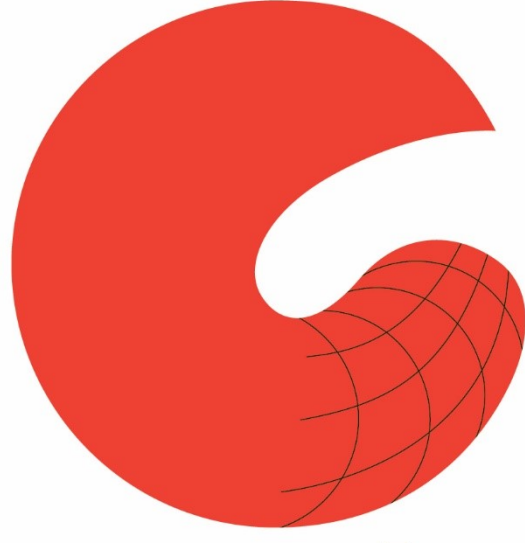




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400 THAMES VALLEY PARK DRIVE – CONVERSION, EARLEY
Daylight & Sunlight Assessment

400 THAMES VALLEY PARK DRIVE – CONVERSION, EARLEY

Daylight & Sunlight Assessment

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Reference: MB/VL/P24-3203/01

Date: May 2024

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Registration of Amendments

Revision and Date	Amendment Details	Revision Prepared By	Revision Approved By

EXECUTIVE SUMMARY

This report assesses the level of daylight and sunlight provision for the proposed new development located at 400 Thames Valley Park Drive – Conversion, Earley, in the Wokingham Borough Council and examines the proposed development's impact on the neighbouring properties and amenity areas.

The development is a permitted development which involves the conversion of a commercial building to residential (Class MA).

This assessment has been undertaken following the guidance given in the Building Research Establishment's (BRE) Publication 'Site Layout Planning for Daylight and Sunlight', 2022 Edition. It calculates the Vertical Sky Component (VSC), Illuminance Levels (Lux) and Annual Probable Sunlight Hours (APSH) for the proposed units and reviews these values in line with BRE guidance. For the existing buildings in the vicinity of the site, the assessment determines the overall reduction in VSC for the relevant windows within the dwellings, which will be experienced following the construction of the proposed extension. It also assesses the APSH for existing living spaces.

It has been established that there are no specific daylight criteria for commercial buildings, therefore the neighbouring non-residential buildings have been excluded from this assessment.

Results for the proposed development

The assessment finds that all of relevant spaces meet the BRE guidance for the recommended level of daylight in new developments.

An assessment of access to sunlight has also been carried out for all living rooms with windows facing within 90 degrees of south. The results confirm that the modelled spaces have achieved the recommended values for average annual and winter sunlight exposure.

Results for existing spaces

There are two buildings close to the proposed development: Oracle 540 and Sanofi UK. Both are commercial buildings. It has been established that there are no specific daylight criteria for commercial buildings; therefore, the neighbouring non-residential buildings can be excluded from this assessment.

Amenity areas

It is concluded that there are no external amenity areas that would be impacted on by the proposed development.

Conclusion

It is concluded that the proposed development will have a satisfactory level of daylight and sunlight in all new spaces and will have a no significant impact on the internal day and sun-light levels in the neighbouring buildings. There is no significant impact caused by the proposed development on the existing buildings.

1.0 INTRODUCTION

- 1.1 Create Consulting Engineers Ltd has been engaged by TVP Investments Limited to conduct a Daylight & Sunlight Assessment in support of a permitted development. The application for development will be submitted under Class (MA) for "*Change of use from commercial building to residential.*" This application pertains to the proposed conversion of a commercial building located at Thames Valley Park, 400 Thames Valley Park Dr, Earley, Reading RG6 1PT, within the Wokingham Borough. This report evaluates the impact of the development proposals on the availability of daylight and sunlight for the proposed dwellings and neighbouring residences surrounding the block. It also provides a comparison with the current existing site conditions.

Site Description and Location

- 1.2 The site is located in the Wokingham Borough, and the proposed development is intended to be carried out at 400 Thames Valley Park Drive – Conversion, Earley. Please refer to the Site Location and plans below for details (Figures 1.1 and 1.2).



Figure 1.1: Proposed site boundary and surrounding buildings (source: Google Earth)

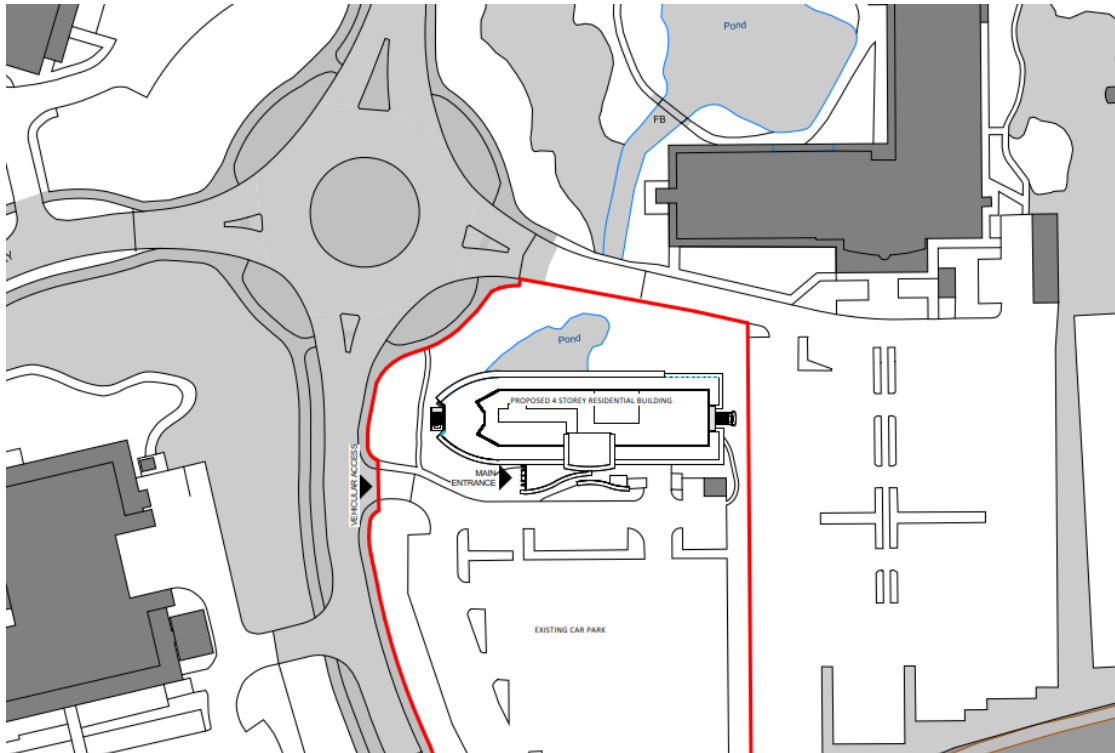


Figure 1.2: Proposed site plan (source: Rohacs Architects)

- 1.3 The site (400 Thames Valley Park Drive) is a commercial building located to the west of Oracle Parkway.

Assessed Spaces

- 1.4 Following the BRE guidance, the following spaces must be included in the assessment:
- For the daylight study – All living rooms, kitchens, bedrooms, and studies in the new proposal and in the neighbouring properties, on affected elevations;
 - For the sunlight study - all living rooms facing within 90 degrees of due south, located in the proposed development and in the surrounding dwellings (where floor layout is known);
 - For the over-shading study – all private gardens and communal sitting areas potentially overshadowed by the proposed development.

Policy Context

Wokingham Borough Core Strategy – Aspirations and Spatial Issues for the Borough

2.68 Overall, taking account of these issues, the aspirations and spatial issues that therefore need to be addressed by the Core Strategy are (in no order of priority):

- i) Delivers sustainable development by providing an acceptable balance of housing and employment including the provision of a full range of services accessible to people;*
- ii) Promotes sustainable use and disposal of resources while mitigating and adapting to climate change;*
- iii) Delivers housing in locations that meet the needs of the community;*
- iv) Supports a sequential approach to new mixed use development locations based primarily on larger scale (SDL) consisting of accessible, high quality, well designed development. The SDL will be supported by Development Briefs to ensure delivery of the essential community facilities and infrastructure required;*
- v) Delivers affordable housing that meets identified local needs;*
- vi) Promotes a transport system that enables access to services by a variety of modes;*
- vii) Protects the character of the borough by maintaining/improving the built/natural environment while mitigating the effect of new development on the environment;*
- viii) Maintains the distinct and separate identity of the borough's settlements;*
- ix) Maintains and enhances all the infrastructure, including roads, railways, schools, healthcare and open space provision through new development, taking account of the health and well being of residents;*
- x) Supports the renaissance of Wokingham and other town centres;*
- xi) Limits development in those areas at most risk of flooding and pollution;*
- xii) Protects the most important areas for biodiversity, landscape and heritage from development;*
- xiii) Maintains and enhances the borough's knowledge and skills base;*
- xiv) Ensures good design which is in keeping with the area*
- xv) Where national and regional policies allow, takes account of the public's views following consultation and engagement.*

- 1.5 This document confirms that the BRE guidance on assessing the level of daylight and sunlight in new and existing buildings should be followed.
- 1.6 The Validation Checklist issued for minor and major developments also states that where the proposed development may have a potentially adverse effect on the daylight and/or sunlight enjoyed by adjoining properties a Daylight/Sunlight Assessment is required to be submitted with the application for permitted development.

- 1.7 This application will be submitted under Class MA for 'change of use from commercial to residential'. As part of the submission, it is required that the following relevant conditions are met:

“For the Class MA application, the regulations require:

- 1) *Development under Class MA is permitted subject to the following conditions.*
- 2) *Before beginning development under Class MA, the developer must apply to the local planning authority for a determination as to whether the prior approval of the authority will be required as to—...(f)the provision of adequate natural light in all habitable rooms of the dwellinghouses (Class MA).”*

2.0 CALCULATION METHODOLOGY

Guidance and Software Used

- 2.1 The provision of daylight access has been assessed based upon the guidance and methodologies detailed in the Building Research Establishment's (BRE) Guide 'Site Layout and Planning for Daylight and Sunlight – a Good Practice Guide', 2022 Edition.
- 2.2 The assessment model was produced using IES VE version 2022.2.0.0, a full dynamic simulation modelling software capable of performing a variety of environment simulations for large and complex buildings. IES VE can produce accurate predictions of several lighting parameters through its SunCast and RadianceIES modules.

25 Degree Line Check

- 2.3 The 25 degree line check is an initial quick test to determine if a new development will impact upon the amount of daylight received by the surrounding buildings, as well as assessing whether the surrounding buildings will impact upon the amount of daylight received within the proposed development.
- 2.4 The 25 degree line check consists of drawing a line in a sectional view from the highest obstructing point to the centre of the assessed window. If the angle of this line exceeds 25° from the perpendicular, then the amount of daylight received by the window is likely to be affected.
- 2.5 For areas identified as failing the 25 degree line check, the BRE guide presents two additional methods for more in-depth daylight analysis. These are the Vertical Sky Component (VSC) and Average Daylight Factors (ADF).

45 Degree Line Check

- 2.6 The 45 degree line check is applicable to extensions or new parts of the development where part of the building is perpendicular to the potentially affected windows. It involves drawing a line on elevation at an angle of 45 degrees away from the near top corner of the perpendicular extension and drawing another line on the plan, also at 45 degrees angle, back towards the window wall from the end of the extension.
- 2.7 The 45 degree line check is not applicable for this site as the main parts of the proposed building are not perpendicular to any of the existing residential buildings.

Vertical Sky Component (VSC)

- 2.8 The Vertical Sky Component is a measure of the amount of skylight incident on a vertical plane. It is most commonly applied to the light incident at the centre of a window, and in this sense is a measure of the potential for good day light. The VSC is calculated by taking the ratio of the skylight incident at a point to the unobstructed skylight available at that same point on a horizontal plane. For a uniform sky, the maximum value is 50% (since the point is on a vertical plane, clearly only half the hemisphere can contribute). For a CIE sky, which for the purposes of the daylight & sunlight study is a standard overcast sky, the maximum value is 39.6%. VSC calculations have been undertaken using computer-based simulation.

Illuminance Check

- 2.9 The illuminance recommendations are based around the illuminances that would be met or exceeded over half of the room, over half of daylight hours over the year. BS EN 17037 gives a range of recommendations for high, medium and minimum daylight provision. The National Annex A also gives minimum values for housing in living rooms, kitchens and bedrooms. These are minimum recommended values for locations where a predominantly daylight appearance is not achievable, e.g., where external obstructions are present.

Sunlight Analysis

- 2.10 The measure of sunlight that a given window may expect over a year period is known as the Annual Probable Sunlight Hours (APSH) and expressed as a percentage. Due to the sun's path across our sky, north facing windows are able to receive direct sunlight on only a small number of occasions per year and windows facing east or west will typically only receive sunlight in the morning or evening. Therefore, BRE guidance states that only windows with an orientation 90° of south need be assessed.
- 2.11 Sunlight access and overshadowing impact have been determined using a 3D computer simulation of the proposed development and a sun path calculation tool to determine the difference in direct solar exposure between the existing and proposed developments.

Limitations and Assumptions

- 2.12 The following assumptions and limitations have been made within this assessment:
- Location and sizes of openings to the assessed neighbouring dwellings at Ray Court and Stanmore House are based on street view photographs and the site topographical survey provided by the client as well as historic drawings and sales documents available online.
 - Ground topography has been simplified based on the site topographical survey drawing prepared by Rohacs Architects, dated December 2023.

-
- Reflectance and transmittance values for all glazing as well as for external walls, balconies, internal walls and ceilings are based on information acquired from the IES Construction Database and to align with the BRE recommendations.

3.0 DAYLIGHT (VSC)

- 3.1 The assessment of Daylight has been undertaken using Vertical Sky Component (VSC).
- 3.2 The VSC calculation has been assessed against the guidance given in the BRE publication 'Site Layout Planning for Daylight and Sunlight'. The VSC check is used to assess the daylight access to a vertical surface such as a window. VSC calculations produce a value between 0 and 40%.
- 3.3 If the calculated VSC for a window is greater than 27% then the window is considered to receive enough skylight. If the VSC for the buildings surrounding the proposed development, is both less than 27% and less than 0.8 times its former value ('existing' case), occupants of the existing building will notice the reduction in the amount of skylight.
- 3.4 Comments by the Greater London Authority (GLA), in the context of a planning appeal, are also noted:

"It should, nevertheless, be noted that the 27% VSC target value is derived from a low-density suburban housing model. The independent daylight and sunlight review states that in an inner-city urban environment, VSC values more than 20% should be considered as reasonably good, and that VSC in the mid-teens should be acceptable. However, where the VSC value falls below 10% (to be in single figures), the availability of direct light from the sky will be poor."

Source: Greater London Authority, representation hearing report D&P/3067/03 – Appendix 1, 18/11/2013

- 3.5 VSC check should be carried out for all 'main windows' which are defined as openings serving living rooms, dining rooms, studies, kitchens and bedrooms. Windows to bathrooms, toilets, storerooms and circulation do not have to be analysed.
- 3.6 VSC checks have been undertaken for all of the openings to main rooms within the proposed development and relevant openings in existing neighbouring buildings.
- 3.7 It should be noted that the VSC check measures the illuminance of a surface, as opposed to the level of light that is transmitted through an opening. Subsequently, the precise geometric dimensions of any window or surface assessed are less important than its relative position to any obstructions.

Results of the calculations for the proposed development

- 3.8 The numerical results of the VSC calculations for all the assessed windows calculated for the proposed development are detailed in Appendix A. The results confirm that the majority of windows pass the VSC check. Please refer to figures below for visual representation of VSC check results.

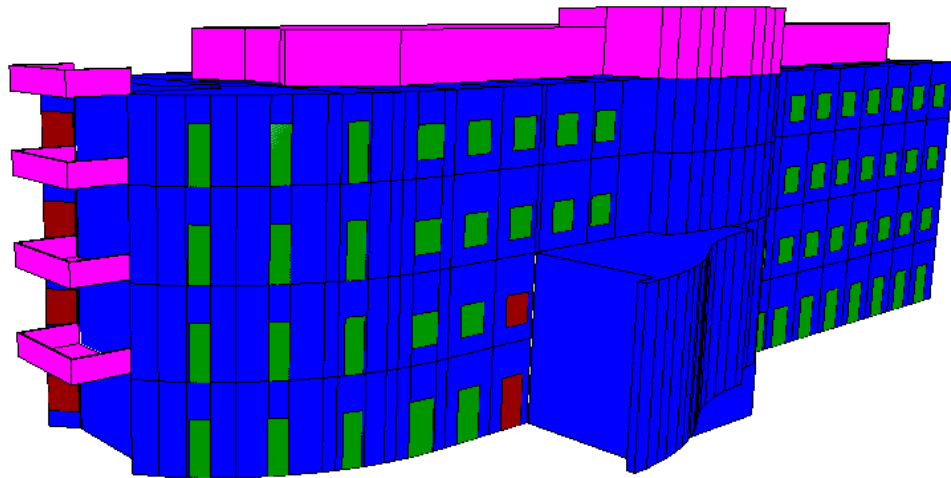


Figure 3.1: Visual representation of VSC results for the proposed building – south and west elevation; green areas indicate a passing window (extracted from IES Radiance)

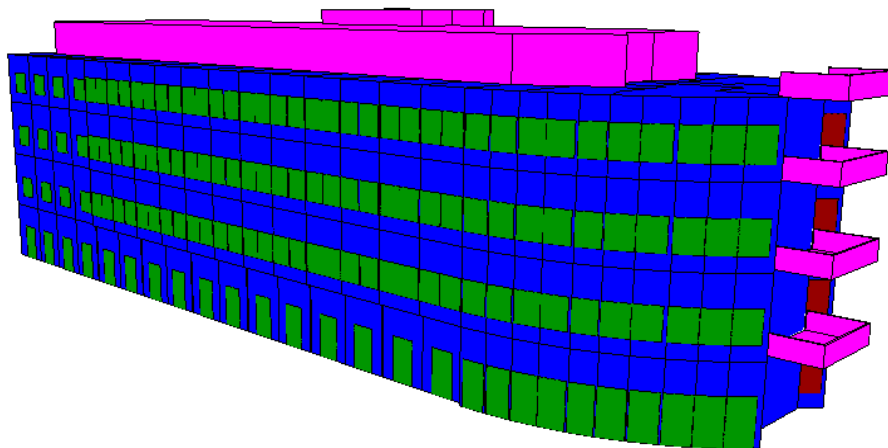


Figure 3.2: Visual representation of VSC results for the proposed building – north elevation; green areas indicate a passing window (extracted from IES Radiance)

Total Assessed Windows:	216		
VSC Pass	206	95%	100%
VSC Marginal Fail (Pass2: VSC>15)	10	5%	
VSC Fail	0		

Table 3.1: VSC Results for Proposed Development

- 3.9 The overall scheme will attain an exceptionally high level of daylight compliance, as all 216 windows evaluated for VSC (100%) meet the BRE Guidelines.

Results of the calculations for existing dwellings

- 3.10 Two buildings, Oracle 540 and Sanofi UK, are situated near the proposed development. Both are commercial buildings. Since there are no specific daylight criteria established for commercial buildings, the neighbouring non-residential buildings can be excluded from this assessment.

4.0 ILLUMINANCE METHOD

- 4.1 Illuminance is a measure of the amount of light falling on a surface, usually measured in lux.
- 4.2 Illuminance method involves using climatic data for the location of the site to calculate the illuminance from daylight at each point on an assessment grid on the reference plane at an at least hourly interval for a typical year.
- 4.3 For compliance with the BRE standard (and BS EN 17037) a daylight space should achieve the minimum level of recommendation. This is shown in the table 4.1 below.

Level of recommendation	Target illuminance Et (lx) for 50% of assessment grid	Target illuminance Et (lx) for 95% of assessment grid
Minimum	300	100
Medium	500	300
High	750	500

Table 4.1: Illuminance targets

- 4.4 Additionally, according to the UK National Annex, the illuminance recommendations for daylight provision in UK dwellings is as below:

Room type	Target illuminance Et (lx) for 50% of assessment grid
Bedroom	100
Living room	150
Kitchen	200

Table 4.2: Illuminance targets for UK dwellings according to UK National Annex

- 4.5 Where the room is designed to serve as kitchen, dining and living area, the higher kitchen target might be difficult to achieve due to the room's depth. In such circumstances the recommended illuminance value for living rooms would be more appropriate, as it usually is the predominant space use.
- 4.6 The illuminance check for the proposed development has not been carried out because all habitual rooms receive a good amount of daylight, and no window has a VSC<15. Therefore, no illuminance check was conducted.

5.0 SUNLIGHT ANALYSIS (APSH)

- 5.1 Sunlight is direct light from the sun, as opposed to diffused light which is measured through the daylight factor method.

Access to Sunlight (APSH)

- 5.2 The BRE guidance requires that access to sunlight be considered and that sunlight availability be maximised without overheating the space. The guidance recommends that where practical, at least one window to a main living room faces within 90 degrees of south and should receive at least 25% of annual probable sunlight hours including at least 5% of Annual Probable Sunlight Hours (APSH) between 21st September and 21st March, where possible.
- 5.3 Consequently, to assess the loss of sunlight to an existing building, it is recommended that **all main living rooms** of dwellings should be checked **if they have a window facing within 90 degrees of due south**. The BRE guidance states that the check for those windows should meet the following criteria:
- Receive at least 25% of APSH, including at least 5% of APSH in winter months between September 21st and March 21st; failing this, the openings should:
 - Receive at least 80% of its former sunlight hours both annually and during the winter months and;
 - Have a reduction in sunlight received over the whole year of less than 4% of APSH.
- 5.4 If the above criteria are met, the change in the sunlight levels received by the existing building will not be adversely affected.
- 5.5 The IES VE SunCast module has been used to calculate the annual probable sunlight hours (APSH) for the existing site and the proposed development.
- 5.6 The analysis of the site location plan confirms that the windows located in the following buildings should be assessed for level of sunlight received:
- 400 Thames Valley Park Drive (Proposed Development) –The windows on the south, east, and west elevations of the development, serving living rooms, have been assessed.

Results for the Proposed Development

- 5.7 The results show that all windows in kitchen/living rooms orientated within 90 degrees due south pass the above criteria. Detailed results of APSH calculations for the identified windows are shown in Appendix B.
- 5.8 The results show that 100% of the assessed windows within 90° of due south in the proposed development meet the sunlight criteria.
- 5.9 To determine whether an adequate amount of sunlight is achieved within a room, the following criteria need to be met: at least one main window wall should face within 90° of due south. Additionally, at least one window should receive a minimum of 25% of annual probable sunlight hours, including at least 5% during the winter months between September 21st and March 21st. All the windows within 90° of due south of living rooms meet the above criteria. Therefore, the rooms should be receiving an adequate amount of sunlight. With this information, it can be concluded that the proposed development receives an adequate amount of sunlight.
- 5.10 Regarding sunlight (APSH), the scheme will achieve a very high level of BRE compliance, as all the windows within 90° of due south in the proposed development meet the sunlight criteria.

Results for Neighbouring Buildings

- 5.11 Two buildings, Oracle 540 and Sanofi UK, are situated near the proposed development. Both are commercial buildings. Since there are no specific daylight criteria established for commercial buildings, the neighbouring non-residential buildings can be excluded from this assessment.

Over-shading of Gardens and Open Spaces

- 5.12 According to the BRE guide, the availability of sunlight should also be checked for all open spaces “where it will be required”. It suggests that assessments should include:
- Main, back gardens of a house;
 - Parks and playing fields;
 - Sitting out areas, such as those in public squares;
 - Other areas e.g., children’s playgrounds, paddling pools, fountains etc.
- 5.13 Following the above recommendations and the review of the outdoor spaces surrounding the proposed development and the adjacent plots, it has been concluded that the only relevant outdoor space in close vicinity to the proposed development is the sitting out areas of the Oracle 540, located to the east, and Sanofi UK, located to the south of the proposal.
- 5.14 The BRE guide further recommends that *"as a check (...) at least half of the amenity areas listed above should receive at least two hours of sunlight on 21 March."*
- 5.15 Based on the hourly images for the spring equinox, it is clear that the shade created by the proposed development does not affect the assessed area. Please refer to Appendix C for the shading images.

6.0 CONCLUSION

- 6.1 This assessment has been undertaken following the guidance given in the Building Research Establishment's (BRE) Publication 'Site Layout Planning for Daylight and Sunlight'.
- 6.2 The assessment indicates that all the habitual spaces in the proposed development meet the recommended values for VSC and APSH. The results demonstrate that the proposal will ensure that all new flats receive an adequate level of daylight and sunlight.
- 6.3 The neighbouring amenity areas have been assessed to determine the level of sunlight received by the external spaces. It has been found that areas of relevance will not be affected by the proposed development.
- 6.4 It is concluded that the proposed development will have a no significant impact on the neighbouring buildings.

7.0 DISCLAIMER

- 7.1 Create Consulting Engineers Ltd disclaims any responsibility to the Client, TVP Investments Limited and others in respect of any matters outside the scope of this report.
- 7.2 The copyright of this report is vested in Create Consulting Engineers Ltd. The Client, TVP Investments Limited or their appointed representatives, may copy the report for purposes in connection with the development described herein. It shall not be copied by any other party or used for any other purposes without the written consent of Create Consulting Engineers Ltd.
- 7.3 Create Consulting Engineers Ltd accepts no responsibility whatsoever to other parties to whom this report, or any part thereof, is made known. Any such other parties rely upon the report at their own risk.

APPENDICES

APPENDIX A

Num	Zone	Surface	Opening	VSC	Status	Location Description
1	GF000000	2	0	39.55	Pass	
2	GF000000	3	0	39.59	Pass	
3	GF000000	4	0	38.83	Pass	
4	GF000000	5	0	39.94	Pass	
5	GF000000	6	0	39.83	Pass	
6	GF000000	16	0	20.77	Pass2	
7	GF000002	2	0	39.75	Pass	
8	GF000002	3	0	40.35	Pass	
9	GF000002	4	0	39.58	Pass	
10	GF000001	10	0	39.35	Pass	
11	GF000001	11	0	39.6	Pass	
12	GF000009	2	0	38.65	Pass	
13	GF00000A	2	0	19.88	Pass2	
14	GF00000A	5	0	38.76	Pass	
15	GF00000A	8	0	39.19	Pass	
16	GF00000C	6	0	35.96	Pass	
17	GF00000D	5	0	30.44	Pass	
18	GF000011	4	0	21.29	Pass2	
19	GF000012	3	0	39.12	Pass	
20	GF000016	2	0	39.08	Pass	
21	GF000017	3	0	38.79	Pass	
22	GF00001B	2	0	38.81	Pass	
23	GF00001C	3	0	38.72	Pass	
24	GF000020	2	0	38.25	Pass	
25	GF000021	3	0	37.94	Pass	
26	GF000025	2	0	37.89	Pass	
27	GF000026	3	0	37.44	Pass	
28	GF00002A	2	0	37.43	Pass	
29	GF00002B	3	0	36.85	Pass	
30	GF00002F	2	0	36.53	Pass	
31	GF000030	3	0	36.3	Pass	
32	GF000034	2	0	35.91	Pass	
33	GF000037	2	0	35.59	Pass	
34	GF000039	3	0	37.55	Pass	
35	GF000039	4	0	35.19	Pass	
36	GF00003B	3	0	38.17	Pass	
37	GF00003B	4	0	39.9	Pass	
38	GF00003C	5	0	39.89	Pass	
39	GF000040	4	0	39.8	Pass	
40	GF000043	3	0	39.91	Pass	
41	GF000045	4	0	39.72	Pass	
42	GF000048	3	0	39.61	Pass	
43	GF000049	6	0	39.45	Pass	
44	GF00004D	4	0	37.56	Pass	
45	GF000050	2	0	39.8	Pass	
46	GF000050	3	0	40.08	Pass	
47	GF000050	4	0	39.84	Pass	
48	GF000050	5	0	39.91	Pass	
49	GF000050	6	0	39.92	Pass	
50	GF000050	16	0	20.64	Pass2	
51	GF000051	2	0	39.99	Pass	

Num	Zone	Surface	Opening	VSC	Status	Location Description
52	GF000051	3	0	39.78	Pass	
53	GF000051	4	0	39.72	Pass	
54	GF000053	10	0	39.79	Pass	
55	GF000053	11	0	40.01	Pass	
56	GF000058	2	0	39.36	Pass	
57	GF000059	2	0	19.61	Pass2	
58	GF000059	5	0	39.35	Pass	
59	GF000059	8	0	39.53	Pass	
60	GF00005C	6	0	38.34	Pass	
61	GF00005D	5	0	35.33	Pass	
62	GF000061	4	0	25.54	Pass2	
63	GF000080	3	0	38.14	Pass	
64	GF000084	2	0	38.46	Pass	
65	GF000087	2	0	38.15	Pass	
66	GF000089	3	0	38.41	Pass	
67	GF000089	4	0	38.06	Pass	
68	GF00008B	3	0	38.76	Pass	
69	GF00008B	4	0	40.01	Pass	
70	GF00008C	5	0	40	Pass	
71	GF000090	4	0	39.82	Pass	
72	GF000093	3	0	39.81	Pass	
73	GF000095	4	0	39.99	Pass	
74	GF000098	3	0	39.66	Pass	
75	GF000099	6	0	39.58	Pass	
76	GF00009D	4	0	35.82	Pass	
77	FF000000	2	0	39.59	Pass	
78	FF000000	2	1	39.66	Pass	
79	FF000001	2	0	39.65	Pass	
80	FF000001	2	1	39.52	Pass	
81	FF000002	2	0	39.52	Pass	
82	FF000002	2	1	39.56	Pass	
83	FF000003	2	0	39.52	Pass	
84	FF000003	2	1	39.66	Pass	
85	FF000004	2	0	39.53	Pass	
86	FF000004	2	1	39.54	Pass	
87	FF000005	2	0	39.26	Pass	
88	FF000005	2	1	39.31	Pass	
89	FF000006	2	0	39.27	Pass	
90	FF000006	2	1	39.23	Pass	
91	FF000007	2	0	39.24	Pass	
92	FF000007	2	1	39.05	Pass	
93	FF000008	2	0	39.12	Pass	
94	FF000008	2	1	39.14	Pass	
95	FF000009	2	0	38.95	Pass	
96	FF000009	2	1	38.72	Pass	
97	FF00000A	2	0	38.87	Pass	
98	FF00000A	2	1	38.77	Pass	
99	FF00000B	2	0	38.71	Pass	
100	FF00000B	2	1	38.69	Pass	
101	1F000000	2	0	39.98	Pass	
102	1F000000	3	0	39.85	Pass	
103	1F000000	4	0	39.94	Pass	

Num	Zone	Surface	Opening	VSC	Status	Location Description
104	1F000000	5	0	40.01	Pass	
105	1F000000	6	0	39.94	Pass	
106	1F000000	16	0	20.82	Pass2	
107	1F000001	2	0	40.08	Pass	
108	1F000001	3	0	39.82	Pass	
109	1F000001	4	0	39.75	Pass	
110	1F000003	10	0	39.99	Pass	
111	1F000003	11	0	40.11	Pass	
112	1F000008	2	0	39.77	Pass	
113	1F000009	2	0	19.24	Pass2	
114	1F000009	5	0	39.76	Pass	
115	1F000009	8	0	39.87	Pass	
116	1F00000C	6	0	39.76	Pass	
117	1F00000D	5	0	39.72	Pass	
118	1F000011	4	0	39.67	Pass	
119	1F000024	3	0	39.6	Pass	
120	1F000028	2	0	39.81	Pass	
121	1F00002B	2	0	39.69	Pass	
122	1F00002D	3	0	38.79	Pass	
123	1F00002D	4	0	39.77	Pass	
124	1F00002F	3	0	39.14	Pass	
125	1F00002F	4	0	39.99	Pass	
126	1F000030	5	0	39.97	Pass	
127	1F000034	4	0	39.97	Pass	
128	1F000037	3	0	39.95	Pass	
129	1F000039	4	0	39.95	Pass	
130	1F00003C	3	0	39.83	Pass	
131	1F00003D	6	0	39.53	Pass	
132	1F000041	4	0	34.3	Pass	
133	1F000042	2	0	39.87	Pass	
134	1F000042	2	1	39.89	Pass	
135	1F000043	2	0	39.91	Pass	
136	1F000043	2	1	40	Pass	
137	1F000044	2	0	40.01	Pass	
138	1F000044	2	1	39.96	Pass	
139	1F000045	2	0	39.96	Pass	
140	1F000045	2	1	39.87	Pass	
141	1F000046	2	0	39.87	Pass	
142	1F000046	2	1	39.83	Pass	
143	1F000047	2	0	39.84	Pass	
144	1F000047	2	1	39.81	Pass	
145	1F000048	2	0	39.86	Pass	
146	1F000048	2	1	39.93	Pass	
147	1F000049	2	0	39.85	Pass	
148	1F000049	2	1	39.87	Pass	
149	1F00004A	2	0	39.89	Pass	
150	1F00004A	2	1	39.99	Pass	
151	1F00004B	2	0	39.73	Pass	
152	1F00004B	2	1	39.89	Pass	
153	1F00004C	2	0	39.76	Pass	
154	1F00004C	2	1	39.9	Pass	
155	1F00004D	2	0	39.83	Pass	

Num	Zone	Surface	Opening	VSC	Status	Location Description
156	1F00004D	2	1	39.84	Pass	
157	RS000004	2	0	39.04	Pass	
158	2F000002	2	0	40.03	Pass	
159	2F000002	3	0	40.02	Pass	
160	2F000002	4	0	40.13	Pass	
161	2F000002	5	0	40.2	Pass	
162	2F000002	6	0	40.01	Pass	
163	2F000002	16	0	20.01	Pass2	
164	2F000003	2	0	40.33	Pass	
165	2F000003	3	0	39.97	Pass	
166	2F000003	4	0	40.03	Pass	
167	2F000005	10	0	39.96	Pass	
168	2F000005	11	0	40.04	Pass	
169	2F00000A	2	0	39.83	Pass	
170	2F00000B	2	0	18.25	Pass2	
171	2F00000B	5	0	39.95	Pass	
172	2F00000B	8	0	39.85	Pass	
173	2F00000E	6	0	39.94	Pass	
174	2F00000F	5	0	39.88	Pass	
175	2F000013	4	0	39.86	Pass	
176	2F000026	3	0	39.36	Pass	
177	2F00002A	2	0	39.81	Pass	
178	2F00002D	2	0	39.8	Pass	
179	2F00002F	3	0	39.38	Pass	
180	2F00002F	4	0	39.78	Pass	
181	2F000031	3	0	39.28	Pass	
182	2F000031	4	0	40.07	Pass	
183	2F000032	5	0	40.07	Pass	
184	2F000036	4	0	40.03	Pass	
185	2F000039	3	0	40.03	Pass	
186	2F00003B	4	0	39.98	Pass	
187	2F00003E	3	0	39.77	Pass	
188	2F00003F	6	0	39.47	Pass	
189	2F000043	4	0	34.49	Pass	
190	2F000044	2	0	39.89	Pass	
191	2F000044	2	1	40.04	Pass	
192	2F000045	2	0	40.03	Pass	
193	2F000045	2	1	40.03	Pass	
194	2F000046	2	0	39.92	Pass	
195	2F000046	2	1	39.92	Pass	
196	2F000047	2	0	39.92	Pass	
197	2F000047	2	1	39.9	Pass	
198	2F000048	2	0	39.9	Pass	
199	2F000048	2	1	39.94	Pass	
200	2F000049	2	0	39.94	Pass	
201	2F000049	2	1	39.96	Pass	
202	2F00004A	2	0	39.95	Pass	
203	2F00004A	2	1	39.89	Pass	
204	2F00004B	2	0	39.89	Pass	
205	2F00004B	2	1	39.82	Pass	
206	2F00004C	2	0	39.82	Pass	
207	2F00004C	2	1	39.84	Pass	

Num	Zone	Surface	Opening	VSC	Status	Location Description
208	2F00004D	2	0	39.83	Pass	
209	2F00004D	2	1	39.83	Pass	
210	2F00004E	2	0	39.84	Pass	
211	2F00004E	2	1	39.83	Pass	
212	2F00004F	2	0	39.83	Pass	
213	2F00004F	2	1	39.8	Pass	
214	2F000052	2	0	39.41	Pass	
215	2F000051	2	0	39.4	Pass	
216	2F000057	2	0	39.89	Pass	

Total Assessed Windows:	216		
VSC Pass	206	95%	100.0%
VSC Marginal Fail (Pass2: VSC>15)	10	5%	
VSC Fail	0		0.0%

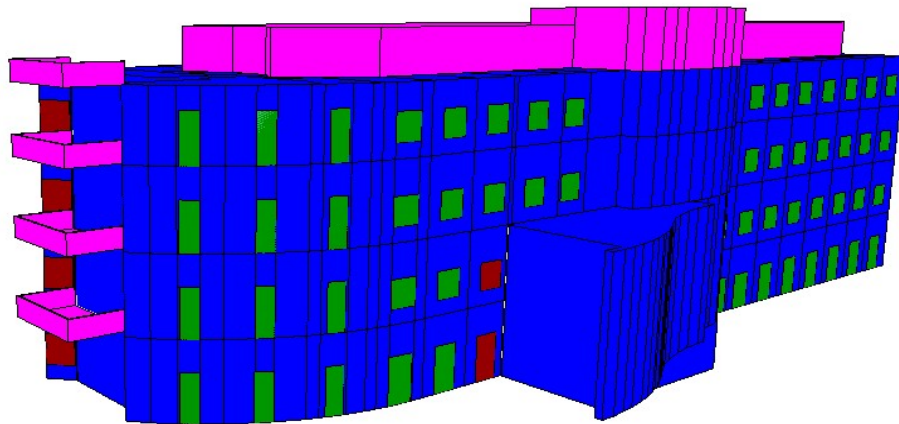


Fig 01: South Elevation

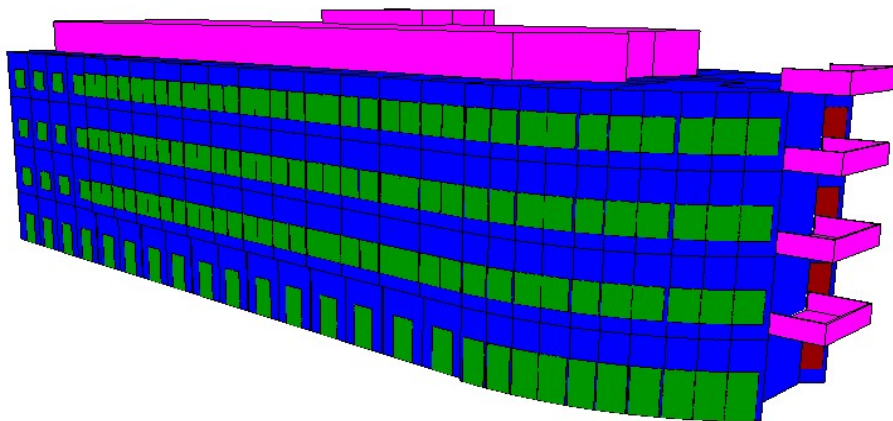


Fig 01: North Elevation

APPENDIX B

Opening	Zone	Surface	Area	Azimuth	Annual	Winter	Location Description
1	GF000000	2	3.57	90	26	4.41	North Elevation
2	GF000000	3	3.57	90	23.39	2.55	
3	GF000000	4	3.57	90	22.12	1.98	
4	GF000000	5	3.57	90	20.81	2.06	
5	GF000000	6	3.57	90	19.16	0.69	
6	GF000000	16	2.55	90	31.63	12.82	
7	GF000002	2	3.31	90	18.09	0.69	North Elevation
8	GF000002	3	3.57	90	17.33	0	
9	GF000002	4	3.57	90	17.28	0	
10	GF000001	10	3.31	90	16.53	0	
11	GF000001	11	3.32	90	15.86	0	
12	GF000009	2	2.29	90	72.7	32.06	North Elevation
13	GF00000A	2	2.04	90	27.09	4.42	
14	GF00000A	5	2.29	90	72.94	31.28	
15	GF00000A	8	2.28	90	74.48	32.21	
16	GF00000C	6	3.57	90	64.16	29.44	
17	GF00000D	5	3.57	90	52.29	24.27	
18	GF000011	4	3.57	90	40.32	17.84	North Elevation
19	GF000012	3	3.57	90	12.13	0	
20	GF000016	2	3.57	90	14.35	0	
21	GF000017	3	3.57	90	14.82	0	
22	GF00001B	2	3.57	90	15.34	0	
23	GF00001C	3	3.57	90	15.25	0	
24	GF000020	2	3.57	90	15.16	0	
25	GF000021	3	3.57	90	15.06	0	
26	GF000025	2	3.57	90	14.95	0	
27	GF000026	3	3.57	90	14.72	0	
28	GF00002A	2	3.57	90	14.86	0	
29	GF00002B	3	3.57	90	15.27	0	
30	GF00002F	2	3.57	90	16.19	0	
31	GF000030	3	3.57	90	16.28	0	
32	GF000034	2	3.57	90	16.98	0	
33	GF000037	2	3.57	90	17.18	0	
34	GF000039	3	2.29	90	41.48	15.46	North Elevation
35	GF000039	4	3.57	90	17.65	0	
36	GF00003B	3	2.29	90	50	18.75	
37	GF00003B	4	3.57	90	79.84	38.19	
38	GF00003C	5	3.57	90	78.95	38.18	
39	GF000040	4	3.57	90	77.24	37.5	
40	GF000043	3	3.57	90	77.08	37.5	North Elevation
41	GF000045	4	3.57	90	77.08	37.5	
42	GF000048	3	3.57	90	76.45	37.45	
43	GF000049	6	3.45	90	73.59	36.81	
44	GF00004D	4	3.45	90	68.11	35.25	
45	GF000050	2	2.38	90	26.65	4.76	
46	GF000050	3	2.38	90	23.61	2.78	North Elevation
47	GF000050	4	2.38	90	22.22	2.08	
48	GF000050	5	2.38	90	20.83	2.08	
49	GF000050	6	2.38	90	19.44	0.69	
50	GF000050	16	2.55	90	30.88	12.27	
51	GF000051	2	2.21	90	18.75	0.69	North Elevation
52	GF000051	3	2.38	90	18.05	0	
53	GF000051	4	2.38	90	18.06	0	
54	GF000053	10	2.38	90	17.36	0	
55	GF000053	11	2.38	90	16.67	0	
56	GF000058	2	2.29	90	75.86	33.5	
57	GF000059	2	2.04	90	27.2	4.86	North Elevation
58	GF000059	5	2.29	90	73.37	31.95	
59	GF000059	8	2.28	90	75.4	33.13	
60	GF00005C	6	2.25	90	72.49	30.89	
61	GF00005D	5	2.25	90	63.39	26.48	
62	GF000061	4	2.25	90	45.82	19.61	
63	GF000080	3	2.25	90	14.1	0	North Elevation
64	GF000084	2	2.25	90	16.8	0	

Opening	Zone	Surface	Area	Azimuth	Annual	Winter	Location Description
65	GF000087	2	2.25	90	17.4	0	North Elevation
66	GF000089	3	2.07	90	41.44	15.4	
67	GF000089	4	2.25	90	18.06	0	North Elevation
68	GF00008B	3	2.07	90	50	18.75	
69	GF00008B	4	2.25	90	79.86	38.19	
70	GF00008C	5	2.25	90	79.8	38.13	
71	GF000090	4	2.25	90	78.47	37.5	
72	GF000093	3	2.25	90	78.47	37.5	
73	GF000095	4	2.25	90	77.67	37.5	
74	GF000098	3	2.25	90	76.81	37.5	
75	GF000099	6	2.25	90	74.3	36.81	
76	GF00009D	4	2.25	90	63.16	32.64	
77	FF000000	2	2.38	90	18.75	0	North Elevation
78	FF000000	2	2.38	90	18.75	0	
79	FF000001	2	2.38	90	18.75	0	
80	FF000001	2	2.38	90	18.75	0	
81	FF000002	2	2.38	90	18.75	0	
82	FF000002	2	2.38	90	18.75	0	
83	FF000003	2	2.38	90	18.75	0	
84	FF000003	2	2.38	90	18.75	0	
85	FF000004	2	2.38	90	18.75	0	
86	FF000004	2	2.38	90	18.75	0	
87	FF000005	2	2.38	90	18.75	0	
88	FF000005	2	2.38	90	18.75	0	
89	FF000006	2	2.38	90	18.75	0	
90	FF000006	2	2.38	90	18.75	0	
91	FF000007	2	2.38	90	18.75	0	
92	FF000007	2	2.38	90	18.75	0	
93	FF000008	2	2.38	90	18.75	0	
94	FF000008	2	2.38	90	18.75	0	
95	FF000009	2	2.38	90	18.75	0	
96	FF000009	2	2.38	90	18.75	0	
97	FF00000A	2	2.38	90	18.75	0	
98	FF00000A	2	2.38	90	18.75	0	
99	FF00000B	2	2.38	90	18.75	0	
100	FF00000B	2	2.38	90	19.38	0	
101	1F000000	2	2.38	90	27.11	5.32	North Elevation
102	1F000000	3	2.38	90	24.2	3.36	
103	1F000000	4	2.38	90	22.97	2.14	
104	1F000000	5	2.38	90	21.59	2.15	
105	1F000000	6	2.38	90	20.22	0.77	North Elevation
106	1F000000	16	2.55	90	31.43	12.81	
107	1F000001	2	2.21	90	20.14	0.69	
108	1F000001	3	2.38	90	19.44	0	
109	1F000001	4	2.38	90	19.44	0	North Elevation
110	1F000003	10	2.38	90	18.75	0	
111	1F000003	11	2.38	90	18.06	0	
112	1F000008	2	2.29	90	79.23	36.17	
113	1F000009	2	2.04	90	27.8	5.45	North Elevation
114	1F000009	5	2.29	90	74.13	32.72	
115	1F000009	8	2.28	90	77.18	34.81	
116	1F00000C	6	2.25	90	81.26	37.51	
117	1F00000D	5	2.25	90	78.42	37.54	North Elevation
118	1F000011	4	2.25	90	77.89	37.62	
119	1F000024	3	2.25	90	14.79	0	
120	1F000028	2	2.25	90	17.5	0	
121	1F00002B	2	2.25	90	18.09	0	North Elevation
122	1F00002D	3	2.07	90	43.08	15.37	
123	1F00002D	4	2.25	90	18.75	0	North Elevation
124	1F00002F	3	2.07	90	50	18.75	
125	1F00002F	4	2.25	90	79.86	38.19	
126	1F000030	5	2.25	90	79.86	38.19	
127	1F000034	4	2.25	90	79.17	38.19	
128	1F000037	3	2.25	90	79.17	38.19	
129	1F000039	4	2.25	90	78.64	38.19	

Opening	Zone	Surface	Area	Azimuth	Annual	Winter	Location Description
130	1F00003C	3	2.25	90	78.03	38.19	
131	1F00003D	6	2.25	90	75.2	37.71	
132	1F000041	4	2.25	90	60.48	31.12	
133	1F000042	2	2.38	90	20.14	0	North Elevation
134	1F000042	2	2.38	90	20.14	0	
135	1F000043	2	2.38	90	20.14	0	
136	1F000043	2	2.38	90	20.14	0	
137	1F000044	2	2.38	90	20.14	0	
138	1F000044	2	2.38	90	20.14	0	
139	1F000045	2	2.38	90	20.14	0	
140	1F000045	2	2.38	90	20.14	0	
141	1F000046	2	2.38	90	20.14	0	
142	1F000046	2	2.38	90	20.14	0	
143	1F000047	2	2.38	90	20.14	0	
144	1F000047	2	2.38	90	20.14	0	
145	1F000048	2	2.38	90	20.14	0	
146	1F000048	2	2.38	90	20.14	0	
147	1F000049	2	2.38	90	20.14	0	
148	1F000049	2	2.38	90	20.14	0	
149	1F00004A	2	2.38	90	20.14	0	
150	1F00004A	2	2.38	90	20.14	0	
151	1F00004B	2	2.38	90	20.14	0	
152	1F00004B	2	2.38	90	20.14	0	
153	1F00004C	2	2.38	90	20.14	0	
154	1F00004C	2	2.38	90	20.14	0	
155	1F00004D	2	2.38	90	20.14	0	
156	1F00004D	2	2.38	90	20.14	0	
157	RS000004	2	2.25	90	74.27	36.97	
158	2F000002	2	2.38	90	28.68	6.6	North Elevation
159	2F000002	3	2.38	90	25.67	4.84	
160	2F000002	4	2.38	90	24.31	3.47	
161	2F000002	5	2.38	90	22.22	2.78	
162	2F000002	6	2.38	90	20.83	1.39	
163	2F000002	16	2.55	90	30.6	12.73	
164	2F000003	2	2.21	90	20.14	0.69	North Elevation
165	2F000003	3	2.38	90	19.44	0	
166	2F000003	4	2.38	90	19.44	0	
167	2F000005	10	2.38	90	18.75	0	
168	2F000005	11	2.38	90	18.06	0	
169	2F00000A	2	2.29	90	80.56	37.5	
170	2F00000B	2	2.04	90	29.23	6.94	
171	2F00000B	5	2.29	90	75.44	34.03	
172	2F00000B	8	2.28	90	78.47	36.11	
173	2F00000E	6	2.25	90	81.94	38.19	
174	2F00000F	5	2.25	90	79.08	38.19	
175	2F000013	4	2.25	90	78.47	38.19	
176	2F000026	3	2.25	90	14.79	0	North Elevation
177	2F00002A	2	2.25	90	18.45	0	
178	2F00002D	2	2.25	90	19.47	0	
179	2F00002F	3	2.07	90	45.89	14.81	
180	2F00002F	4	2.25	90	20.14	0	North Elevation
181	2F000031	3	2.07	90	50	18.75	
182	2F000031	4	2.25	90	79.86	38.19	
183	2F000032	5	2.25	90	79.86	38.19	
184	2F000036	4	2.25	90	79.85	38.19	
185	2F000039	3	2.25	90	79.23	38.19	
186	2F00003B	4	2.25	90	78.64	38.19	
187	2F00003E	3	2.25	90	78.18	38.19	
188	2F00003F	6	2.25	90	75.57	38.09	
189	2F000043	4	2.25	90	60.48	31.12	
190	2F000044	2	2.38	90	20.14	0	
191	2F000044	2	2.38	90	20.14	0	
192	2F000045	2	2.38	90	20.14	0	
193	2F000045	2	2.38	90	20.14	0	
194	2F000046	2	2.38	90	20.14	0	

Opening	Zone	Surface	Area	Azimuth	Annual	Winter	Location Description
195	2F000046	2	2.38	90	20.14	0	North Elevation
196	2F000047	2	2.38	90	20.14	0	
197	2F000047	2	2.38	90	20.14	0	
198	2F000048	2	2.38	90	20.14	0	
199	2F000048	2	2.38	90	20.14	0	
200	2F000049	2	2.38	90	20.14	0	
201	2F000049	2	2.38	90	20.14	0	
202	2F00004A	2	2.38	90	20.14	0	
203	2F00004A	2	2.38	90	20.14	0	
204	2F00004B	2	2.38	90	20.14	0	
205	2F00004B	2	2.38	90	20.14	0	
206	2F00004C	2	2.38	90	20.14	0	
207	2F00004C	2	2.38	90	20.14	0	
208	2F00004D	2	2.38	90	20.14	0	
209	2F00004D	2	2.38	90	20.14	0	
210	2F00004E	2	2.38	90	20.14	0	
211	2F00004E	2	2.38	90	20.14	0	
212	2F00004F	2	2.38	90	20.14	0	
213	2F00004F	2	2.38	90	20.14	0	
214	2F000052	2	2.25	90	74.8	37.5	
215	2F000051	2	2.25	90	76.53	37.64	
216	2F000057	2	2.25	90	77.37	38.19	

APPENDIX C

400 Thames Valley Park Driver- Conversion

App C – Solar Shading Images

Suncast image:

View time = 21 Mar 06:00

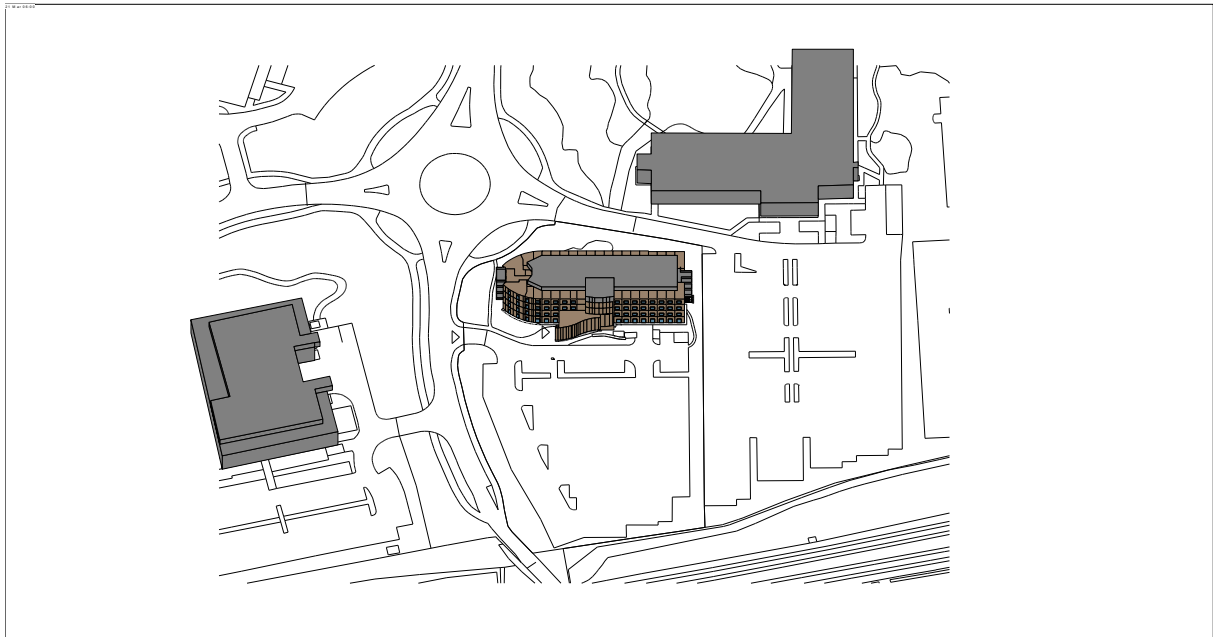
Site Latitude = 51.48

Longitude diff. = -0.45

Model Bearing = 0.00

Sun is not up

Eye: azi = 180.00 alt = 60.00



400 Thames Valley Park Driver- Conversion

App C – Solar Shading Images

Suncast image:

View time = 21 Mar 07:00

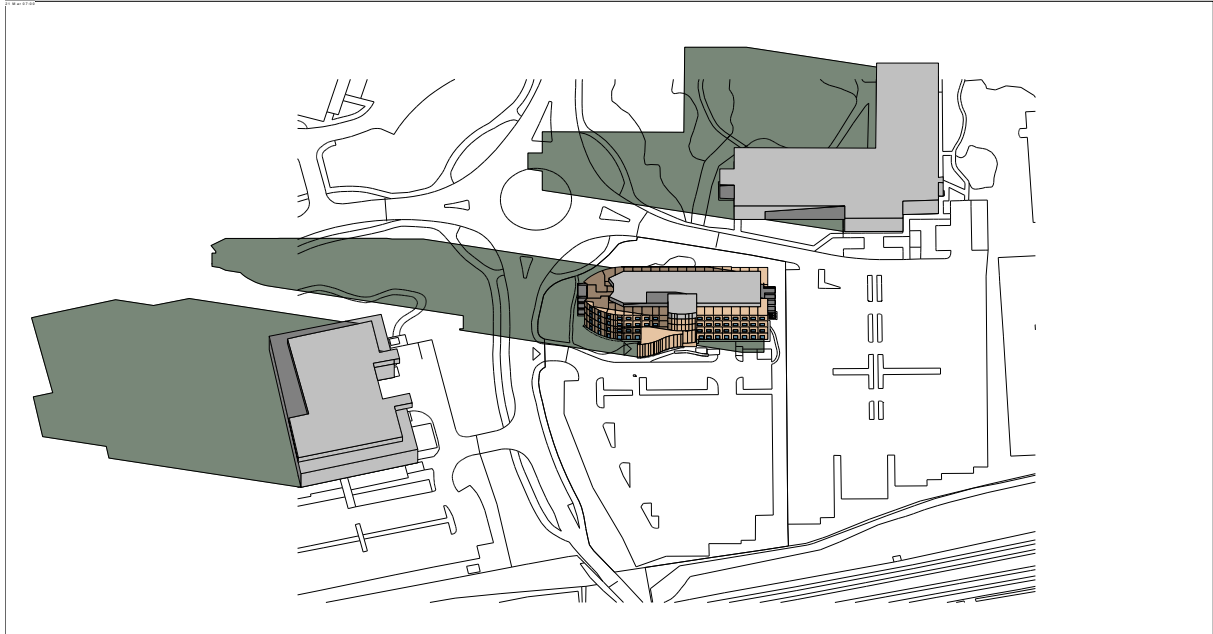
Site Latitude = 51.48

Longitude diff. = -0.45

Model Bearing = 0.00

Sun: azi = 99.98 alt = 7.85

Eye: azi = 180.00 alt = 60.00



400 Thames Valley Park Driver- Conversion

App C – Solar Shading Images

Suncast image:

View time = 21 Mar 08:00

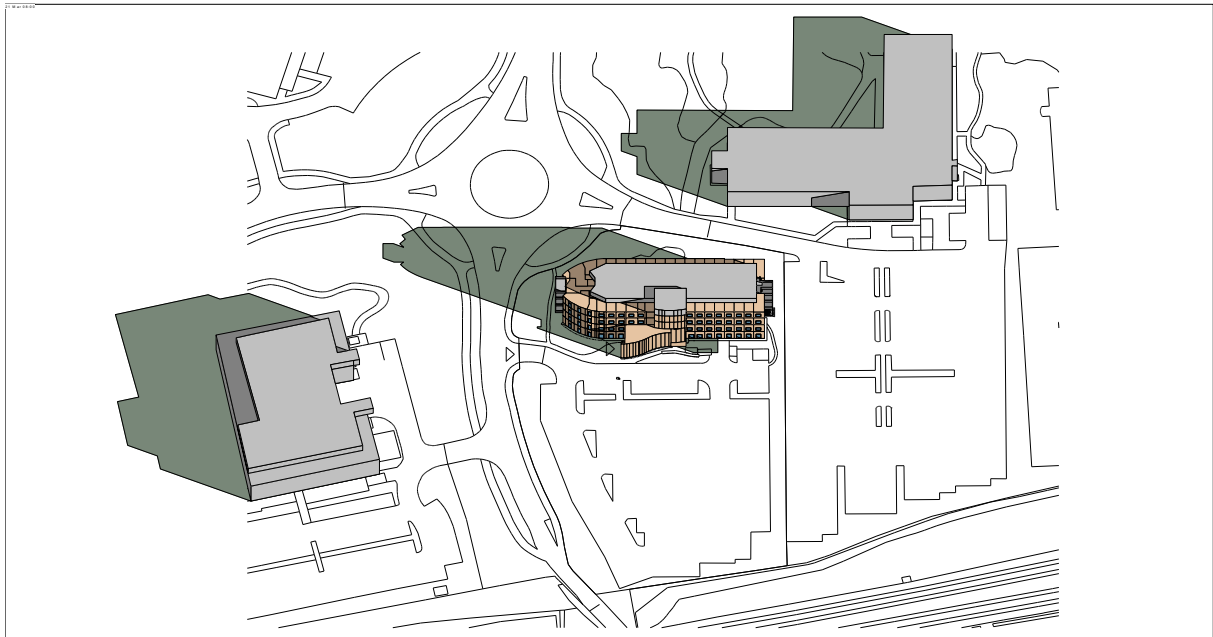
Site Latitude = 51.48

Longitude diff. = -0.45

Model Bearing = 0.00

Sun: azi = 112.30 alt = 16.81

Eye: azi = 180.00 alt = 60.00



400 Thames Valley Park Driver- Conversion

App C – Solar Shading Images

Suncast image:

View time = 21 Mar 09:00

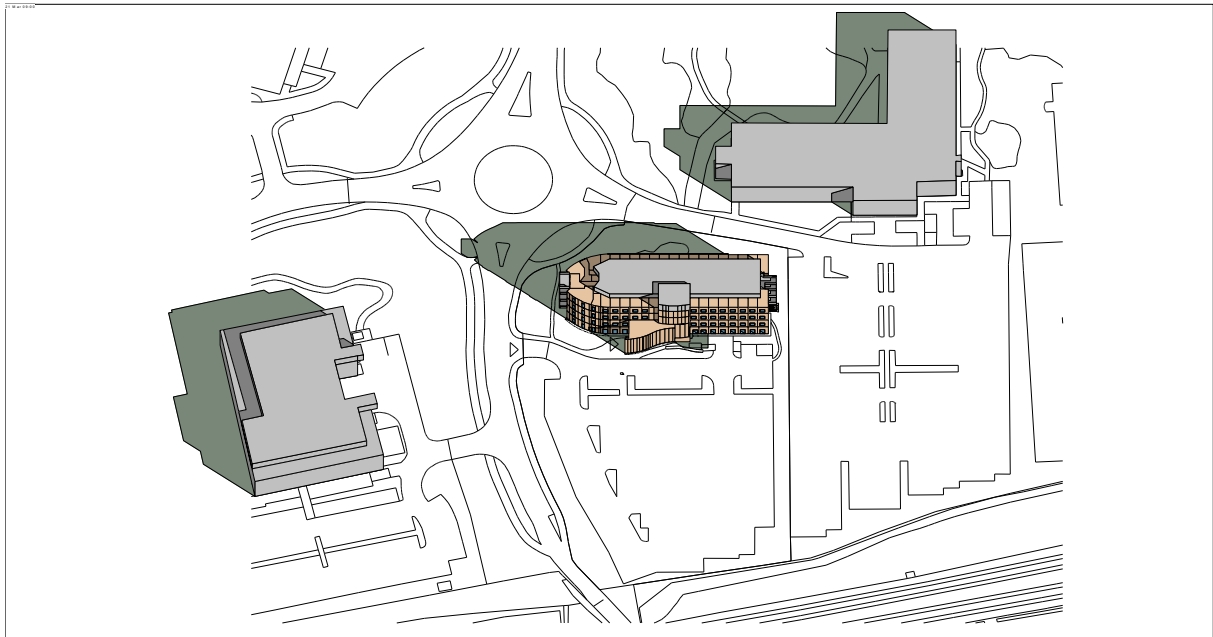
Site Latitude = 51.48

Longitude diff. = -0.45

Model Bearing = 0.00

Sun: azi = 125.80 alt = 24.96

Eye: azi = 180.00 alt = 60.00



400 Thames Valley Park Driver- Conversion

App C – Solar Shading Images

Suncast image:

View time = 21 Mar 10:00

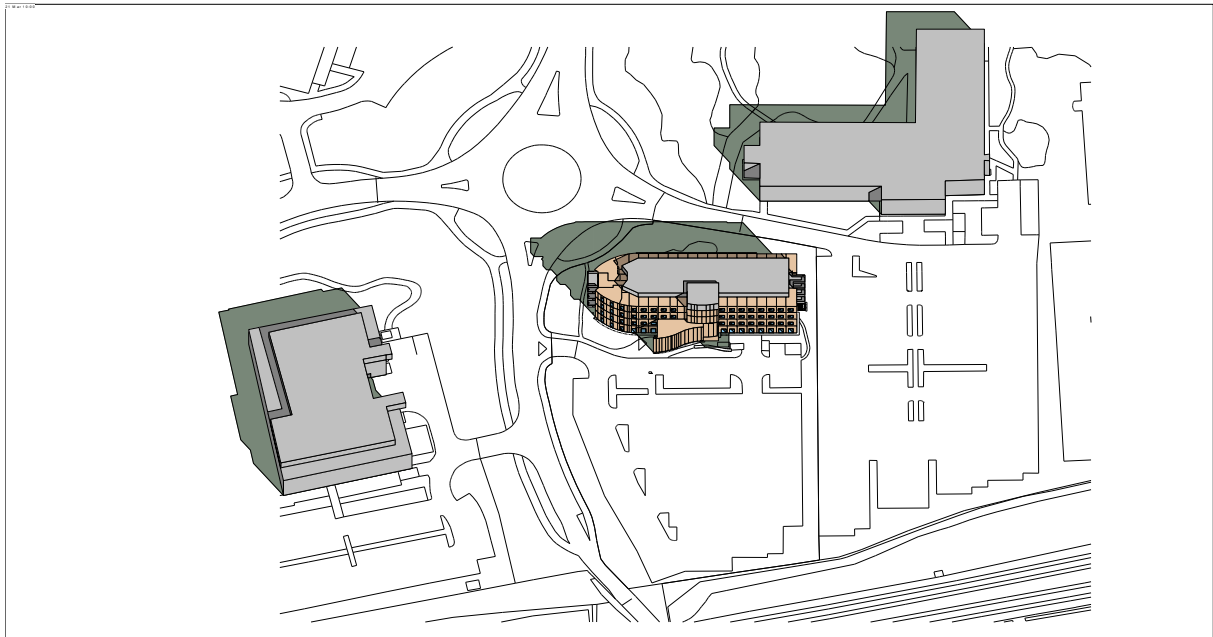
Site Latitude = 51.48

Longitude diff. = -0.45

Model Bearing = 0.00

Sun: azi = 141.03 alt = 31.75

Eye: azi = 180.00 alt = 60.00



400 Thames Valley Park Driver- Conversion

App C – Solar Shading Images

Suncast image:

View time = 21 Mar 11:00

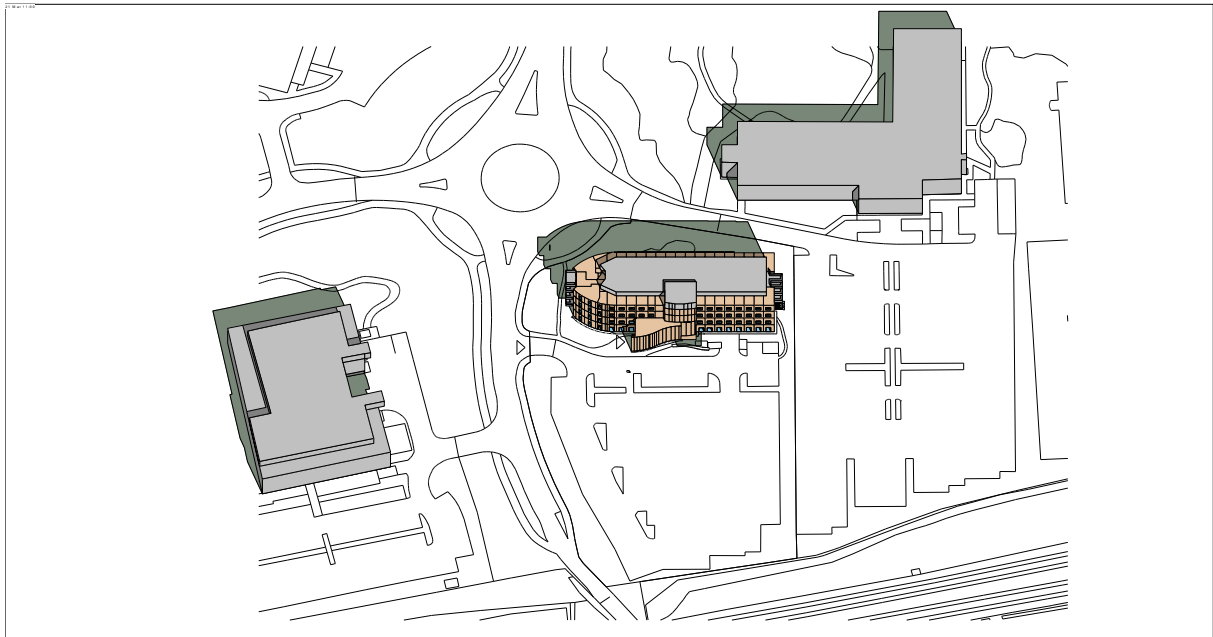
Site Latitude = 51.48

Longitude diff. = -0.45

Model Bearing = 0.00

Sun: azi = 158.25 alt = 36.47

Eye: azi = 180.00 alt = 60.00



400 Thames Valley Park Driver- Conversion

App C – Solar Shading Images

Suncast image:

View time = 21 Mar 12:00

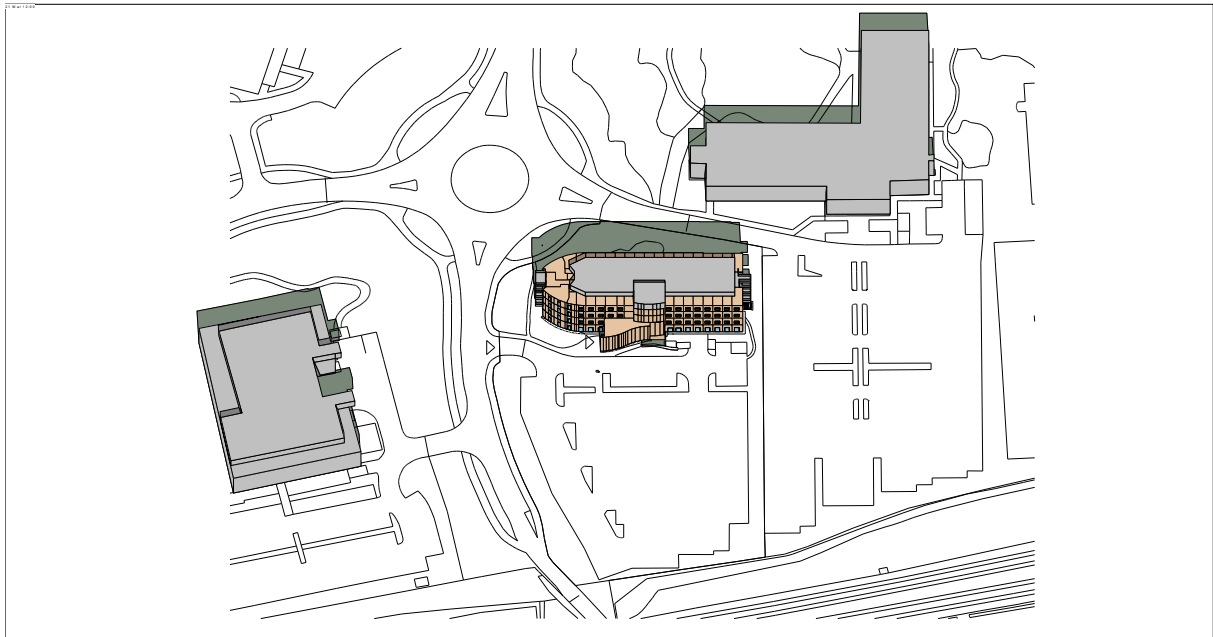
Site Latitude = 51.48

Longitude diff. = -0.45

Model Bearing = 0.00

Sun: azi = 177.02 alt = 38.48

Eye: azi = 180.00 alt = 60.00



400 Thames Valley Park Driver- Conversion

App C – Solar Shading Images

Suncast image:

View time = 21 Mar 13:00

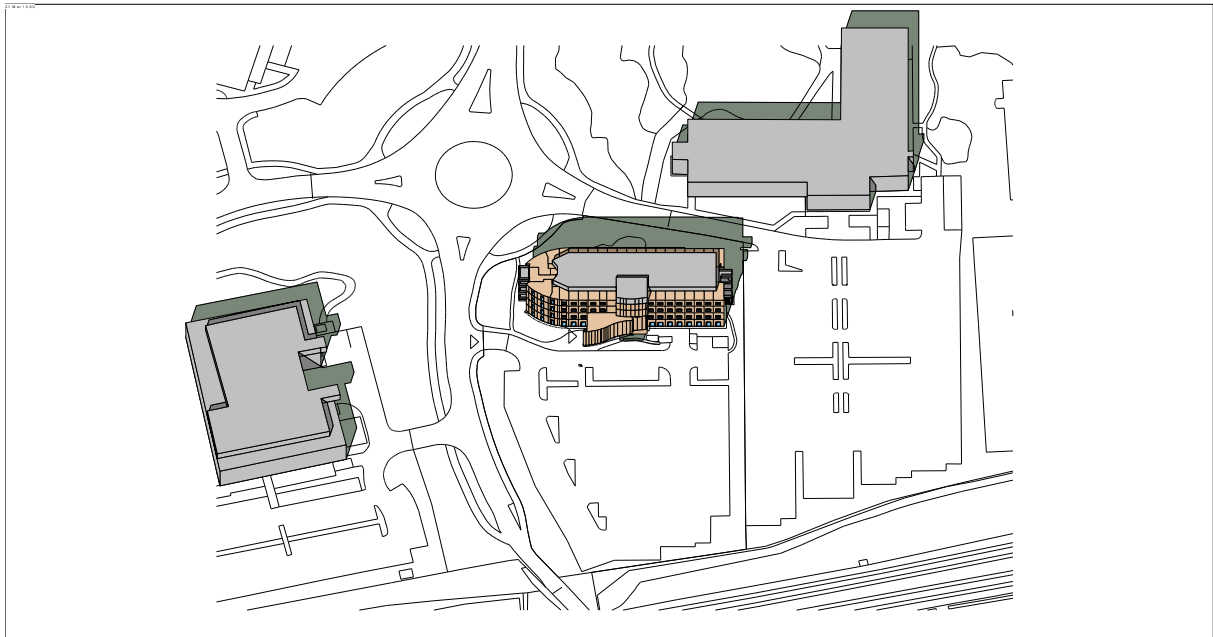
Site Latitude = 51.48

Longitude diff. = -0.45

Model Bearing = 0.00

Sun: azi = 196.03 alt = 37.42

Eye: azi = 180.00 alt = 60.00



400 Thames Valley Park Driver- Conversion

App C – Solar Shading Images

Suncast image:

View time = 21 Mar 14:00

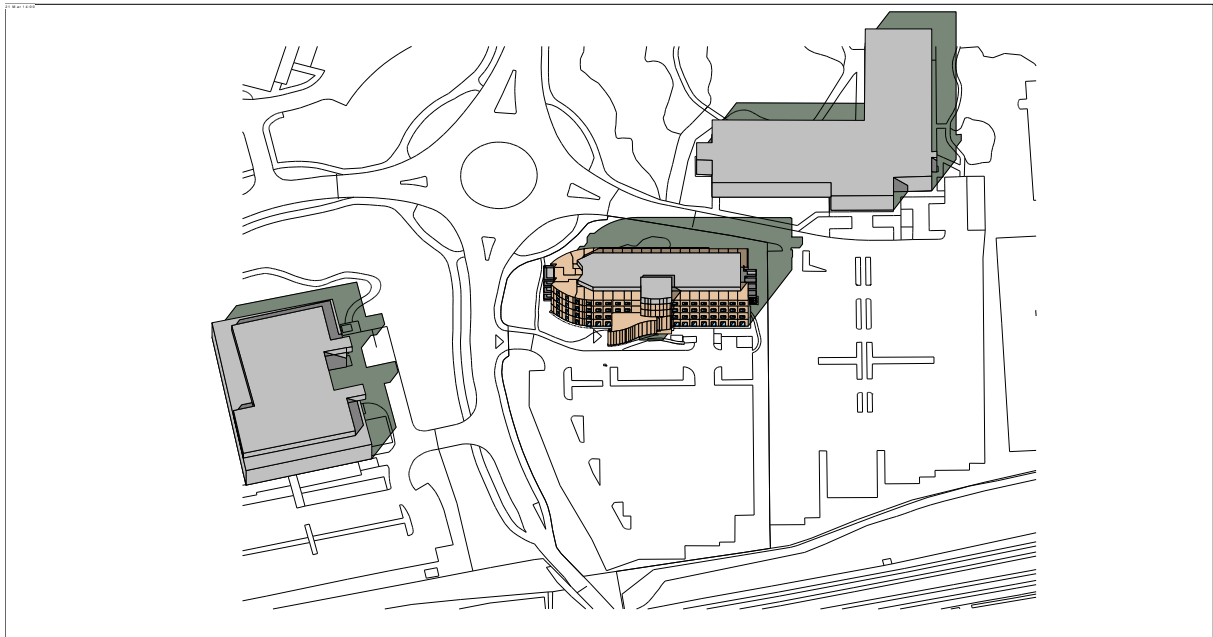
Site Latitude = 51.48

Longitude diff. = -0.45

Model Bearing = 0.00

Sun: azi = 213.82 alt = 33.47

Eye: azi = 180.00 alt = 60.00



400 Thames Valley Park Driver- Conversion

App C – Solar Shading Images

Suncast image:

View time = 21 Mar 15:00

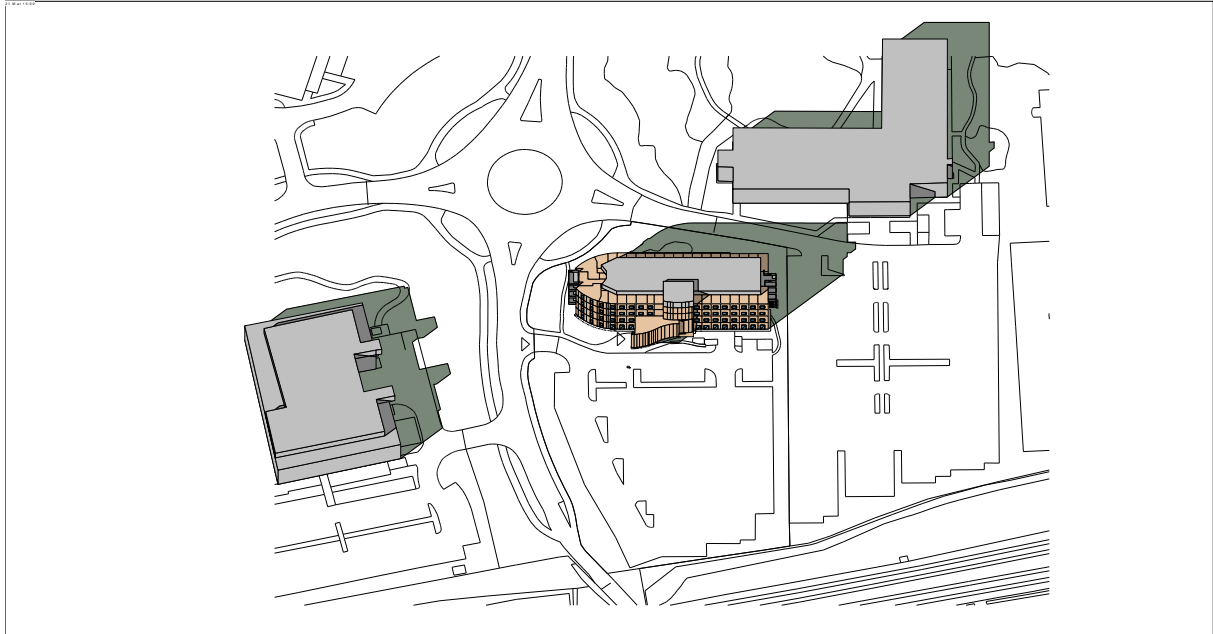
Site Latitude = 51.48

Longitude diff. = -0.45

Model Bearing = 0.00

Sun: azi = 229.67 alt = 27.25

Eye: azi = 180.00 alt = 60.00



400 Thames Valley Park Driver- Conversion

App C – Solar Shading Images

Suncast image:

View time = 21 Mar 16:00

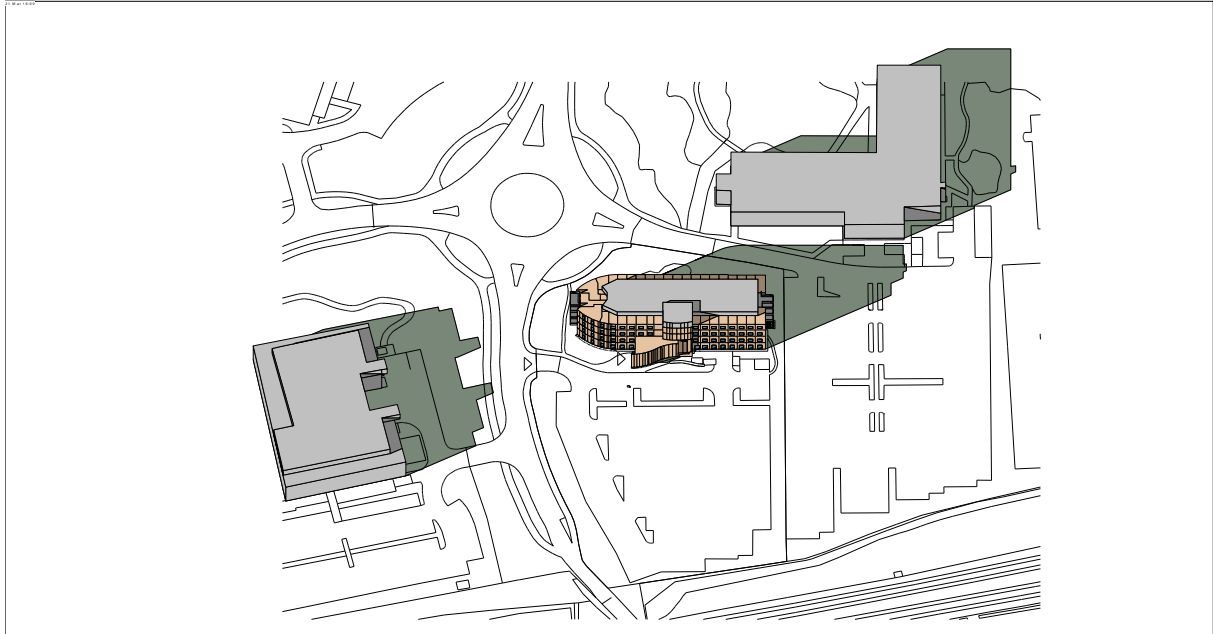
Site Latitude = 51.48

Longitude diff. = -0.45

Model Bearing = 0.00

Sun: azi = 243.65 alt = 19.45

Eye: azi = 180.00 alt = 60.00



400 Thames Valley Park Driver- Conversion

App C – Solar Shading Images

Suncast image:

View time = 21 Mar 17:00

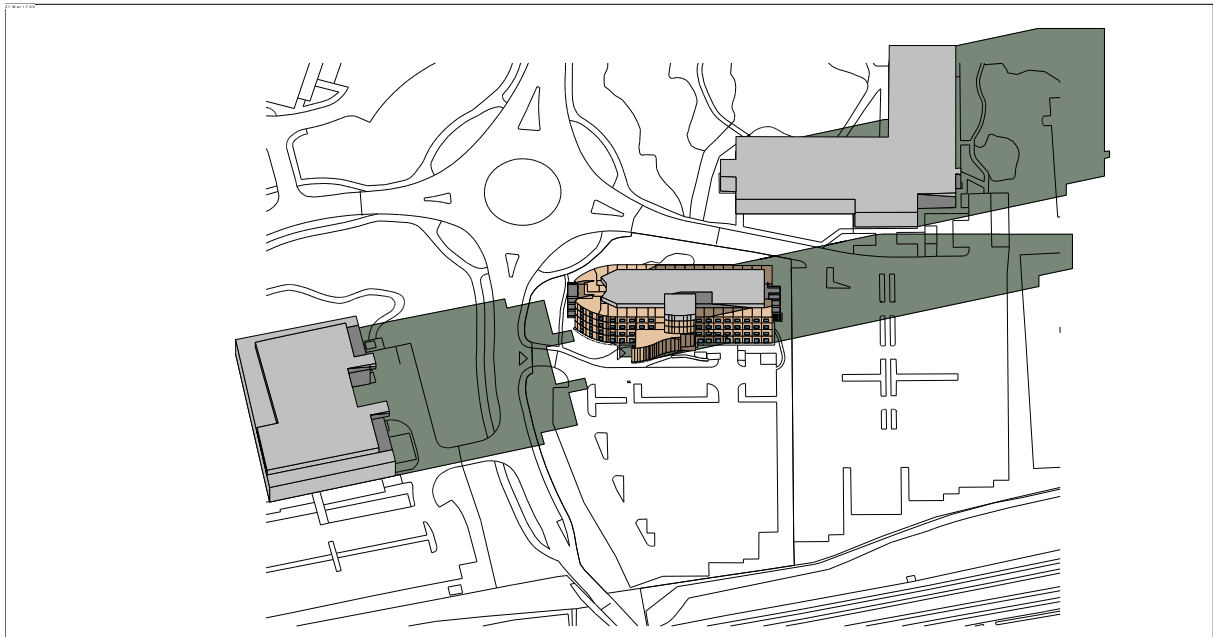
Site Latitude = 51.48

Longitude diff. = -0.45

Model Bearing = 0.00

Sun: azi = 256.28 alt = 10.69

Eye: azi = 180.00 alt = 60.00



400 Thames Valley Park Driver- Conversion

App C – Solar Shading Images

Suncast image:

View time = 21 Mar 18:00

Site Latitude = 51.48

Longitude diff. = -0.45

Model Bearing = 0.00

Sun: azi = 268.17 alt = 1.45

Eye: azi = 180.00 alt = 60.00

