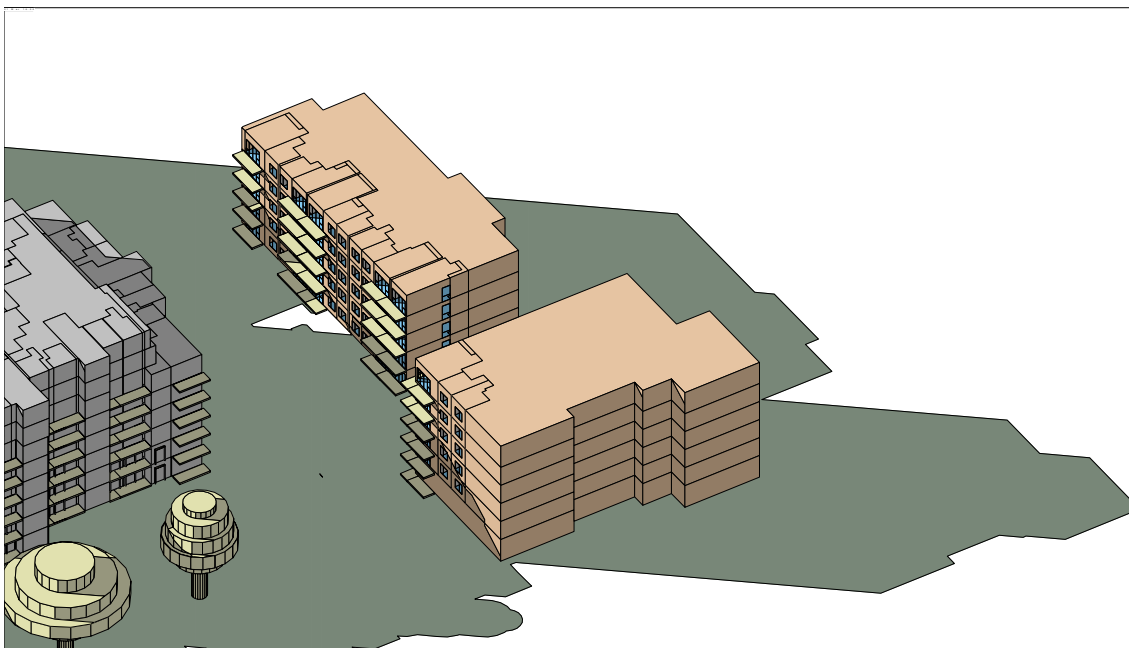
Suncast image:

View time = 21 Mar 15:00
Site Latitude = 53.42
Longitude diff. = -6.27
Model Bearing = 9.00
Sun: azi = 222.75 alt = 28.14
Eye: azi = 140.00 alt = 40.00



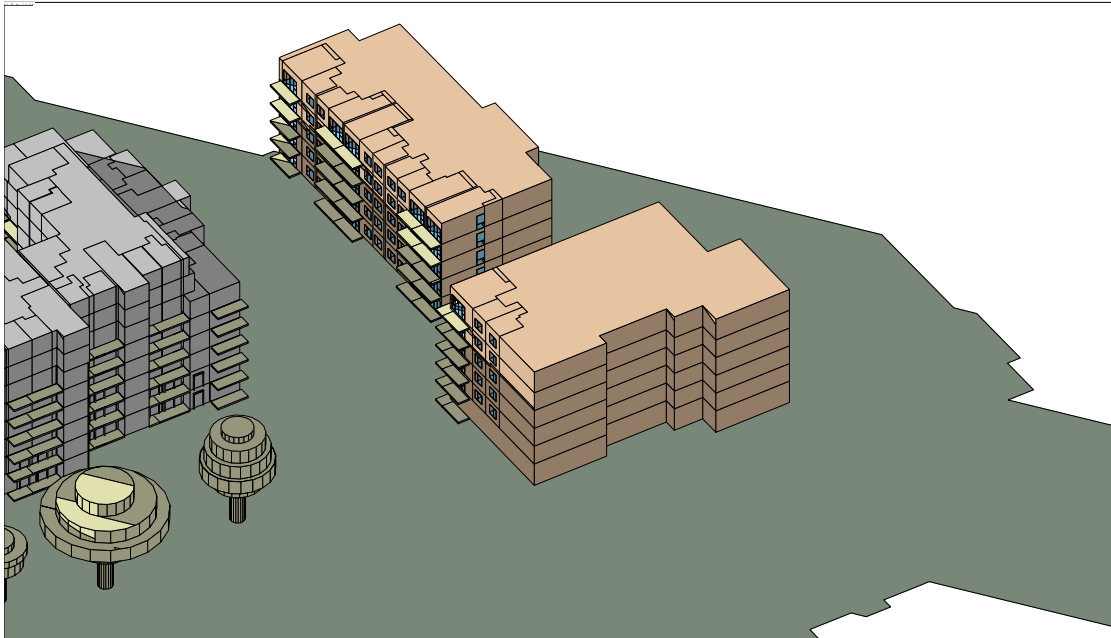
Suncast image:

View time = 21 Mar 16:00
Site Latitude = 53.42
Longitude diff. = -6.27
Model Bearing = 9.00
Sun: azi = 237.46 alt = 21.29
Eye: azi = 140.00 alt = 40.00



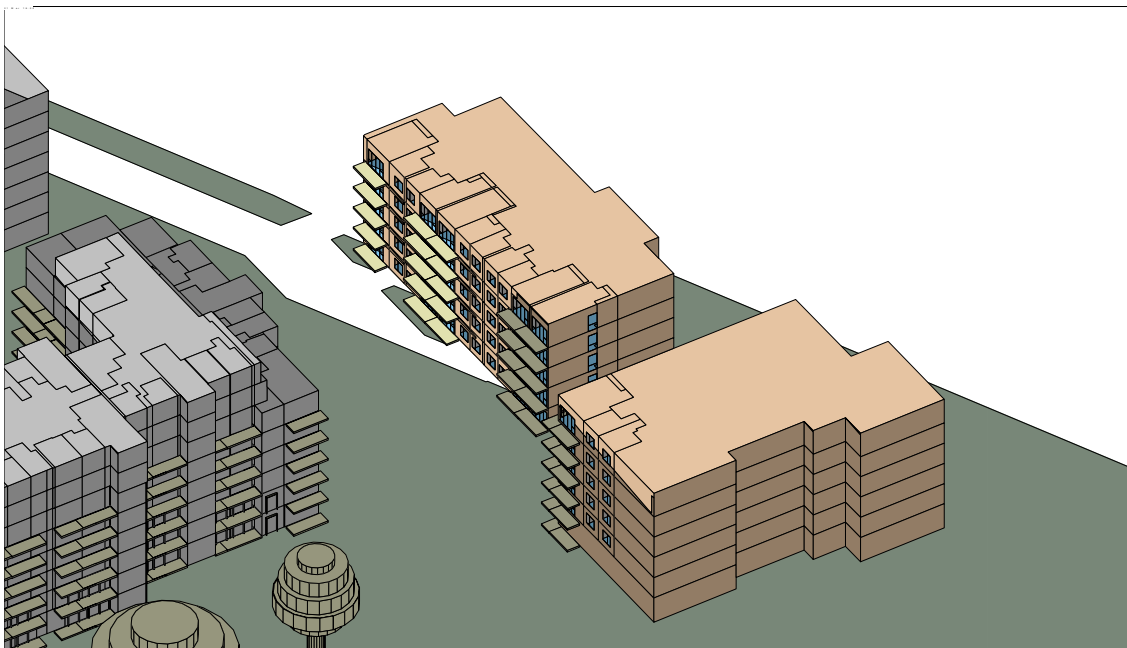
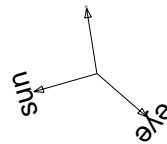
Suncast image:

View time = 21 Mar 17:00
Site Latitude = 53.42
Longitude diff. = -6.27
Model Bearing = 9.00
Sun: azi = 250.75 alt = 13.26
Eye: azi = 140.00 alt = 40.00



Suncast image:

View time = 21 Mar 18:00
Site Latitude = 53.42
Longitude diff. = -6.27
Model Bearing = 9.00
Sun: azi = 263.13 alt = 4.57
Eye: azi = 140.00 alt = 40.00



15 Appendix D1: Average Daylight Factors for Rooms in the Proposed Scheme

The Average Daylight Factor for the assessed rooms are presented in the following table:

Table 15-1 ADF Results of the proposed scheme Block A

| Room Reference / Room Type | Floor Level | Floor Area (m2) | Area-weighted Average Daylight Factor (%) | | Conclusion |
|--------------------------------|-------------|-----------------|---|------------|------------|
| | | | Target ADF | ADF Result | |
| Block A | | | | | |
| A.L0.001 Bedroom 01 | 0 | 14.8 | 1.0 | 1.60 | Above |
| A.L0.001 Bedroom 02 | 0 | 10.5 | 1.0 | 2.99 | Above |
| A.L0.001 Kitchen/Dining/Living | 0 | 32.0 | 1.5 | 1.66 | Above |
| A.L0.002 Bedroom 01 | 0 | 12.9 | 1.0 | 1.17 | Above |
| A.L0.002 Bedroom 02 | 0 | 10.3 | 1.0 | 1.87 | Above |
| A.L0.002 Kitchen/Dining/Living | 0 | 43.4 | 1.5 | 1.40 | Below |
| A.L0.003 Bedroom 01 | 0 | 7.4 | 1.0 | 1.40 | Above |
| A.L0.003 Bedroom 02 | 0 | 5.4 | 1.0 | 1.74 | Above |
| A.L0.003 Kitchen/Dining/Living | 0 | 26.2 | 1.5 | 1.61 | Above |
| A.L0.004 Bedroom 01 | 0 | 13.3 | 1.0 | 0.80 | Below |
| A.L0.004 Bedroom 02 | 0 | 11.2 | 1.0 | 0.90 | Below |
| A.L0.004 Kitchen/Dining/Living | 0 | 35.0 | 1.5 | 1.75 | Above |
| A.L0.005 Bedroom 01 | 0 | 14.3 | 1.0 | 1.05 | Above |
| A.L0.005 Bedroom 02 | 0 | 11.5 | 1.0 | 1.01 | Above |
| A.L0.005 Kitchen/Dining/Living | 0 | 38.3 | 1.5 | 2.33 | Above |
| A.L0.006 Bedroom 01 | 0 | 11.7 | 1.0 | 1.34 | Above |
| A.L0.006 Bedroom 02 | 0 | 11.0 | 1.0 | 1.32 | Above |
| A.L0.006 Kitchen/Dining/Living | 0 | 28.5 | 1.5 | 2.95 | Above |
| A.L0.007 Bedroom 01 | 0 | 17.3 | 1.0 | 1.18 | Above |
| A.L0.007 Kitchen/Dining/Living | 0 | 28.9 | 1.5 | 1.10 | Below |
| A.L0.008 Bedroom 01 | 0 | 11.8 | 1.0 | 1.17 | Above |
| A.L0.008 Bedroom 02 | 0 | 11.1 | 1.0 | 0.98 | Below |
| A.L0.008 Bedroom 03 | 0 | 6.4 | 1.0 | 2.33 | Above |
| A.L0.008 Kitchen/Dining/Living | 0 | 33.5 | 1.5 | 2.60 | Above |
| A.L0.009 Bedroom 01 | 0 | 13.1 | 1.0 | 0.87 | Below |
| A.L0.009 Bedroom 02 | 0 | 11.9 | 1.0 | 0.86 | Below |
| A.L0.009 Kitchen/Dining/Living | 0 | 31.3 | 1.5 | 2.01 | Above |

| Room Reference / Room Type | Floor Level | Floor Area (m2) | Area-weighted Average Daylight Factor (%) | | Conclusion |
|--------------------------------|-------------|-----------------|---|------------|------------|
| | | | Target ADF | ADF Result | |
| A.L1.101 Bedroom 01 | 1 | 14.7 | 1.0 | 1.67 | Above |
| A.L1.101 Bedroom 02 | 1 | 10.5 | 1.0 | 3.17 | Above |
| A.L1.101 Kitchen/Dining/Living | 1 | 32.0 | 1.5 | 1.71 | Above |
| A.L1.102 Bedroom 01 | 1 | 12.9 | 1.0 | 1.75 | Above |
| A.L1.102 Bedroom 02 | 1 | 10.3 | 1.0 | 1.08 | Above |
| A.L1.102 Kitchen/Dining/Living | 1 | 43.4 | 1.5 | 1.23 | Above |
| A.L1.103 Bedroom 01 | 1 | 11.6 | 1.0 | 1.62 | Above |
| A.L1.103 Bedroom 02 | 1 | 15.5 | 1.0 | 1.94 | Above |
| A.L1.103 Kitchen/Dining/Living | 1 | 42.3 | 1.5 | 1.46 | Below |
| A.L1.104 Bedroom 01 | 1 | 13.3 | 1.0 | 0.74 | Below |
| A.L1.104 Bedroom 02 | 1 | 11.2 | 1.0 | 0.82 | Below |
| A.L1.104 Kitchen/Dining/Living | 1 | 35.0 | 1.5 | 1.64 | Above |
| A.L1.108 Bedroom 01 | 1 | 11.8 | 1.0 | 1.07 | Above |
| A.L1.108 Bedroom 02 | 1 | 11.1 | 1.0 | 1.10 | Above |
| A.L1.108 Bedroom 03 | 1 | 6.4 | 1.0 | 2.12 | Above |
| A.L1.108 Kitchen/Dining/Living | 1 | 33.5 | 1.5 | 2.45 | Above |
| A.L1.109 Bedroom 01 | 1 | 13.1 | 1.0 | 0.80 | Below |
| A.L1.109 Bedroom 02 | 1 | 11.9 | 1.0 | 0.80 | Below |
| A.L1.109 Kitchen/Dining/Living | 1 | 31.3 | 1.5 | 1.93 | Above |
| A.L1.110 Bedroom 01 | 1 | 13.2 | 1.0 | 2.86 | Above |
| A.L1.110 Bedroom 02 | 1 | 13.1 | 1.0 | 2.65 | Above |
| A.L1.110 Bedroom 03 | 1 | 8.4 | 1.0 | 4.60 | Above |
| A.L1.110 Kitchen/Dining/Living | 1 | 34.6 | 1.5 | 2.92 | Above |
| A.L1.111 Bedroom 01 | 1 | 14.6 | 1.0 | 2.95 | Above |
| A.L1.111 Bedroom 02 | 1 | 11.7 | 1.0 | 2.88 | Above |
| A.L1.111 Kitchen/Dining/Living | 1 | 34.9 | 1.5 | 1.77 | Above |
| A.L2.202 Bedroom 01 | 2 | 12.9 | 1.0 | 1.87 | Above |
| A.L2.202 Bedroom 02 | 2 | 10.3 | 1.0 | 1.19 | Above |
| A.L2.202 Kitchen/Dining/Living | 2 | 43.4 | 1.5 | 1.50 | Above |

Table 15-2 ADF Results of the proposed scheme Block B

| Room Reference / Room Type | Floor Level | Floor Area (m2) | Area-weighted Average Daylight Factor (%) | | Conclusion |
|--------------------------------|-------------|-----------------|---|------------|--------------|
| | | | Target ADF | ADF Result | |
| Block B | | | | | |
| B.L0.001 Bedroom 01 | 0 | 12.6 | 1.0 | 0.69 | Below |
| B.L0.001 Bedroom 02 | 0 | 11.7 | 1.0 | 0.52 | Below |
| B.L0.001 Kitchen/Dining/Living | 0 | 31.9 | 1.5 | 1.76 | Above |
| B.L0.002 Bedroom 01 | 0 | 12.6 | 1.0 | 1.13 | Above |
| B.L0.002 Bedroom 02 | 0 | 11.7 | 1.0 | 0.92 | Below |
| B.L0.002 Kitchen/Dining/Living | 0 | 31.9 | 1.5 | 2.19 | Above |
| B.L0.003 Bedroom 01 | 0 | 12.9 | 1.0 | 2.41 | Above |
| B.L0.003 Bedroom 02 | 0 | 7.6 | 1.0 | 0.52 | Below |
| B.L0.003 Kitchen/Dining/Living | 0 | 27.3 | 1.5 | 1.66 | Above |
| B.L0.004 Bedroom 01 | 0 | 15.5 | 1.0 | 1.72 | Above |
| B.L0.004 Bedroom 02 | 0 | 12.2 | 1.0 | 1.46 | Above |
| B.L0.004 Kitchen/Dining/Living | 0 | 38.3 | 1.5 | 0.56 | Below |
| B.L1.101 Bedroom 01 | 1 | 12.6 | 1.0 | 0.59 | Below |
| B.L1.101 Bedroom 02 | 1 | 11.7 | 1.0 | 0.47 | Below |
| B.L1.101 Kitchen/Dining/Living | 1 | 31.3 | 1.5 | 1.71 | Above |
| B.L1.102 Bedroom 01 | 1 | 12.6 | 1.0 | 1.05 | Above |
| B.L1.102 Bedroom 02 | 1 | 11.7 | 1.0 | 0.90 | Below |
| B.L1.102 Kitchen/Dining/Living | 1 | 31.9 | 1.5 | 2.14 | Above |
| B.L1.103 Bedroom 01 | 1 | 22.2 | 1.0 | 2.51 | Above |
| B.L1.103 Bedroom 02 | 1 | 13.9 | 1.0 | 0.78 | Below |
| B.L1.103 Bedroom 03 | 1 | 13.6 | 1.0 | 0.68 | Below |
| B.L1.103 Kitchen/Dining/Living | 1 | 34.9 | 1.5 | 2.46 | Above |
| B.L1.104 Bedroom 01 | 1 | 11.8 | 1.0 | 1.82 | Above |
| B.L1.104 Bedroom 02 | 1 | 16.2 | 1.0 | 1.11 | Above |
| B.L1.104 Kitchen/Dining/Living | 1 | 33.9 | 1.5 | 3.35 | Above |

Table 15-3 ADF Results of the proposed scheme Block C

| Room Reference / Room Type | Floor Level | Floor Area (m2) | Area-weighted Average Daylight Factor (%) | | Conclusion |
|----------------------------|-------------|-----------------|---|------------|------------------------|
| | | | Target ADF | ADF Result | Above/Below ADF Target |

Block C

| | | | | | |
|--------------------------------|---|------|-----|------|-------|
| C.L0.001 Bedroom 01 | 0 | 15.5 | 1.0 | 1.18 | Above |
| C.L0.001 Kitchen/Dining/Living | 0 | 48.1 | 1.5 | 1.40 | Below |
| C.L0.002 Bedroom 01 | 0 | 17.2 | 1.0 | 1.24 | Above |
| C.L0.002 Bedroom 02 | 0 | 11.6 | 1.0 | 1.74 | Above |
| C.L0.002 Kitchen/Dining/Living | 0 | 38.6 | 1.5 | 0.88 | Below |
| C.L0.003 Bedroom 01 | 0 | 12.3 | 1.0 | 1.11 | Above |
| C.L0.003 Bedroom 02 | 0 | 11.4 | 1.0 | 1.03 | Above |
| C.L0.003 Kitchen/Dining/Living | 0 | 31.5 | 1.5 | 2.03 | Above |
| C.L1.101 Bedroom 01 | 1 | 10.1 | 1.0 | 0.70 | Below |
| C.L1.101 Bedroom 02 | 1 | 13.1 | 1.0 | 2.22 | Above |
| C.L1.101 Kitchen/Dining/Living | 1 | 30.9 | 1.5 | 1.58 | Above |
| C.L1.103 Bedroom 01 | 1 | 12.3 | 1.0 | 1.09 | Above |
| C.L1.103 Bedroom 02 | 1 | 11.4 | 1.0 | 1.01 | Above |
| C.L1.103 Kitchen/Dining/Living | 1 | 31.5 | 1.5 | 2.03 | Above |
| C.L1.104 Bedroom 01 | 1 | 11.8 | 1.0 | 1.90 | Above |
| C.L1.104 Bedroom 02 | 1 | 16.3 | 1.0 | 1.38 | Above |
| C.L1.104 Kitchen/Dining/Living | 1 | 35.3 | 1.5 | 2.81 | Above |
| C.L1.111 Bedroom 01 | 1 | 14.3 | 1.0 | 0.73 | Below |
| C.L1.111 Bedroom 02 | 1 | 11.4 | 1.0 | 0.90 | Below |
| C.L1.111 Kitchen/Dining/Living | 1 | 30.9 | 1.5 | 4.84 | Above |

Table 15-4 ADF Results of the proposed scheme Block D

| Room Reference / Room Type | Floor Level | Floor Area (m2) | Area-weighted Average Daylight Factor (%) | | Conclusion |
|--------------------------------|-------------|-----------------|---|------------|------------------------|
| | | | Target ADF | ADF Result | Above/Below ADF Target |
| Block D | | | | | |
| D.L0.001 Bedroom 01 | 0 | 13.4 | 1.0 | 1.26 | Above |
| D.L0.001 Bedroom 02 | 0 | 11.8 | 1.0 | 2.04 | Above |
| D.L0.001 Kitchen/Dining/Living | 0 | 30.8 | 1.5 | 1.17 | Below |
| D.L0.002 Bedroom 01 | 0 | 10.7 | 1.0 | 1.37 | Above |
| D.L0.002 Bedroom 02 | 0 | 11.7 | 1.0 | 1.27 | Above |
| D.L0.002 Kitchen/Dining/Living | 0 | 30.5 | 1.5 | 1.00 | Below |
| D.L0.003 Bedroom 01 | 0 | 13.2 | 1.0 | 0.80 | Below |
| D.L0.003 Bedroom 02 | 0 | 11.7 | 1.0 | 0.76 | Below |
| D.L0.003 Kitchen/Dining/Living | 0 | 31.1 | 1.5 | 1.97 | Above |
| D.L0.004 Bedroom 01 | 0 | 16.4 | 1.0 | 1.67 | Above |
| D.L0.004 Bedroom 02 | 0 | 11.7 | 1.0 | 2.30 | Above |
| D.L0.004 Kitchen/Dining/Living | 0 | 42.4 | 1.5 | 1.43 | Below |
| D.L0.005 Bedroom 01 | 0 | 12.7 | 1.0 | 0.82 | Below |
| D.L0.005 Kitchen/Dining/Living | 0 | 35.7 | 1.5 | 3.92 | Above |
| D.L0.006 Bedroom 01 | 0 | 13.1 | 1.0 | 1.54 | Above |
| D.L0.006 Bedroom 02 | 0 | 11.0 | 1.0 | 3.19 | Above |
| D.L0.006 Kitchen/Dining/Living | 0 | 31.9 | 1.5 | 4.49 | Above |
| D.L0.007 Bedroom 01 | 0 | 14.4 | 1.0 | 1.35 | Above |
| D.L0.007 Bedroom 02 | 0 | 14.0 | 1.0 | 1.27 | Above |
| D.L0.007 Kitchen/Dining/Living | 0 | 34.5 | 1.5 | 2.90 | Above |
| D.L0.008 Bedroom 01 | 0 | 14.2 | 1.0 | 0.85 | Below |
| D.L0.008 Bedroom 02 | 0 | 11.5 | 1.0 | 1.11 | Above |
| D.L0.008 Kitchen/Dining/Living | 0 | 38.2 | 1.5 | 3.28 | Above |
| D.L0.009 Bedroom 01 | 0 | 11.8 | 1.0 | 1.08 | Above |
| D.L0.009 Bedroom 02 | 0 | 11.2 | 1.0 | 1.13 | Above |
| D.L0.009 Kitchen/Dining/Living | 0 | 28.3 | 1.5 | 3.15 | Above |
| D.L0.010 Bedroom 01 | 0 | 13.3 | 1.0 | 0.85 | Below |
| D.L0.010 Bedroom 02 | 0 | 11.9 | 1.0 | 0.92 | Below |
| D.L0.010 Kitchen/Dining/Living | 0 | 35.0 | 1.5 | 1.59 | Above |

| Room Reference / Room Type | Floor Level | Floor Area (m2) | Area-weighted Average Daylight Factor (%) | | Conclusion |
|--------------------------------|-------------|-----------------|---|------------|------------------------|
| | | | Target ADF | ADF Result | Above/Below ADF Target |
| D.L0.011 Bedroom 01 | 0 | 12.9 | 1.0 | 1.38 | Above |
| D.L0.011 Bedroom 02 | 0 | 11.9 | 1.0 | 1.36 | Above |
| D.L0.011 Kitchen/Dining/Living | 0 | 26.6 | 1.5 | 2.19 | Above |
| D.L0.012 Bedroom 01 | 0 | 16.2 | 1.0 | 1.86 | Above |
| D.L0.012 Bedroom 02 | 0 | 14.0 | 1.0 | 2.84 | Above |
| D.L0.012 Kitchen/Dining/Living | 0 | 31.4 | 1.5 | 1.64 | Above |
| D.L1.101 Bedroom 01 | 1 | 13.4 | 1.0 | 1.12 | Above |
| D.L1.101 Bedroom 02 | 1 | 11.8 | 1.0 | 1.91 | Above |
| D.L1.101 Kitchen/Dining/Living | 1 | 30.8 | 1.5 | 1.02 | Below |
| D.L1.102 Bedroom 01 | 1 | 10.7 | 1.0 | 1.26 | Above |
| D.L1.102 Bedroom 02 | 1 | 11.7 | 1.0 | 1.17 | Above |
| D.L1.102 Kitchen/Dining/Living | 1 | 30.5 | 1.5 | 0.77 | Below |
| D.L1.103 Bedroom 01 | 1 | 13.2 | 1.0 | 0.77 | Below |
| D.L1.103 Bedroom 02 | 1 | 11.7 | 1.0 | 0.74 | Above |
| D.L1.103 Kitchen/Dining/Living | 1 | 31.1 | 1.5 | 1.94 | Above |
| D.L1.104 Bedroom 01 | 1 | 16.4 | 1.0 | 1.72 | Above |
| D.L1.104 Bedroom 02 | 1 | 11.7 | 1.0 | 2.42 | Above |
| D.L1.104 Kitchen/Dining/Living | 1 | 42.4 | 1.5 | 1.32 | Below |
| D.L1.106 Bedroom 01 | 1 | 12.9 | 1.0 | 2.86 | Above |
| D.L1.106 Bedroom 02 | 1 | 11.5 | 1.0 | 3.05 | Above |
| D.L1.106 Kitchen/Dining/Living | 1 | 34.2 | 1.5 | 4.18 | Above |
| D.L1.107 Bedroom 01 | 1 | 14.4 | 1.0 | 1.23 | Above |
| D.L1.107 Bedroom 02 | 1 | 14.0 | 1.0 | 1.13 | Above |
| D.L1.107 Kitchen/Dining/Living | 1 | 34.5 | 1.5 | 2.80 | Above |

| Room Reference / Room Type | Floor Level | Floor Area (m2) | Area-weighted Average Daylight Factor (%) | | Conclusion |
|--------------------------------|-------------|-----------------|---|------------|------------------------|
| | | | Target ADF | ADF Result | Above/Below ADF Target |
| D.L1.110 Bedroom 01 | 1 | 13.3 | 1.0 | 0.83 | Below |
| D.L1.110 Bedroom 02 | 1 | 11.9 | 1.0 | 0.89 | Below |
| D.L1.110 Kitchen/Dining/Living | 1 | 35.0 | 1.5 | 1.53 | Above |
| D.L1.111 Bedroom 01 | 1 | 12.9 | 1.0 | 1.36 | Above |
| D.L1.111 Bedroom 02 | 1 | 11.9 | 1.0 | 1.35 | Above |
| D.L1.111 Kitchen/Dining/Living | 1 | 26.6 | 1.5 | 2.00 | Above |
| D.L2.204 Bedroom 01 | 2 | 16.4 | 1.0 | 1.91 | Above |
| D.L2.204 Bedroom 02 | 2 | 11.7 | 1.0 | 2.69 | Above |
| D.L2.204 Kitchen/Dining/Living | 2 | 42.4 | 1.5 | 1.42 | Below |
| D.L3.304 Kitchen/Dining/Living | 3 | 42.4 | 1.5 | 1.61 | Above |
| D.L2.202 Bedroom 01 | 2 | 10.7 | 1.0 | 1.29 | Above |
| D.L2.202 Bedroom 02 | 2 | 11.7 | 1.0 | 1.38 | Above |
| D.L2.202 Kitchen/Dining/Living | 2 | 30.5 | 1.5 | 1.01 | Below |
| D.L3.302 Kitchen/Dining/Living | 3 | 30.5 | 1.5 | 1.15 | Below |
| D.L4.402 Kitchen/Dining/Living | 4 | 30.5 | 1.5 | 1.29 | Below |
| D.L5.502 Kitchen/Dining/Living | 5 | 30.5 | 1.5 | 1.43 | Below |

16 Appendix D2: Shadow Path Diagrams for Proposed Scheme

The shadow path diagram from 06:00 to 18:00 on 21 March of the proposed scheme is presented below:

Figure 16-1 Shadow Path Diagram for the Proposed scheme with Existing Blocks from 06:00 to 18:00 on 21 March

Suncast image:

View time = 21 Mar 06:00

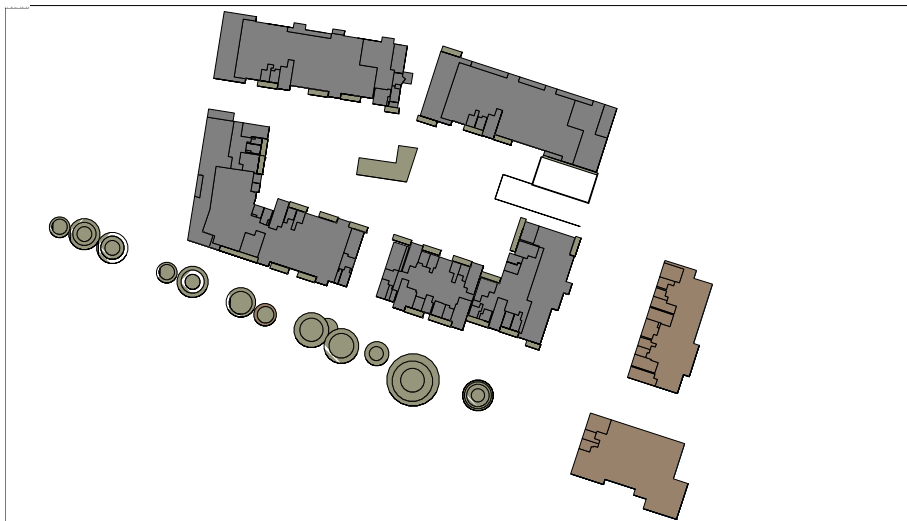
Site Latitude = 53.42

Longitude diff. = -6.27

Model Bearing = 9.00

Sun is not up

Eye: azi = 90.00 alt = 90.00



Suncast image:

View time = 21 Mar 07:00

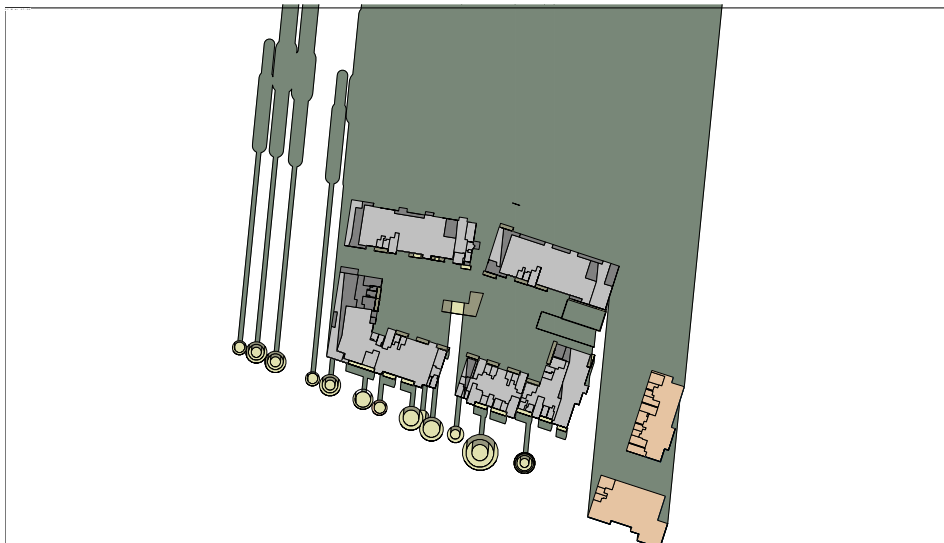
Site Latitude = 53.42

Longitude diff. = -6.27

Model Bearing = 9.00

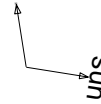
Sun: azi = 95.69 alt = 3.70

Eye: azi = 90.00 alt = 90.00



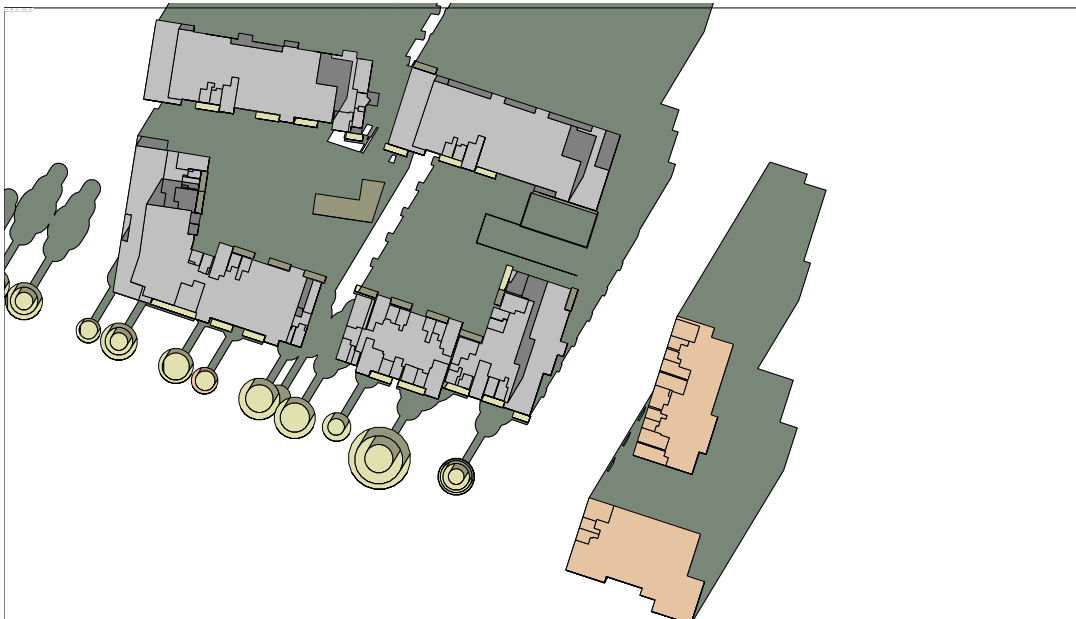
Suncast image:

View time = 21 Mar 08:00
Site Latitude = 53.42
Longitude diff. = -6.27
Model Bearing = 9.00
Sun: azi = 108.02 alt = 12.43
Eye: azi = 90.00 alt = 90.00



Suncast image:

View time = 21 Mar 09:00
Site Latitude = 53.42
Longitude diff. = -6.27
Model Bearing = 9.00
Sun: azi = 121.19 alt = 20.55
Eye: azi = 90.00 alt = 90.00



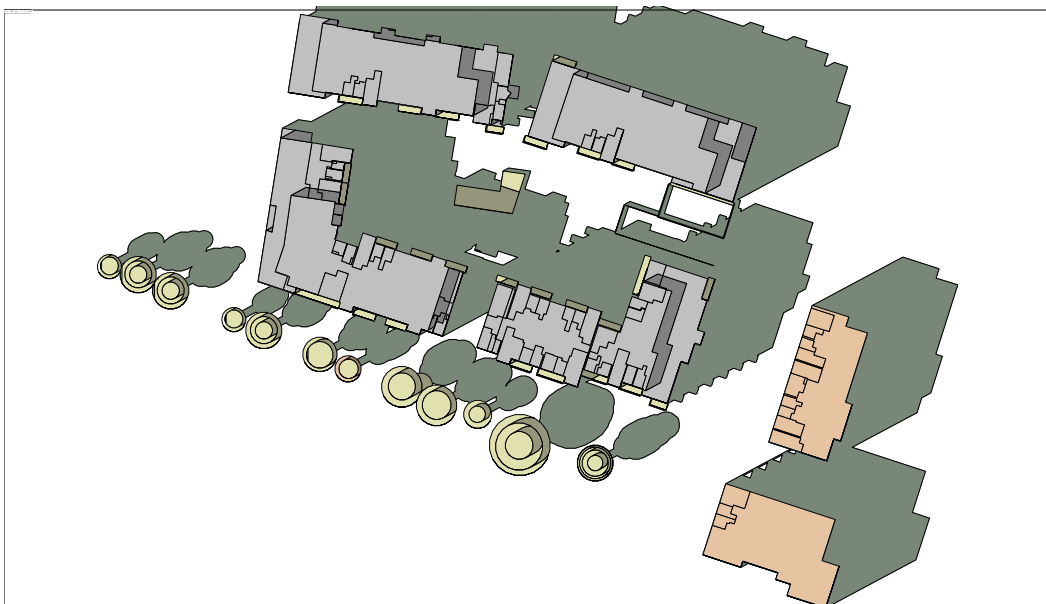
Suncast image:

View time = 21 Mar 10:00
Site Latitude = 53.42
Longitude diff. = -6.27
Model Bearing = 9.00
Sun: azi = 135.74 alt = 27.54
Eye: azi = 90.00 alt = 90.00



Suncast image:

View time = 21 Mar 11:00
Site Latitude = 53.42
Longitude diff. = -6.27
Model Bearing = 9.00
Sun: azi = 152.01 alt = 32.81
Eye: azi = 90.00 alt = 90.00



Suncast image:

View time = 21 Mar 12:00
Site Latitude = 53.42
Longitude diff. = -6.27
Model Bearing = 9.00
Sun: azi = 169.84 alt = 35.74
Eye: azi = 90.00 alt = 90.00



Suncast image:

View time = 21 Mar 13:00
Site Latitude = 53.42
Longitude diff. = -6.27
Model Bearing = 9.00
Sun: azi = 188.36 alt = 35.88
Eye: azi = 90.00 alt = 90.00



Suncast image:

View time = 21 Mar 14:00
Site Latitude = 53.42
Longitude diff. = -6.27
Model Bearing = 9.00
Sun: azi = 206.31 alt = 33.21
Eye: azi = 90.00 alt = 90.00



Suncast image:

View time = 21 Mar 15:00
Site Latitude = 53.42
Longitude diff. = -6.27
Model Bearing = 9.00
Sun: azi = 222.75 alt = 28.14
Eye: azi = 90.00 alt = 90.00



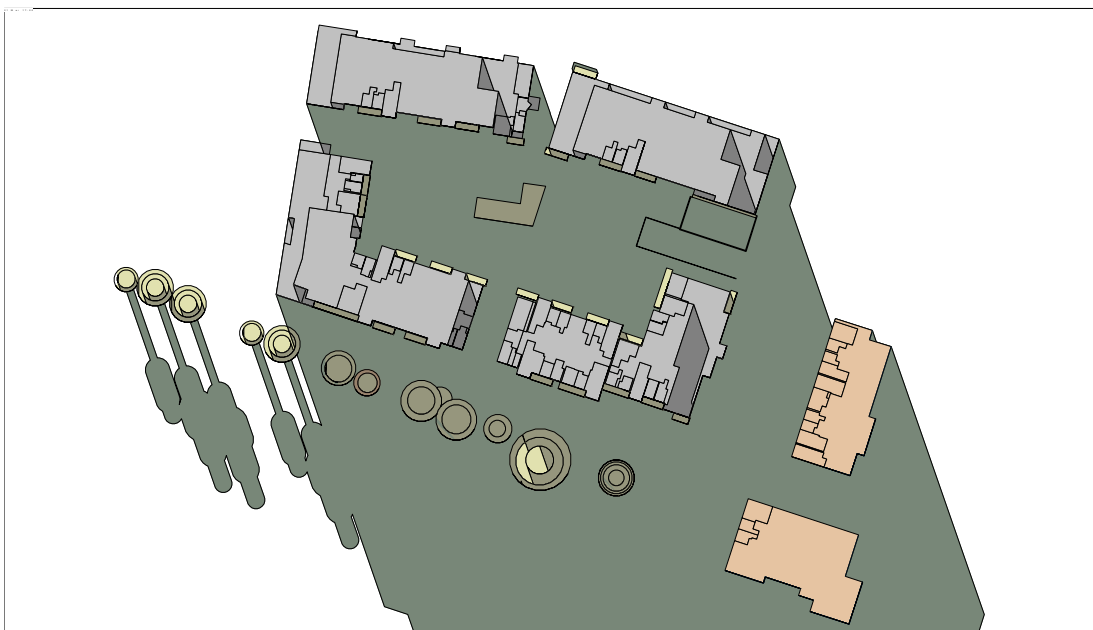
Suncast image:

View time = 21 Mar 16:00
Site Latitude = 53.42
Longitude diff. = -6.27
Model Bearing = 9.00
Sun: azi = 237.46 alt = 21.29
Eye: azi = 90.00 alt = 90.00



Suncast image:

View time = 21 Mar 17:00
Site Latitude = 53.42
Longitude diff. = -6.27
Model Bearing = 9.00
Sun: azi = 250.75 alt = 13.26
Eye: azi = 90.00 alt = 90.00



Suncast image:

View time = 21 Mar 18:00

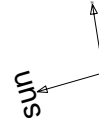
Site Latitude = 53.42

Longitude diff. = -6.27

Model Bearing = 9.00

Sun: azi = 263.13 alt = 4.57

Eye: azi = 90.00 alt = 90.00



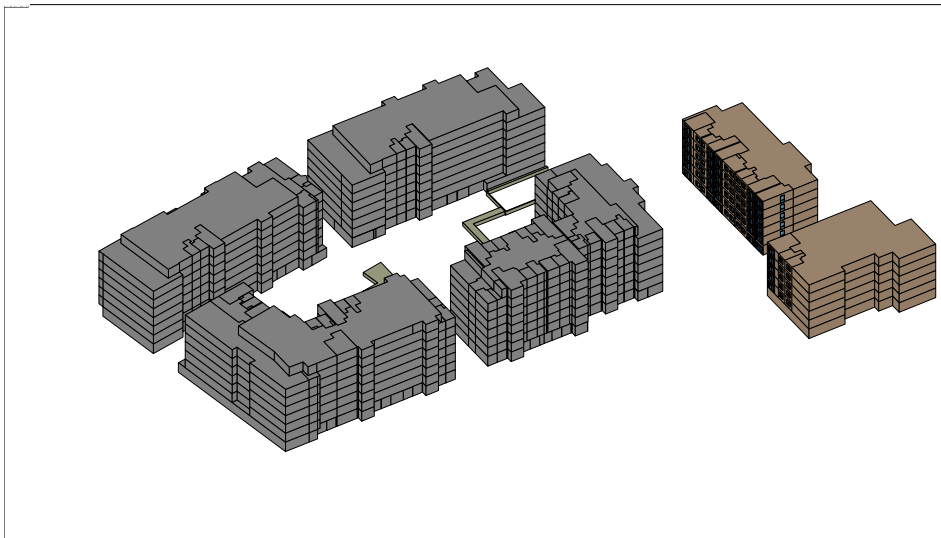
17 Appendix D3: Shadow Path Diagrams for Proposed Scheme with Existing Trees

The shadow path diagrams from 06:00 to 11:00 on 21 March with the existing trees is presented below:

Figure 17-1 Shadow Path Diagram for Existing Trees with Existing Blocks from 06:00 to 11:00 on 21 March

Suncast image:

View time = 21 Mar 06:00
Site Latitude = 53.42
Longitude diff. = -6.27
Model Bearing = 9.00
Sun is not up
Eye: azi = 140.00 alt = 40.00



Suncast image:

View time = 21 Mar 07:00
Site Latitude = 53.42
Longitude diff. = -6.27
Model Bearing = 9.00
Sun: azi = 95.69 alt = 3.70
Eye: azi = 140.00 alt = 40.00



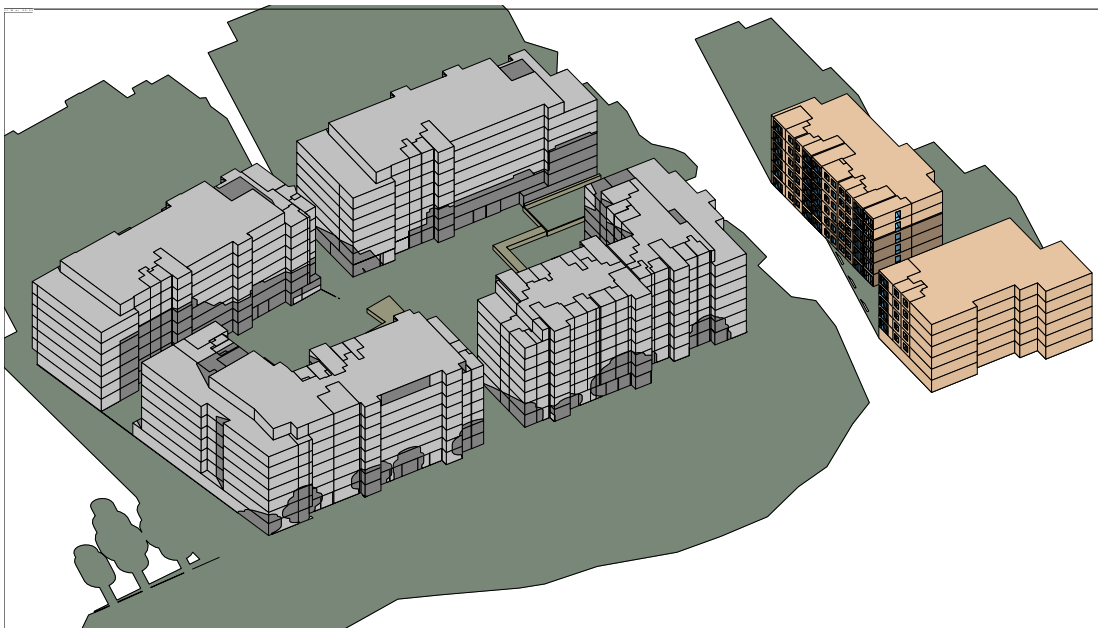
Suncast image:

View time = 21 Mar 08:00
Site Latitude = 53.42
Longitude diff. = -6.27
Model Bearing = 9.00
Sun: azi = 108.02 alt = 12.43
Eye: azi = 140.00 alt = 40.00



Suncast image:

View time = 21 Mar 09:00
Site Latitude = 53.42
Longitude diff. = -6.27
Model Bearing = 9.00
Sun: azi = 121.19 alt = 20.55
Eye: azi = 140.00 alt = 40.00



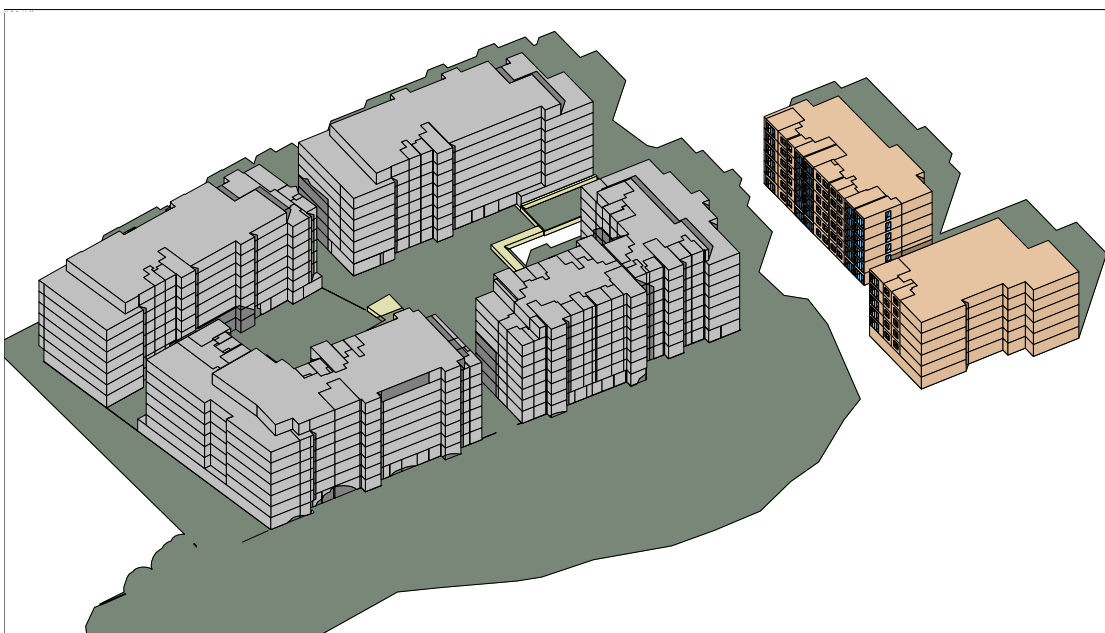
Suncast image:

View time = 21 Mar 10:00
Site Latitude = 53.42
Longitude diff. = -6.27
Model Bearing = 9.00
Sun: azi = 135.74 alt = 27.54
Eye: azi = 140.00 alt = 40.00



Suncast image:

View time = 21 Mar 11:00
Site Latitude = 53.42
Longitude diff. = -6.27
Model Bearing = 9.00
Sun: azi = 152.01 alt = 32.81
Eye: azi = 140.00 alt = 40.00



18 Appendix E: Three-Dimensional Model for Daylight and Sunlight Analysis

Model views of the proposed scheme and existing residences are represented below:

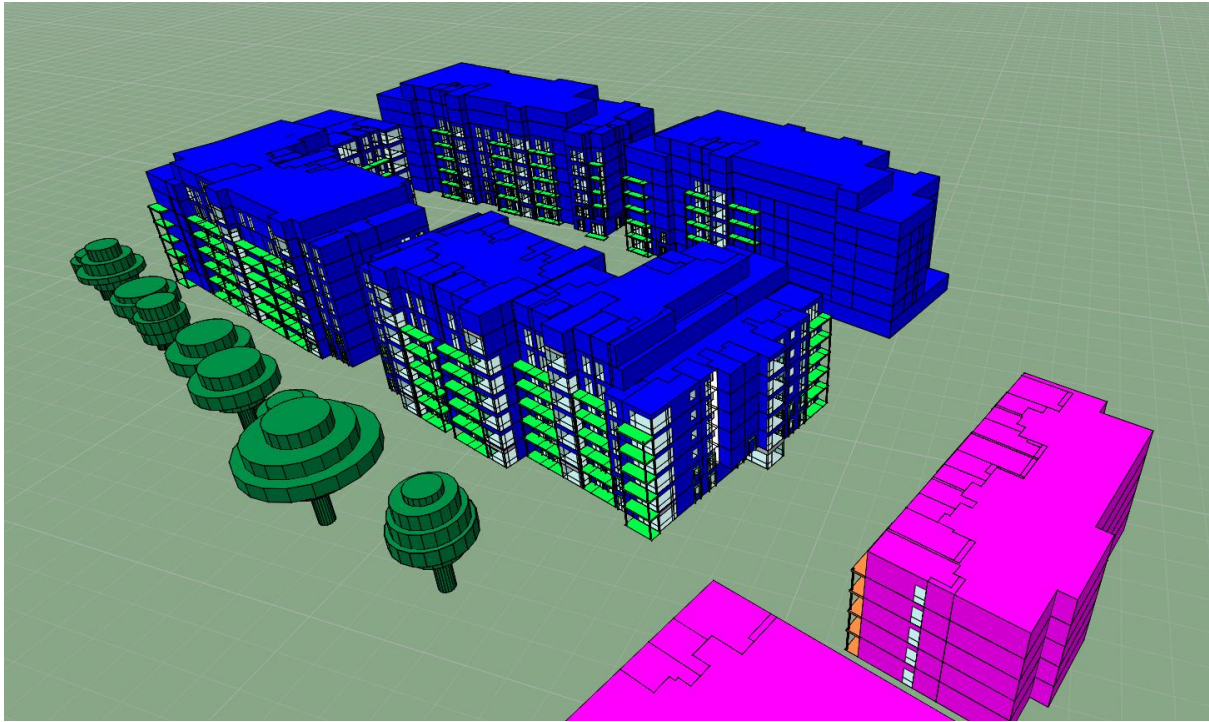


Figure 18-1 Aerial view of the proposed scheme with existing blocks and trees from northeast

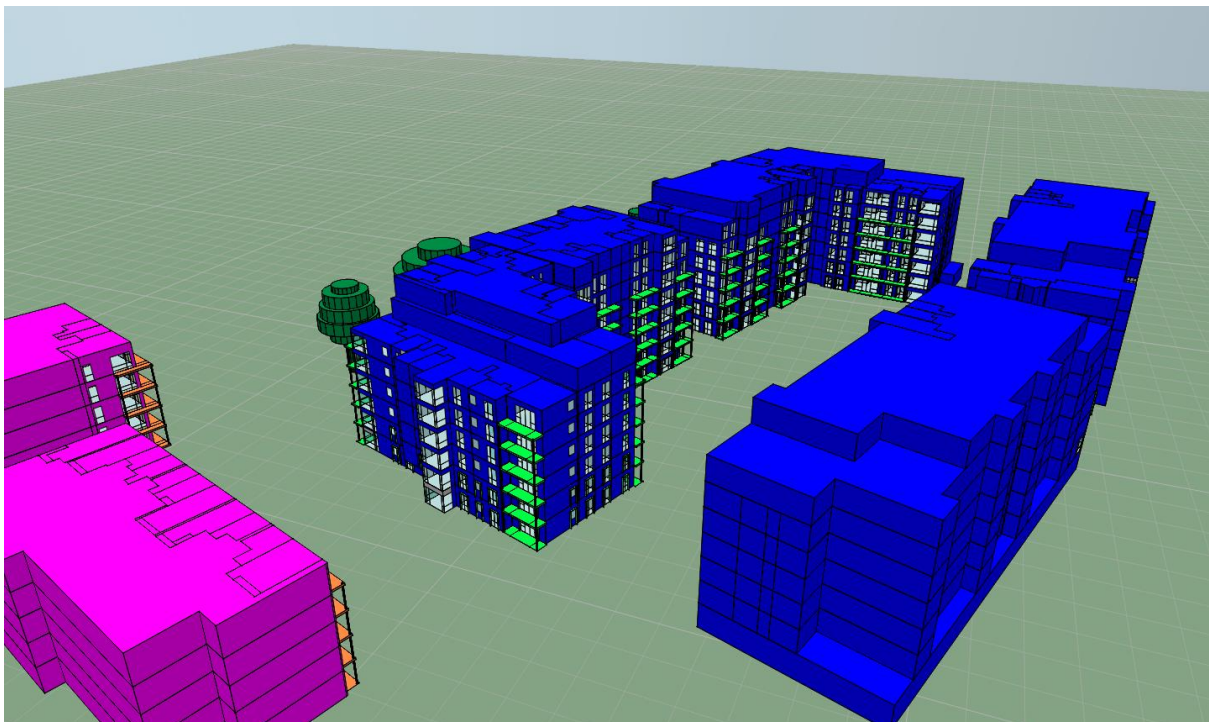


Figure 18-2 Aerial view of the proposed scheme with existing blocks from northwest

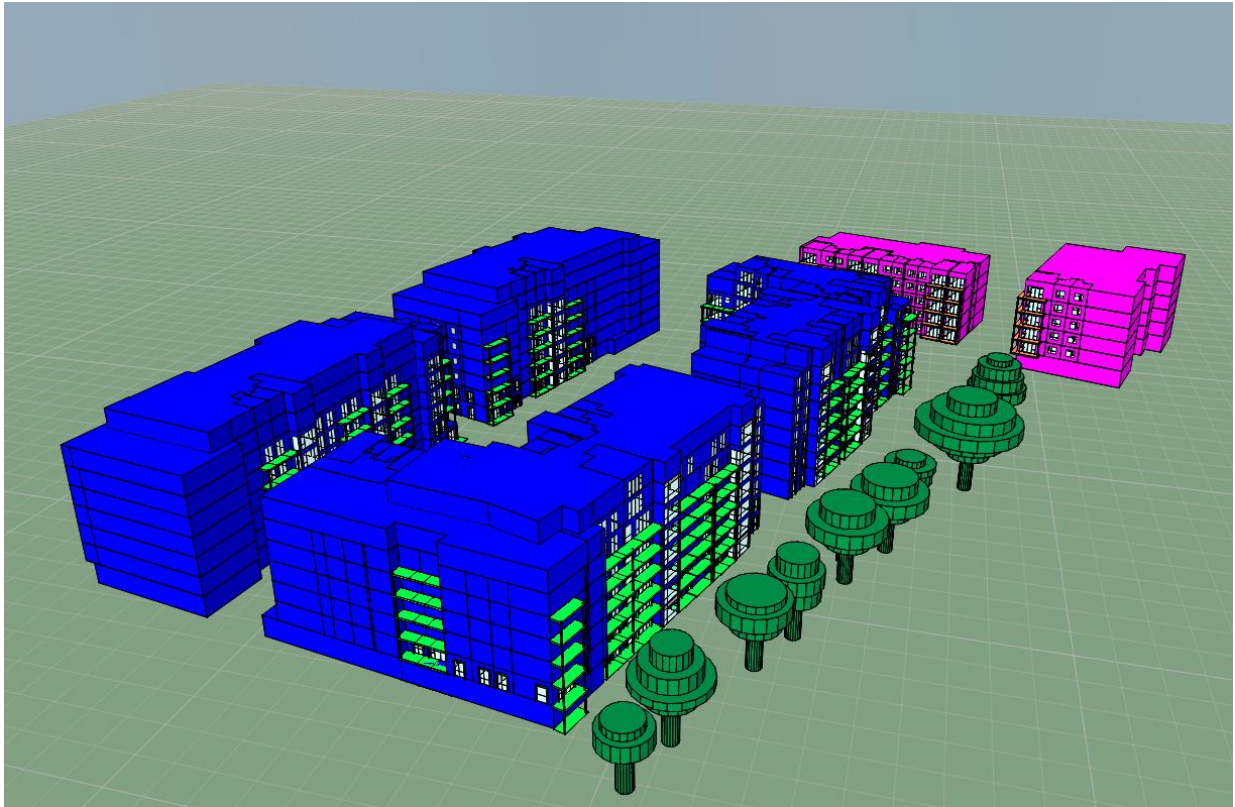


Figure 18-3 Aerial view of the proposed scheme with existing blocks and trees from southeast

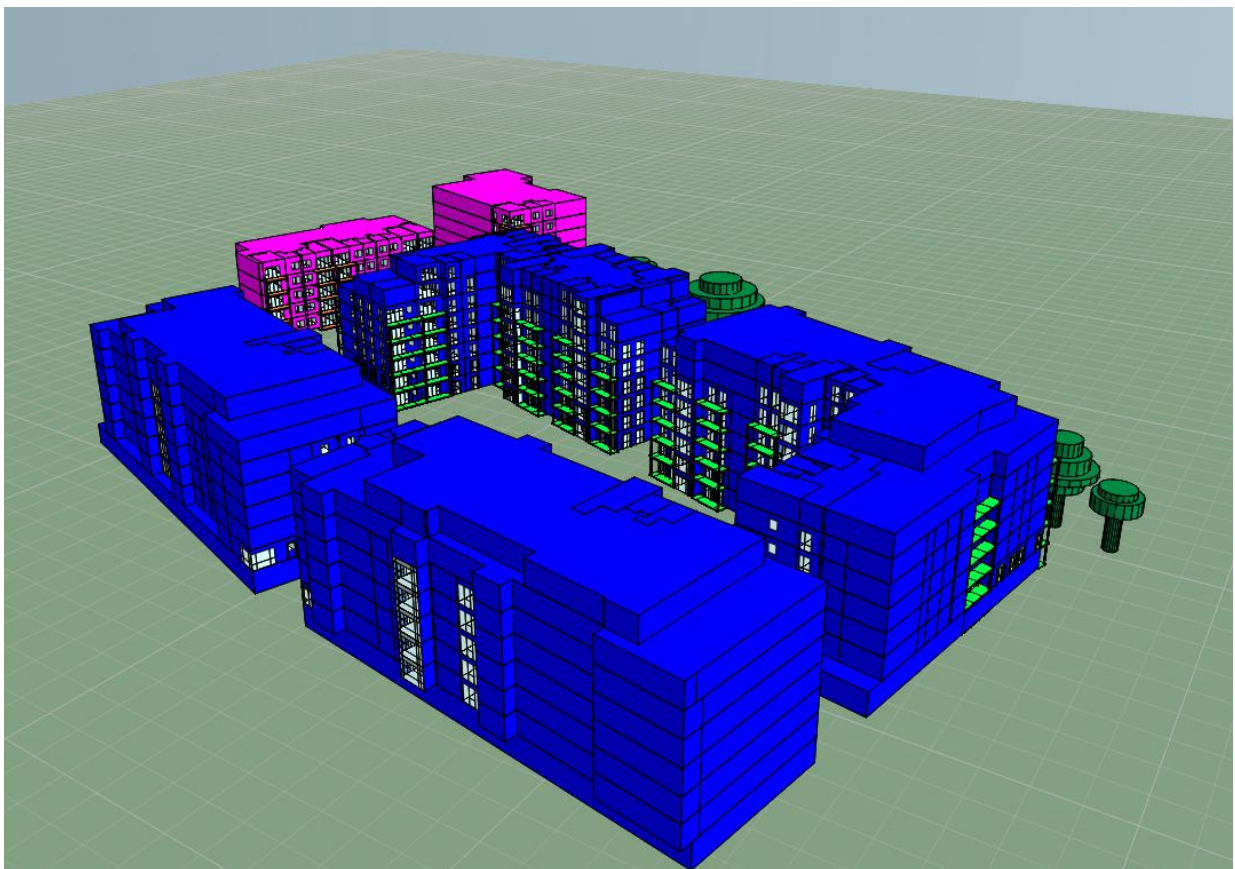


Figure 18-4 Aerial view of the proposed scheme from southwest

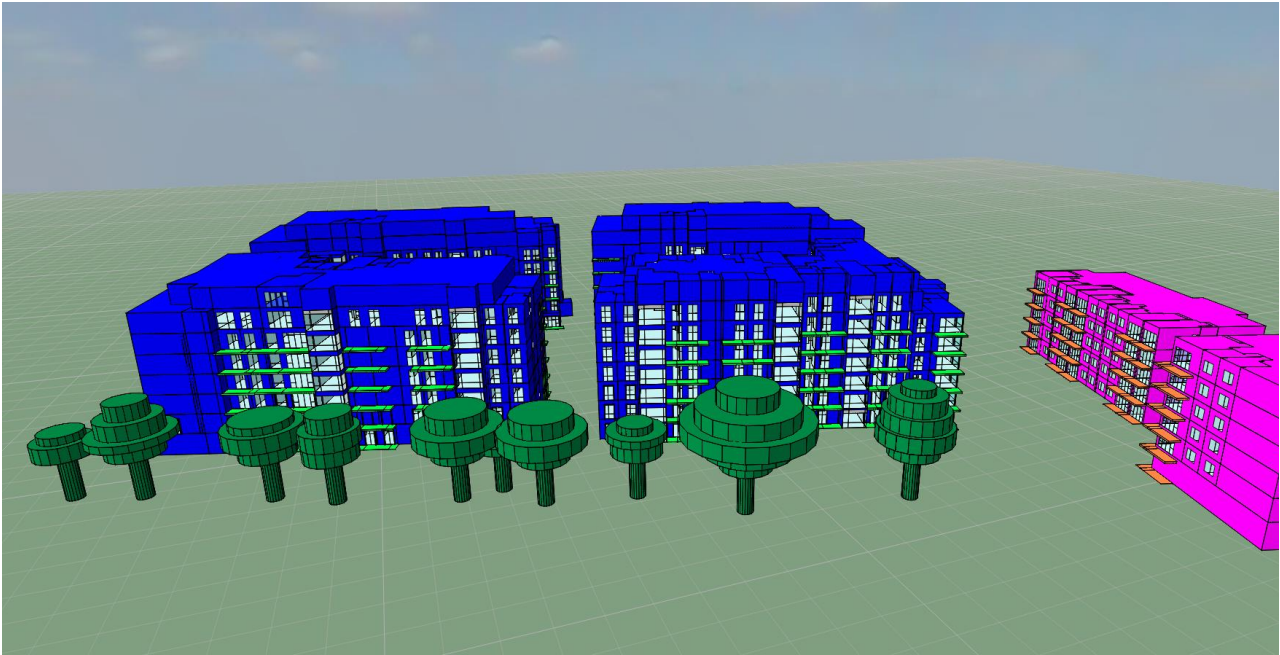


Figure 18-5 Aerial view of the proposed scheme with existing blocks and trees from east

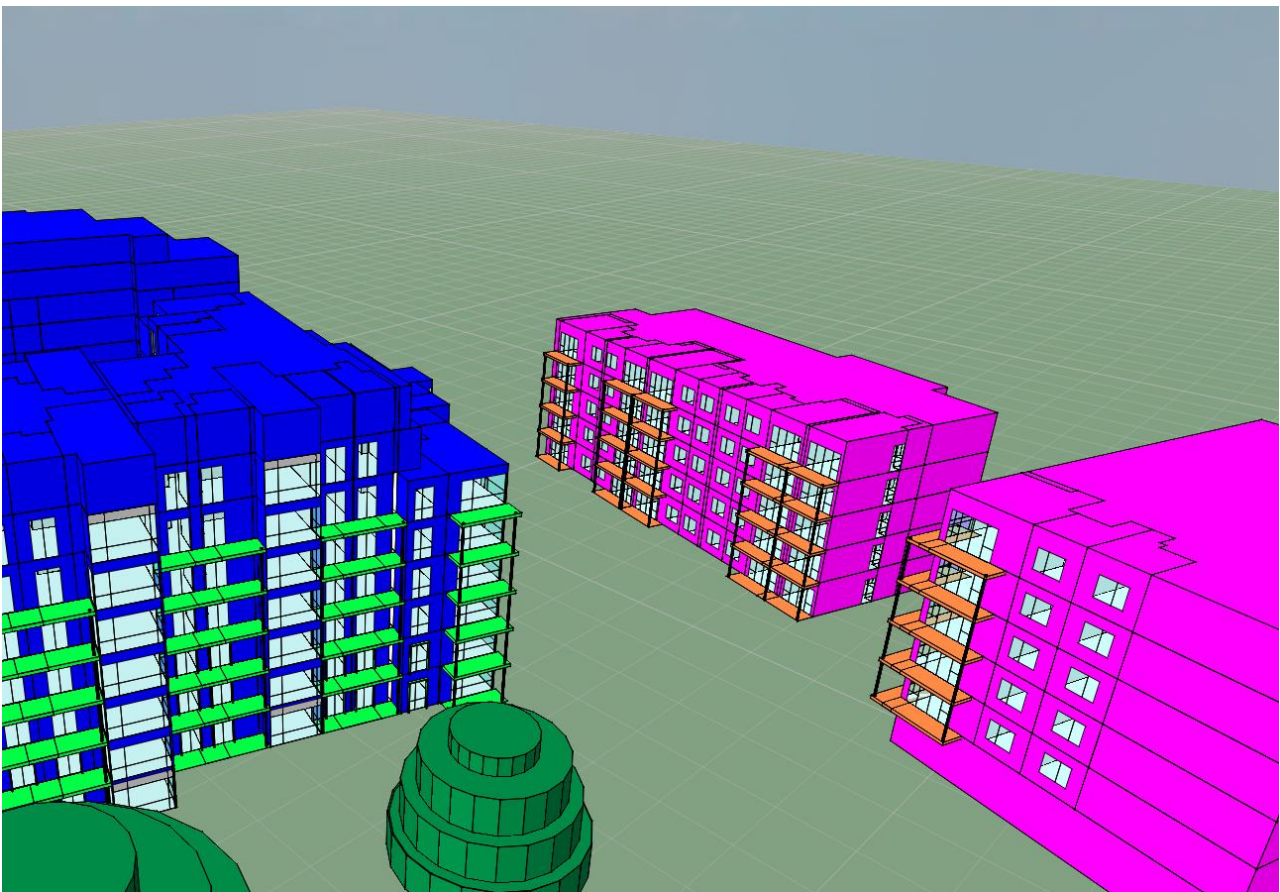


Figure 18-6 Aerial view of the existing blocks and part of block D (proposed) from southeast

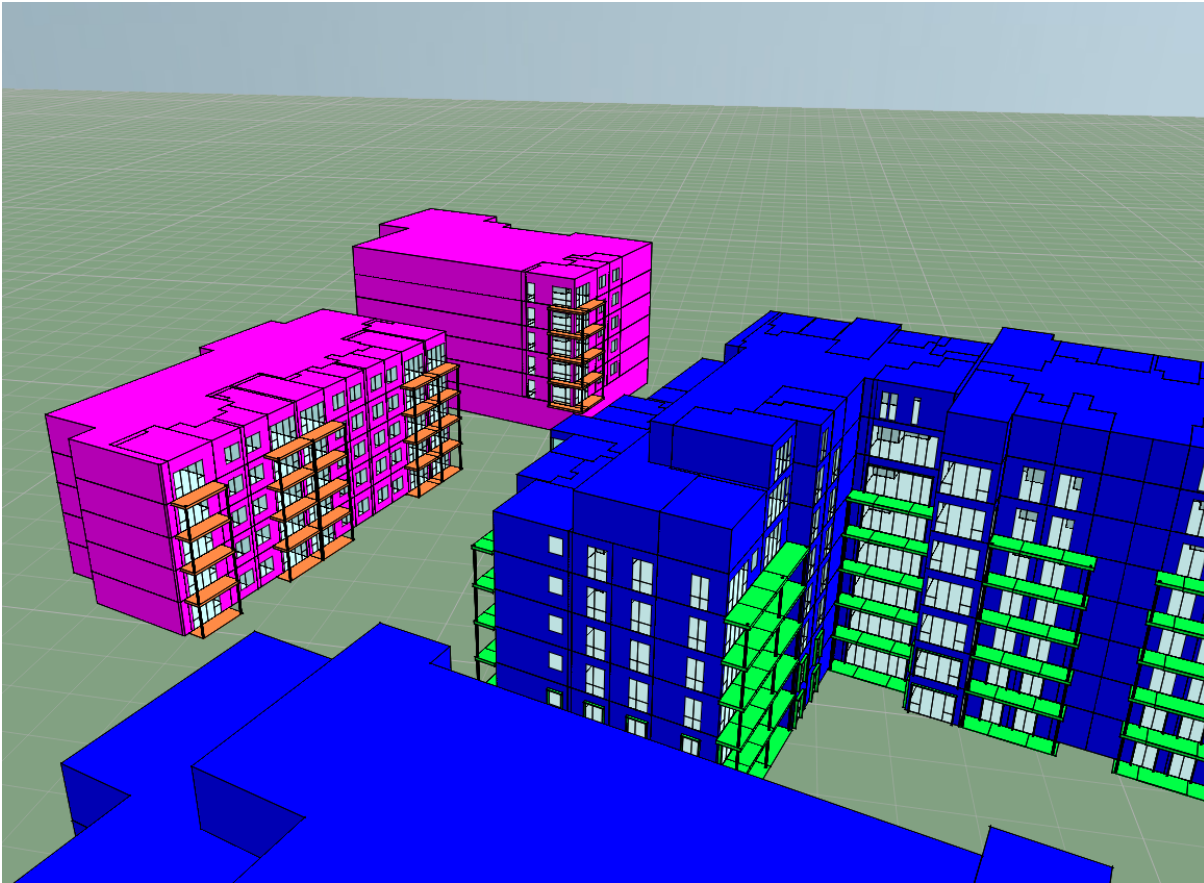


Figure 18-7 Aerial view of the existing blocks and part of block D (proposed) from southwest

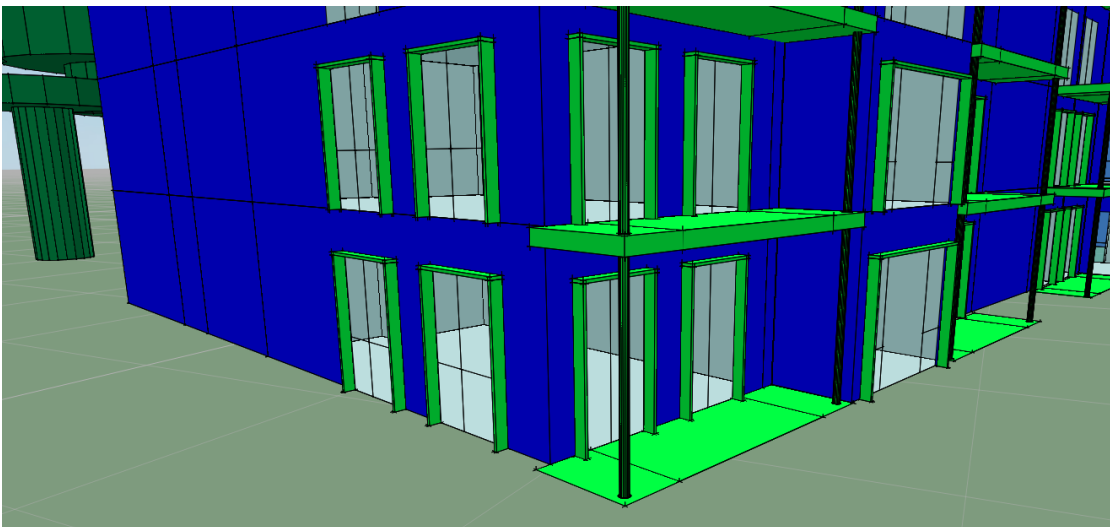


Figure 18-8 Closeup view of typical apartment showing window reveals and balcony overhang

19 Appendix F: References

- [P. a. L. G. Department of Housing, “<https://www.housing.gov.ie/>,” December 2018. [Online].
1 Available:
] https://www.housing.gov.ie/sites/default/files/publications/files/urban_development_and_building_height_guidelines_for_planning_authorities_december_2018.pdf.
- [P. a. L. G. Department of Housing, “<https://www.housing.gov.ie/>,” March 2018. [Online].
2 Available:
] https://www.housing.gov.ie/sites/default/files/publications/files/design_standards_for_new_apartments_-_guidelines_for_planning_authorities_2018.pdf.