



RUGBY FOOTBALL UNION

Daylight, Sunlight, Overshadowing & Solar Glare Report

Twickenham Stadium – East Stand Extension

July 2016





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Twickenham Stadium

East Stand Extension

Richmond upon Thames

Daylight, Sunlight,
Overshadowing and Solar
Glare Report

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Overshadowing

• *Daylight & Sunlight* • *Light Pollution* •

Solar Glare • *Daylight Design*

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1 Executive Summary

- 1.1 This reports considers the potential effect of the KSS Architect's proposals for the extension of the East Stand at Twickenham Stadium ('Proposed Development') in terms of the daylight and sunlight amenity to the existing surrounding residential properties.
- 1.2 There is a full technical analysis contained within this report, however, in summary the effect of the construction of the Proposed Development upon each of the existing surrounding residential properties is considered to be negligible in nature on the basis that the daylight and sunlight amenity alterations, if any, to all of the habitable rooms and windows facing the site are fully compliant with BRE guidance. This means that the occupants of these rooms are unlikely to notice any alteration to their levels of daylight and sunlight amenity once the Proposed Development is implemented.
- 1.3 In terms of the assessment of overshadowing on existing neighbouring amenity areas, the Sun on Ground results confirm that the Proposed Development will not affect the overall sunlight availability to the rear gardens to the Varsity Drive properties, with each of the gardens satisfying BRE guidance. Any solar glare effects are considered to be short-term and intermittent in nature, limited to the early morning only and should not have any noticeable effect on the motorists travelling southbound along Rugby Road towards the Proposed Development.
- 1.4 The effects of the Proposed Development in terms of the daylight and sunlight amenity should therefore be considered acceptable.



2 Introduction

- 2.1 The Rugby Football Union ('RFU') have instructed Point 2 Surveyors to undertake a detailed quantitative daylight and sunlight, overshadowing and solar glare assessment of the proposed East Stand extension at Twickenham Stadium in the London Borough of Richmond-upon-Thames ('LBRuT'). The analysis has been based upon the measured survey undertaken by Plowman Craven, supplemented by a site inspection, photographs and research.
- 2.2 To improve the accuracy of the analysis, where available we have obtained floor plans for the surrounding properties via LBRuT's planning portal or through our own further research and incorporated them into our 3D digital context model of the site and surroundings. Where it has not been possible to obtain floor plans for properties, assumptions have been made as to their probable internal configuration, based upon site observations and incorporating any additional information obtained via our research.
- 2.3 This report will assess the potential daylight and sunlight effects as a result of the implementation of the Proposed Development on the existing surrounding properties.



3 Methodology

- 3.1 The recognised methodology for undertaking daylight and sunlight assessments is provided by the Building Research Establishment 'Site planning for daylight and sunlight – a guide to good practice' (2011); commonly referred to as "the BRE Guidelines".
- 3.2 The BRE Guidelines were construed in relation to a suburban environment and openly acknowledge that they should be interpreted flexibly in other more dense urban locations. As such, the recommendations of the BRE Guidelines should not be perceived as rigid numerical criteria, but should be re-evaluated in the context of each site by considering the relative density and the development context of the surrounding area.
- 3.3 When assessing any potential effects on the surrounding properties, the BRE guidelines suggest that only those windows that have a reasonable expectation of daylight or sunlight need to be assessed. In particular the BRE guidelines at paragraph 2.2.2 state:

"The guidelines given here are intended for use for rooms in adjoining dwellings where daylight is required, including living rooms, kitchens and bedrooms. Windows to bathrooms, toilets, storerooms, circulation areas and garages need not be analysed."

- 3.4 Further to the above statement, it is considered that the vast majority of commercial properties do not have a reasonable expectation of daylight or sunlight. This is because they are generally designed to rely on artificial electric lighting rather than natural light.
- 3.5 If a property is considered to have a reasonable expectation of daylight or sunlight the following methodology to assess the impacts has been used:

Daylighting

- 3.6 It is common to consider the local authorities planning policy in order to establish the basis for which consideration in relation to light should be approached. The following can be used as a quick test to assess the likely effect on existing surrounding properties:
- a) Project a 25 degree line from the centre of the lowest window on the existing building;
 - b) If the whole of your new development is lower than this line then it is unlikely to have a substantial effect on the daylight enjoyed by occupants in the existing building and a more detailed check is not required.
- 3.7 The above test is also known as the 25° angle test and has been undertaken in respect of some of the more distant properties surrounding the site in order to scope them out of the detailed technical assessments.
- 3.8 More detailed tests can be undertaken to fully assess the loss of daylight in existing buildings, in particular the use of the Vertical Sky Component (VSC) method of assessment.



The Vertical Sky Component is expressed as a ratio of the maximum value of daylight achievable for a completely unobstructed vertical wall. The maximum value is almost 40%. This is because daylight hitting a window can only come from one direction immediately halving the available light. The value is limited further by the angle of the sun. This is why if the VSC is greater than 27% enough sunlight [SIC] should be reaching the existing window. Any reduction below this level should be kept to minimum.

Windows to some existing rooms may already fail to achieve this target under existing conditions. In these circumstances it is possible to accept a reduction to the existing level of daylight to no less than 80% of its former value.

- 3.9 It must be noted that whilst the maximum value for a vertical window plane is almost 40%, it is possible for roof lights to achieve higher levels of VSC given they have the potential to view a greater proportion of the sky dome.
- 3.10 In summary of the above, a room is considered to continue to receive good levels of daylight if the window can receive a VSC of at least 27%. If the window receives a VSC below 27% a reduction of less than 0.8 times its former value (20%), as a result of the Proposed Development, is considered acceptable.
- 3.11 In conjunction with the VSC tests, the BRE guidelines and British Standard 8206-Part2:2008 suggest that the distribution of daylight is assessed using the No Sky Line (NSL) test. This test separates those areas of the working plane that can receive direct skylight and those that cannot.
- 3.12 The BRE guidelines suggest that:
- “If, following construction of a new development, the no sky line moves so that the area of the existing room, which does receive direct skylight, is reduced to less than 0.8 times its former value this will be noticeable to the occupants, and more of the room will appear poorly lit.”*
- 3.13 The Average Daylight Factor (ADF) is an additional methodology referenced in the BRE Guidelines, although it is principally designed as an assessment for new-build accommodation and is not typically recommended for assessing existing surrounding buildings.
- 3.14 However, as the ADF is a detailed form of analysis which considers the diffuse levels of daylight internally within accommodation, in some more complex instances it can be a helpful point of reference to understand what levels of daylight amenity are likely to be retained.

Sunlighting

- 3.15 The amount of direct sunlight a window can enjoy is dependent on its orientation and the extent of any external obstructions. For example a window that faces directly north, no matter what external obstructions are present, will not be able to receive good levels of sunlight throughout the year. However, a window that faces directly south with no obstructions will enjoy very high levels of sunlight throughout the year. As the potential to receive sunlight is dependent on a window’s orientation, the BRE guidelines state:



“To assess loss of sunlight to an existing building, it is suggested that all main living rooms of dwellings, and conservatories, should be checked if they have a window facing within 90° of due south. Kitchens and bedrooms are less important, although care should be taken not to block too much sun.”

- 3.16 To consider any sunlight effect to the surrounding properties the BRE guidelines suggest calculating the Annual Probable Sunlight Hours (APSH) at the centre of each window on the outside face of the window wall. The BRE guidelines suggest that:

“If this window point can receive more than one quarter of APSH (see section 3.1), including at least 5% of APSH in the winter months between 21st September and 21st March, then the room should still receive enough sunlight.”

- 3.17 If the above criteria is not met, the BRE guidelines suggest calculating the APSH at the window in the existing situation, i.e. before redevelopment. If the reduction of APSH between the existing and proposed situations is less than 0.8 times its former value for either the total APSH or in the winter months; and greater than 4% for the total APSH, then the occupants of the adjoining building are likely to notice the reduction in sunlight.

- 3.18 In assessing the daylight and sunlight to the neighbouring buildings as well as assessing the quality of light within the proposed habitable rooms that make up the residential units, the true existing baseline condition has been observed. This includes all neighbouring buildings and obstructions within the vicinity that could be affected by the scheme proposal and or affect the potential for light entering into the proposed residential rooms within the scheme.

Sun on the Ground

- 3.19 The method for assessing sun on the ground is the ‘sun-on-ground indicator’. The BRE Guidelines suggest that the Spring Equinox (March 21) is a suitable date for the assessment.
- 3.20 Using specialist software, the path of the sun is tracked to determine where the sun would reach the ground and where it would not. This assessment reviews the total percentage of an area that receives at least 2 hours of direct sunlight on the March 21.
- 3.21 The Guidelines suggest that for a garden or amenity area to appear adequately sunlit throughout the year, no more than half (50%) of the area should be prevented by buildings from receiving 2 hours of sunlight on the 21st March.

Solar Glare

- 3.22 The BRE Guidelines makes the following statement regarding the potential for reflected solar glare on a development:
- 3.23 *“Glare or solar dazzle can occur when sunlight is reflected from a glazed façade or area of metal cladding. This can affect road users outside and the occupants of adjoining buildings. The problem can occur either when there are large areas of reflective tinted glass or cladding on the façade, or when there are areas of glass or cladding, which slope back so that high altitude sunlight can be reflected along the ground. Thus solar dazzle is only a long-term problem for some heavily glazed (or mirror clad) buildings. Photovoltaic panels tend to dazzle because they are designed to absorb light.”*

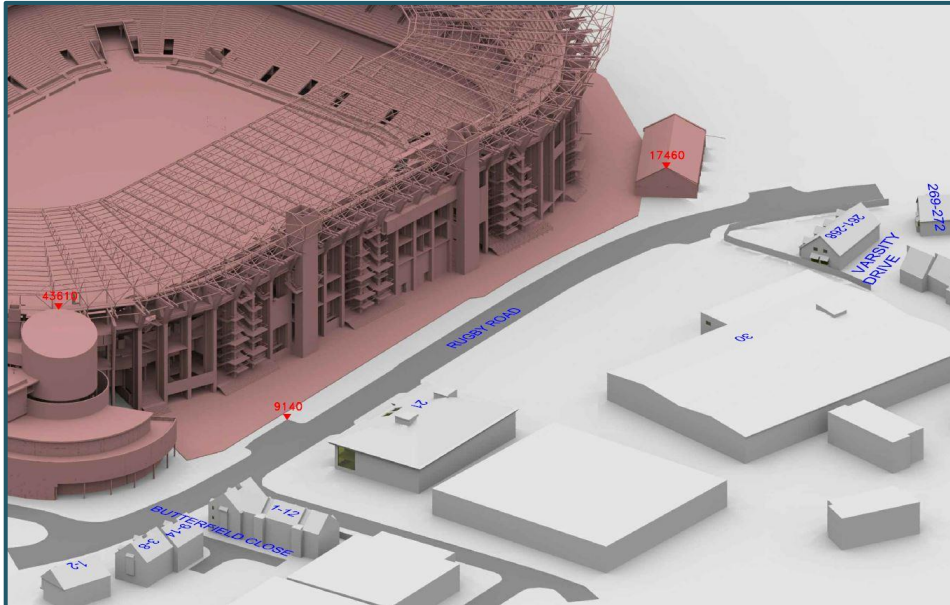


- 3.24 Solar glare assessments simulate the path of the sun for the entire year around a proposed development.
- 3.25 The assessment of solar glare is undertaken, in the first instance, by replacing the glazing upon the building with red mirrors. The analysis results will then show the location of all instances of solar glare around the Application Site throughout the year. From this information, the most sensitive viewpoints around the Application Site are established.
- 3.26 A further solar glare assessment is then undertaken from each of these viewpoints based on the actual façade treatment of the proposed development. An image per viewpoint is then produced indicating the area which sees reflection at any point during the year. The diagram suggests a focal point at 10° from the centre of the visual axis and concentric circles from 20° to 70°. These provide a reference from which potential issues can be judged.
- 3.27 The Guidelines state that: *"...the aim of the document is to help rather than constrain the designer. Though it gives numerical guidelines, these should be interpreted flexibly because natural lighting is only one of the many factors in site layout design."*



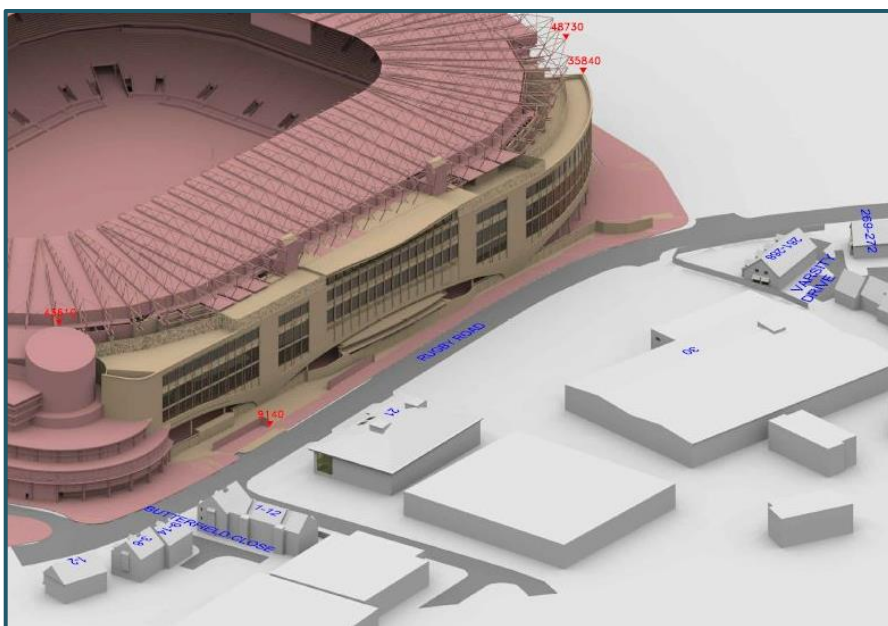
4 The Site and the Surrounding Properties

- 4.1 The development site is situated in the London Borough of Richmond-upon-Thames, and is bound by Rugby Road to the east and Whitton Road to the south. Our understanding of the site location can be seen within drawings P921/01-03 which can be found within Appendix 1.



Drawing Number: P921/03 – 3D View – Existing Site Condition

- 4.2 In accordance with BRE Guideline recommendations, any existing residential properties in the vicinity of the Proposed Development have been analysed for daylight and sunlight. The locations of the existing surrounding properties relative to the development site can be identified from the 3D views provided on the drawings in Appendix 1.
- 4.3 The Proposed Development comprises a lateral extension of 6 storeys on the East Stand of the stadium and is shown on drawings P921/12-14 inclusive in Appendix 1.

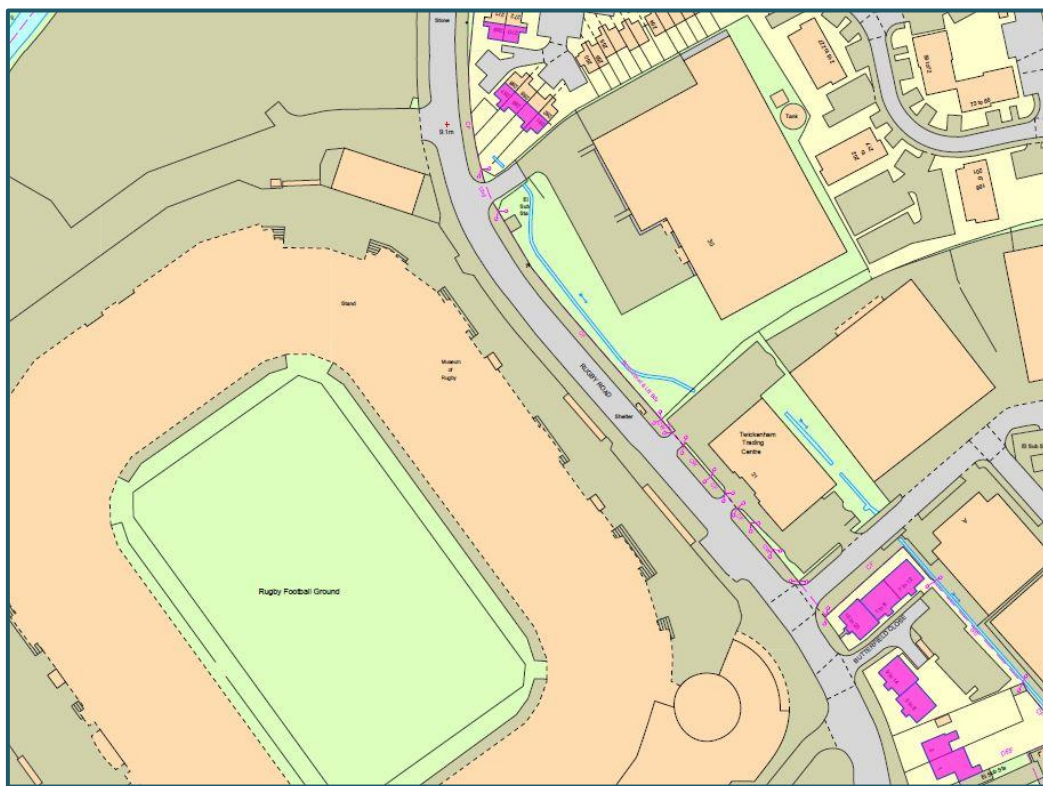


Drawing Number: P737/13 – 3D View – Proposed Development (Gold)

4.4 The following residential properties have been considered in terms of the effect of the proposed development upon their daylight and sunlight amenity, due to their proximity to the site:

- 261-268 Varsity Drive
- 1-12 and 15-20 Butterfield Close
- 9-14 Rugby Road
- 3-8 Rugby Road
- 269-272 Varsity Drive
- 1-2 Rugby Road

The location of each of these properties are identified on the drawings in Appendix 1 and on the site plan below:



Sources of information

Point 2 Surveyors
Site Photographs

London Borough of Richmond-upon-Thames
Planning Drawings

Plowman Craven
Detailed Site Survey

KSS Architects:
Proposed 3D Massing Model 4th April 2016

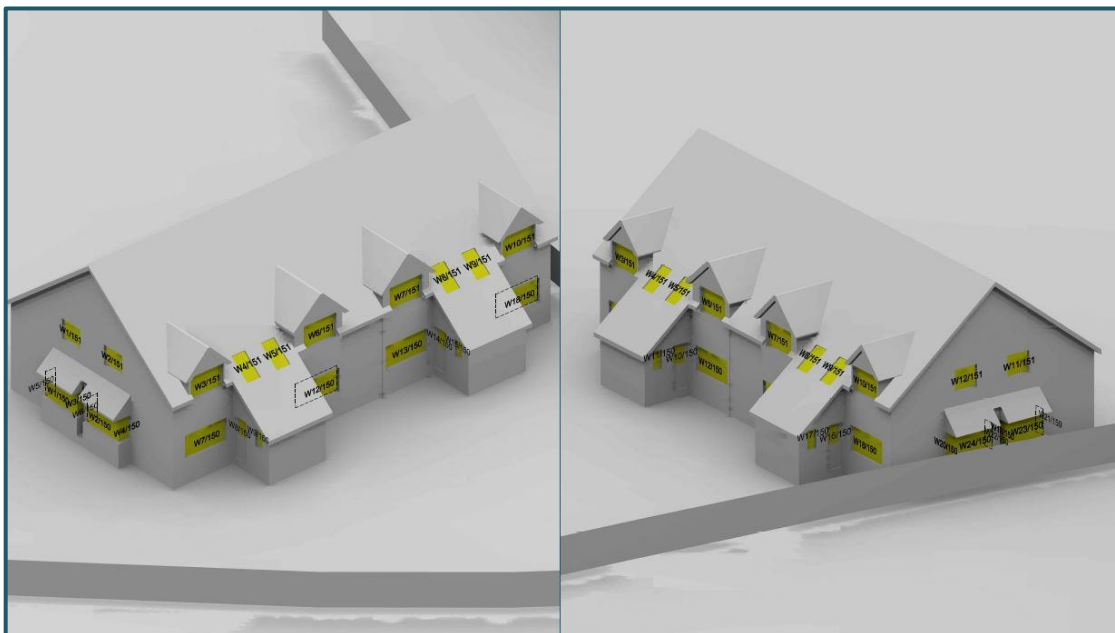


5 Assessment Results for Impacts to Neighbouring Buildings

- 5.1 Detailed daylight and sunlight analysis has been undertaken in accordance with the BRE Guidelines methodology in respect of those properties identified above as sensitive receptors. All windows and rooms that could be of habitable use have been assessed to determine the effect of the Proposed Development. However, where rooms can clearly be identified as non-habitable space - such as corridors, bathrooms or plant space – they have not been included within the assessment.
- 5.2 The potential daylight and sunlight effects of the Proposed Development upon the properties identified in Section 4 as sensitive receptors are discussed in detail below. Detailed results are contained within Appendix 2 in accordance with the methodologies outlined in the BRE Guidelines, with window maps attached at Appendix 4. The window references within the tables can be cross-referenced with the window maps.
- 5.3 Results of the Sun on Ground assessment to existing neighbouring external gardens and amenity spaces are contained within Appendix 5. Finally, the results of the solar glare assessment are included within Appendix 6.

Daylight and Sunlight to Neighbouring Buildings

261-268 Varsity Drive

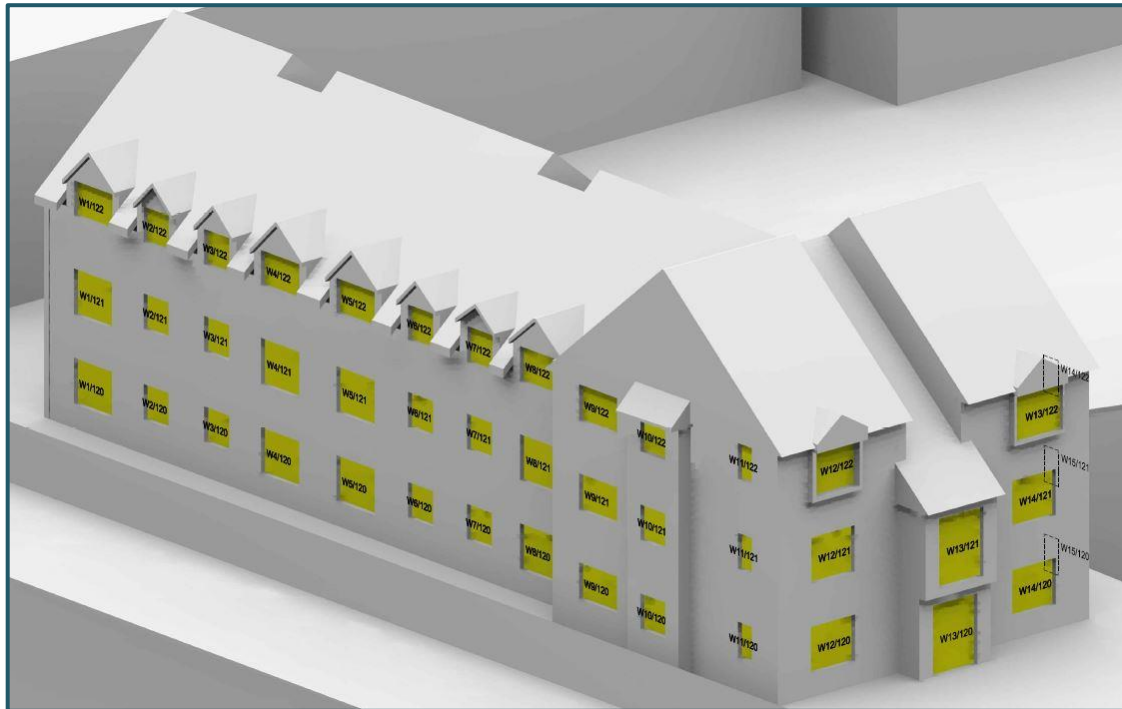


Window Map showing locations of windows analysed within 261-268 Varsity Drive

- 5.4 These residential properties are situated to the north east of the development site and comprise of 20 habitable spaces being lit by 28 windows.
- 5.5 The daylight analysis shows that all of the windows serving habitable rooms in each of the properties facing towards the development site will comfortably meet the BRE Guidelines recommendations in relation to both the Vertical Sky Component (VSC) and No Sky Line (NSL) forms of daylight assessment.

- 5.6 Furthermore, the sunlight (APSH) analysis shows that all of the rooms with south facing windows within these properties will comfortably satisfy the BRE Guidelines for both annual and winter sunlight with the Proposed Development in place.
- 5.7 It is therefore considered that the Proposed Development will have no noticeable effect on the daylight and sunlight amenity currently enjoyed by these properties.

1-12 & 15-20 Butterfield Close



Window Map showing locations of windows analysed within 1-12 & 15-20 Butterfield Close

- 5.8 These residential properties are located to the east of the site and collectively have a total of 43 windows serving 17 habitable rooms directly facing the site.
- 5.9 The daylight analysis shows that all of the windows and rooms assessed will comfortably meet the BRE Guidelines recommendations in relation to both the Vertical Sky Component (VSC) and No Sky Line (NSL) forms of daylight assessment.
- 5.10 Again, the sunlight (APSH) analysis shows that all of the rooms with south facing windows within these properties will comfortably satisfy the BRE Guidelines for both annual and winter sunlight with the Proposed Development in place.
- 5.11 It is therefore considered that the Proposed Development will have no noticeable effect on the daylight and sunlight amenity currently enjoyed by these properties.



Rugby Road Properties



Window Map showing locations of windows analysed within 3-8 & 9-14 Rugby Road

9-14 Rugby Road

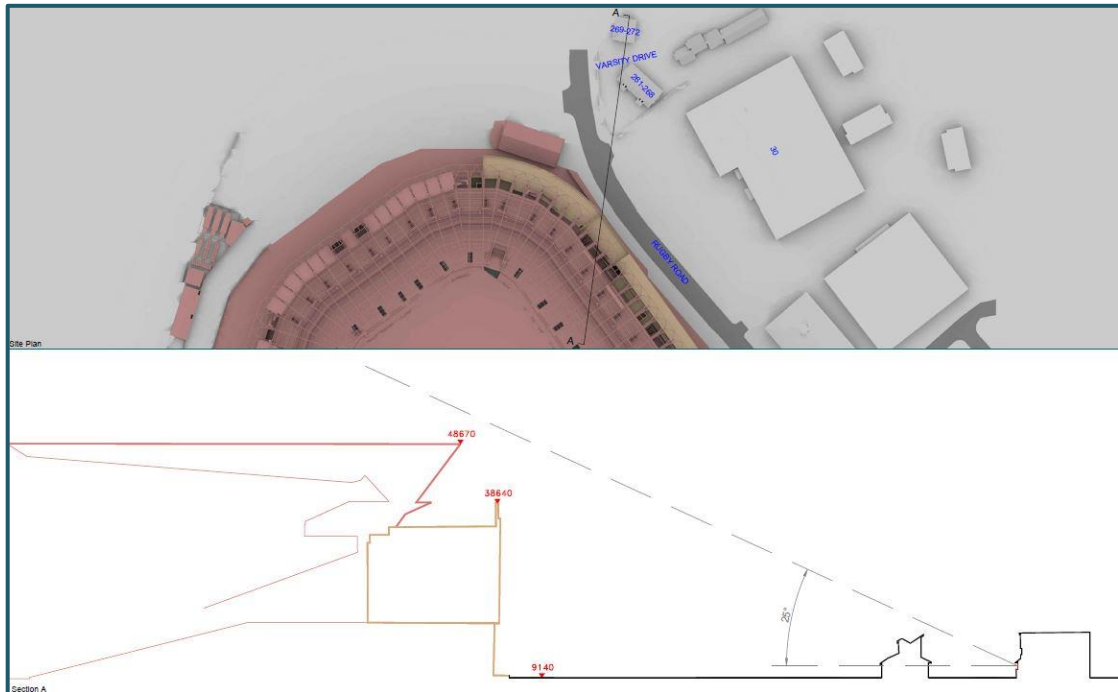
- 5.12 These residential properties are located to the south east of the site and collectively are believed to have a total of 9 windows serving 9 habitable rooms directly facing the site.
- 5.13 The daylight analysis shows that all of the windows and rooms tested will comfortably meet the BRE Guidelines recommendations in relation to both the Vertical Sky Component (VSC) and No Sky Line (NSL) forms of daylight assessment.
- 5.14 Again, the sunlight (APSH) analysis shows that all of the rooms with south facing windows within these properties will comfortably satisfy the BRE Guidelines for both annual and winter sunlight with the Proposed Development in place.
- 5.15 It is therefore considered that the Proposed Development will have no noticeable effect on the daylight and sunlight amenity currently enjoyed by these properties.

3-8 Rugby Road

- 5.16 These residential properties are located to the south east of the site and collectively have a total of 6 windows serving 6 habitable rooms directly facing the site.
- 5.17 The daylight analysis shows that all of the windows and rooms tested will comfortably meet the BRE Guidelines recommendations in relation to both the Vertical Sky Component (VSC) and No Sky Line (NSL) forms of daylight assessment.
- 5.18 Again, the sunlight (APSH) analysis shows that all of the rooms with south facing windows within these properties will comfortably satisfy the BRE Guidelines for both annual and winter sunlight with the Proposed Development in place.
- 5.19 It is therefore considered that the Proposed Development will have no noticeable effect on the daylight and sunlight amenity currently enjoyed by these properties.

269-272 Varsity Drive

5.20 This property is located to the north of the development site.

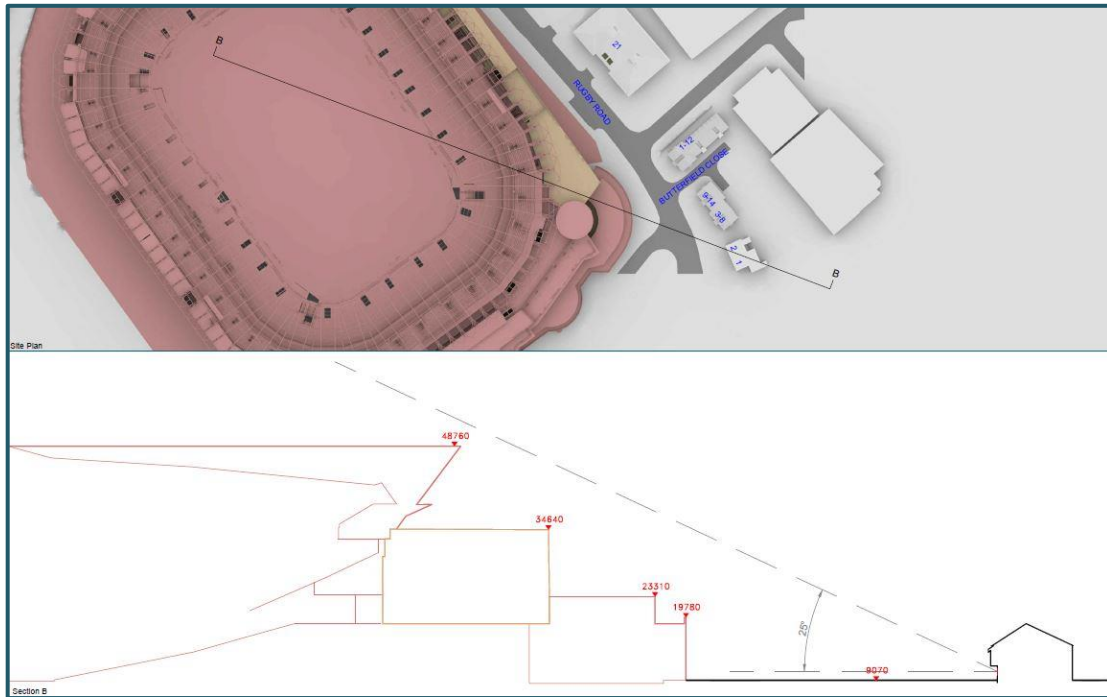


BRE 25 degree section line through 269-272 Varsity Drive

- 5.21 Following recent pre-planning discussions with LBRuT, an extension to the scope of our technical assessment was requested to include 269-272 Varsity Drive.
- 5.22 Given the properties distance from the site, a preliminary check was undertaken in accordance with BRE guideline recommendations.
- 5.23 Drawing P921/07 in Appendix 3 shows that the proposed scheme will fall below a 25 degree section line taken perpendicular from the centre of the lowest site facing window. As explained at paragraphs 3.6 and 3.7 of this report, the BRE guide states that if this angle is less than 25 degrees then it is unlikely to have an effect on the diffuse skylight enjoyed by the existing building and a detailed check need not be required.
- 5.24 Given the proposed east stand extension clearly falls below the 25 degree line, the daylight and sunlight amenity enjoyed by the occupants of 269-272 Varsity Drive will not, therefore, be affected by the Proposed Development.

1-2 Rugby Road

5.25 This property is located to the south east of the development site.



BRE 25 degree section line through 1-2 Rugby Road

5.26 As with 269-272 Varsity Drive, this property was also requested to be included by LBRuT following recent pre-planning discussions and the attached drawing P921/08 in Appendix 3 shows the 25 degree section line taken perpendicular from the centre of the lowest site facing window.

5.27 Again, given the proposed east stand extension clearly falls below the 25 degree line, the daylight and sunlight amenity enjoyed by the occupants of 1-2 Rugby Road will not, therefore, be affected by the Proposed Development and further detailed testing is not required.

Sun on Ground

5.28 The Sun on Ground assessment confirms that the rear gardens to 261- 268 Varsity Drive and 269-272 Varsity Drive will continue to exceed the BRE guideline recommendations for Sun on Ground with the Proposed Development in place. The drawings numbered P921/SHA/03 and 04 at Appendix 5 illustrate the extent of the gardens that receive at least 2 hours of direct sunlight on March 21st and June 21st respectively.

5.29 The drawings confirm that in both March and June each of the gardens will retain at least 2 hours of direct sunlight to in excess of the recommended 50%, with the majority of gardens receiving at least 2 hours of sunlight to 100% of its area. Any minor alterations are compliant with BRE guidance such that the overall effect of the Proposed Development on the sunlight availability to the neighbouring residential gardens will negligible.

Solar Glare

- 5.30 Given that the Proposed Development comprises the extension of the East Stand, the orientation of the new massing in relation to the path of the sun throughout the course of the year means that there are unlikely to be any significant effects of solar glare. Any effects are likely to be minor and transient in nature, limited to early morning periods when the sun is lower in the sky.
- 5.31 Furthermore, the BRE guidelines acknowledge that *“the worst problems occur when drivers are travelling directly towards the building, and sunlight can reflect off surfaces in the driver’s direct line of sight”*.
- 5.32 A full solar glare analysis has been undertaken, the results of which can be found at Appendix 6 of this report.
- 5.33 Drawing P921/SG/00 identifies the locations of the adjacent sensitive viewpoints along Rugby Road as vehicles approach the stadium from the north. These have been established from the annual sequence assessment results taken at 15-minute intervals on the 21st of each month for half the year, with the other half being symmetric. These results illustrate the areas where there will be some solar glare reflectance from the Proposed Development on surrounding sensitive receptors. It is important to note that the annual sequence study assumes a worst case of the windows acting as a perfect mirror for the purposes of showing the annual pattern of reflections.
- 5.34 Drawings P921/SG/01 to 07 show more detailed visualisations undertaken from each of the identified viewpoints at sample times of the year and the effects are summarised below.
- 5.35 The annual sequence assessment results show that:-
- During the course of the year there will be some reflections from the Proposed Development with the most noticeable instances of glare during the early parts of the day when the sun is lower in the sky. Typically, this occurs in sporadic patterns between the hours of 07:55 to 08:55 in December, between 06:00 and 09:30 in March and between 04:30 and 12:00 in June;
 - By reference to each 15-minute interval, it is clear that any solar reflections from the Proposed Development are transient in nature with no prolonged periods of solar glare at any one specific viewpoint; and
 - Given the pattern of fenestration on the Proposed Development, any instances of solar glare would be transient with a broken pattern of short-lived reflections, of which the majority will be a long way off a typical driver’s line of sight.
- 5.36 The viewpoints that have been identified as sensitive receptors are as follows:
- Viewpoints 1: A view taken at a vehicle driver’s eye level as the vehicle approaches the roundabout junction at the northern end of Rugby Road.
 - Viewpoints 2-5: A series of viewpoints taken at a motorist’s eye level as the vehicle travels south along Rugby Road on the approach to the stadium.



5.37 The more detailed sample visualisations show that:-

- From viewpoint 1, drawing P921/SG/01 shows that at the sample time of 05:18 on June 21st, there will be an instance of glare from the curved north-east facade of the Proposed Development at an angle of 40° from the eye line of the motorists approaching the roundabout at the junction with Rugby Road. The glare, however, is offset at an oblique angle from the road and not in the direct line of site of the motorists. Furthermore, the CIE146:2002 Solar Glare report, states that “...occurrences at angles beyond 30° would be of little significance in most situations, but may be relevant in exceptional circumstances. When seated in a driving seat of a typical vehicle, for example, the limits of the windscreen would generally obstruct the driver’s view at angles beyond 30° from the line of sight.” From a further review of the annual sequence, it is evident that any instances of glare at this viewpoint will be short-term.
- From viewpoint 2, drawing P921/SG/01 shows that there will also be some glare from the curved north-east facade of the Proposed Development at 05:25 on June 21st, again within an of 20° from the eye line of the motorists travelling southbound along Rugby Road towards the stadium. Whilst the instance of glare is within the driver’s line of sight, the annual sequence demonstrates that the extent of glare in this proximity will only be apparent for a few seconds at any one time as the vehicles are travelling along the road.
- From viewpoint 3, drawing P921/SG/02 shows that at the sample time of 06:38 on April 21st, there will be an instance of glare from the curved north-east facade of the Proposed Development at an angle of 30° from the eye line of the motorists travelling southbound along Rugby Road. The glare, however, is offset at an oblique angle from the road and not in the direct line of site of the motorists, with any effects likely to be transient and short-term in nature.
- From viewpoint 4, drawing P921/SG/02 shows that at the sample time of 08:03 on February 10th, there will be an instance of glare from the east facade of the Proposed Development at an angle of 20° from the eye line of the motorists approaching the stadium along Rugby Road. A sequence of additional views at 06:53 on March 21st and 06:11 on June 21st on drawing P921/SG/03 shows there would be intermittent instances of glare during the very early parts of the day. Whilst the instances of glare are within 20° of the driver’s line of sight, the annual sequence demonstrates that the extent of glare from any one glazed facet of the development will only be apparent for a few seconds at any one time as the vehicles are travelling along the road.
- From viewpoint 5, drawing P921/SG/04 show a sequence of visualisations at 08:03 on May 17th and 08:26 on 17th February that show there will be an instance of glare from the east facade of the Proposed Development at an angle of 20° from the eye line of the motorists approaching the stadium along Rugby Road. Additional sample times of 07:45 on May 9th, 06:24 on May 16th and 06:41 on June 21st show similar instances of glare on the curved north eastern façade of the stadium. The visualisations demonstrate that the patterns of glare will be transient across the façade of the development as the path of sun moves around at a low trajectory. Again the annual sequence demonstrates that the extent of glare in this proximity will only be apparent for a few seconds at any one time as the vehicles are travelling along the road.



- Based upon the above solar glare assessment results the extent of any glare is localised to the curved north east façade of the Proposed Development and any instances will be short term at any one point along Rugby Road and limited to the early hours of the day throughout the year. Given that motorists will generally be travelling along Rugby Road rather than remaining stationary for any extended periods of time, the effects of glare are unlikely to be noticeable for any longer than a few seconds at a time.

5.38 In summary, any potential solar glare effects from the Proposed Development are likely to occur for limited periods in the early hours of the day and most notably during the winter months when the sun is lower in the sky. The effects are considered to be of a minor adverse significance, with motorists travelling along Rugby Road towards to the stadium only experiencing glare from the Proposed Development for a matter of seconds at any one point in time. As vehicles will generally be travelling along Rugby Road as they approach the stadium, any solar glare effects will be transient in nature and unlikely to have a noticeable effect on the motorists.



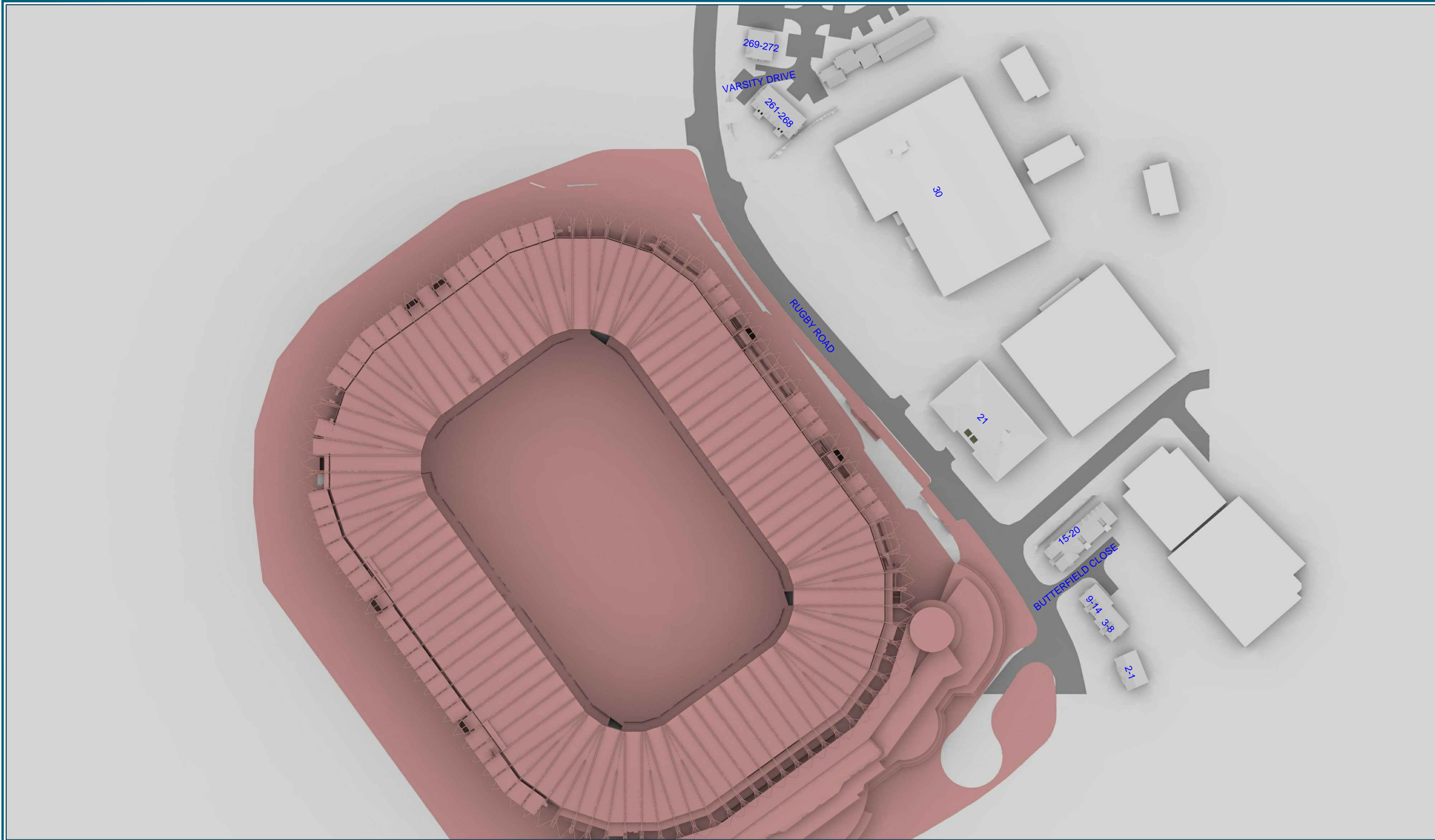
6 Conclusion

- 6.1 Point 2 Surveyors have undertaken a detailed technical analysis to quantify the effect of the construction of the KSS Architects proposals for the East Stand extension of Twickenham Stadium upon the daylight and sunlight amenity of the existing neighbouring residential properties. Additional assessments of overshadowing and solar glare have also been undertaken upon request of LBRuT.
- 6.2 The effect of the Proposed Development upon each of the existing residential properties analysed is considered to be negligible in nature on the basis that the VSC and NSL alterations, if any, to all of the habitable rooms and windows tested are fully compliant with BRE guidance. This means that the occupants of these rooms are unlikely to notice any alteration to their levels of daylight as a result of the Proposed Development.
- 6.3 In terms of the sunlight position, any alterations, where applicable, are also fully compliant with the relevant BRE guidance. This again means that the occupants of those habitable rooms facing the Proposed Development are unlikely to notice any alteration to their sunlight amenity.
- 6.4 A detailed solar glare assessment has indicated the glazed façade of the Proposed Development will give rise to some intermittent and short-term instances of glare during the early parts of the day during the course of the year. From our analysis of key motorist viewpoints along Rugby Road as vehicles travel south towards the stadium, any instances of glare are limited to a broken pattern of short-lived reflections. This is further mitigated by the fact that motorists will generally be moving rather than remaining stationary for extended periods of time, and therefore any effects are likely to be minimal.
- 6.5 Following a detailed technical assessments, the overall daylight and sunlight impacts of the Proposed Development upon the existing neighbouring residential properties follows the guidance and recommendations set out in the BRE Guidelines and should therefore be considered to be acceptable.



Appendix 1 – Site Plan and 3D Drawings





Sources: Site Photos
Point Cloud Data

Ordnance Survey

15735 - ARCH Master - R16 - 160617.rvt
Set of information:
15735TwickenhamStadiumEastStandDevelopment_210879

Key: All the Heights in mm AOD
— Proposed Scheme
— Existing Buildings



Project: Twickenham Stadium

Title: Site Plan
Existing Buildings

Point 2 Surveyors Ltd,
3rd Floor,
17 Slingsby Place,
London WC2E 9AB,
0207 836 5828
www.point2surveyors.com

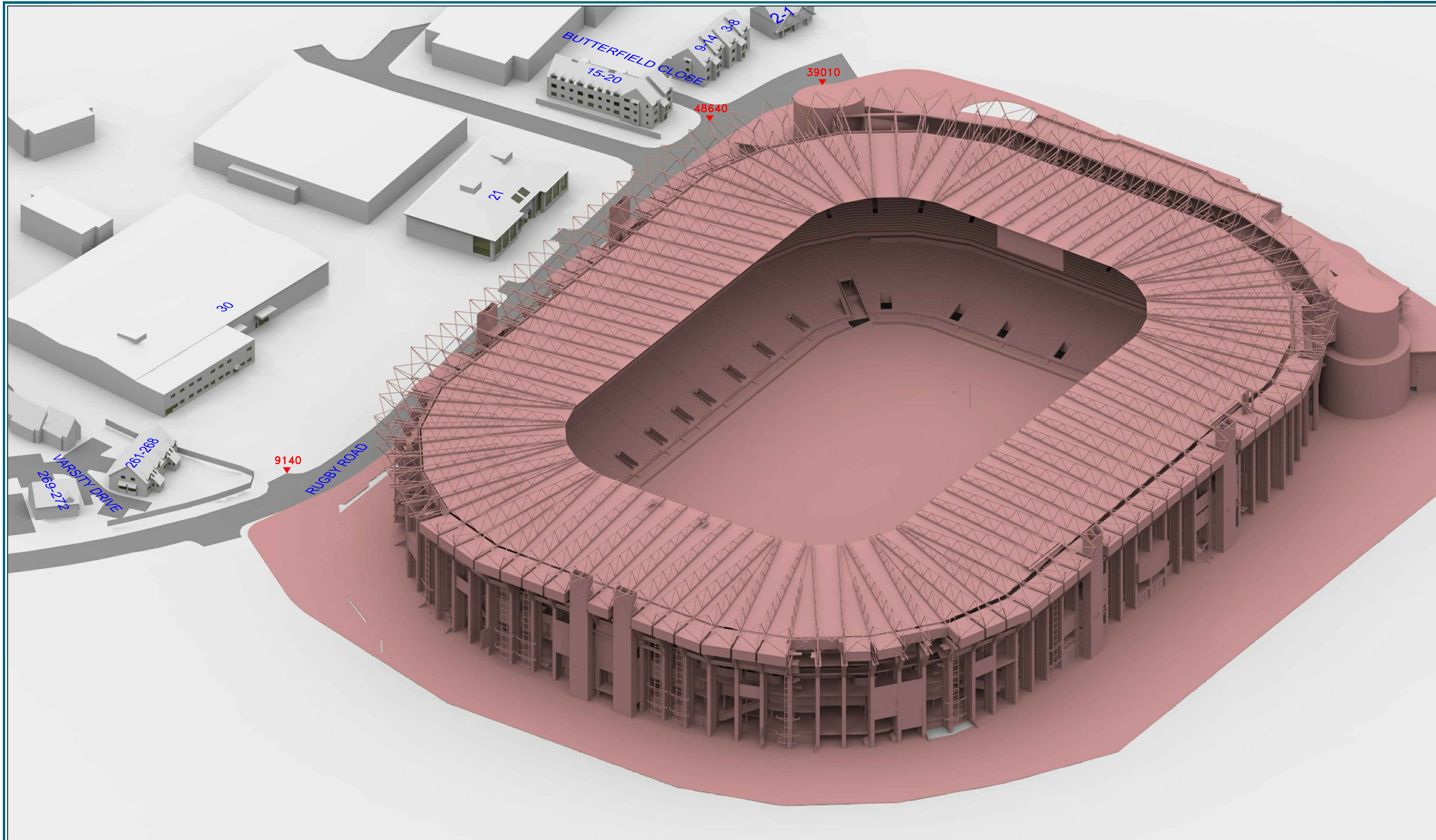
Drawn By: CGC/EVJ

Scale: 1:1500

Date: JUN 16

Dwg No: **P921/01**





Sources: Site Photos
Point Cloud Data

Ordnance Survey

15735 - ARCH Master - R16 - 160617.rvt
Set of information:
15735TwickenhamStadiumEastStandDevelopment_210879

Key: All the Heights in mm AOD
— Proposed Scheme
— Existing Buildings

Project: Twickenham Stadium

Title: 3D View
Existing Buildings

Point 2 Surveyors Ltd,
3rd Floor,
17 Slingsby Place,
London WC2E 9AB,
0207 836 5828
www.point2surveyors.com

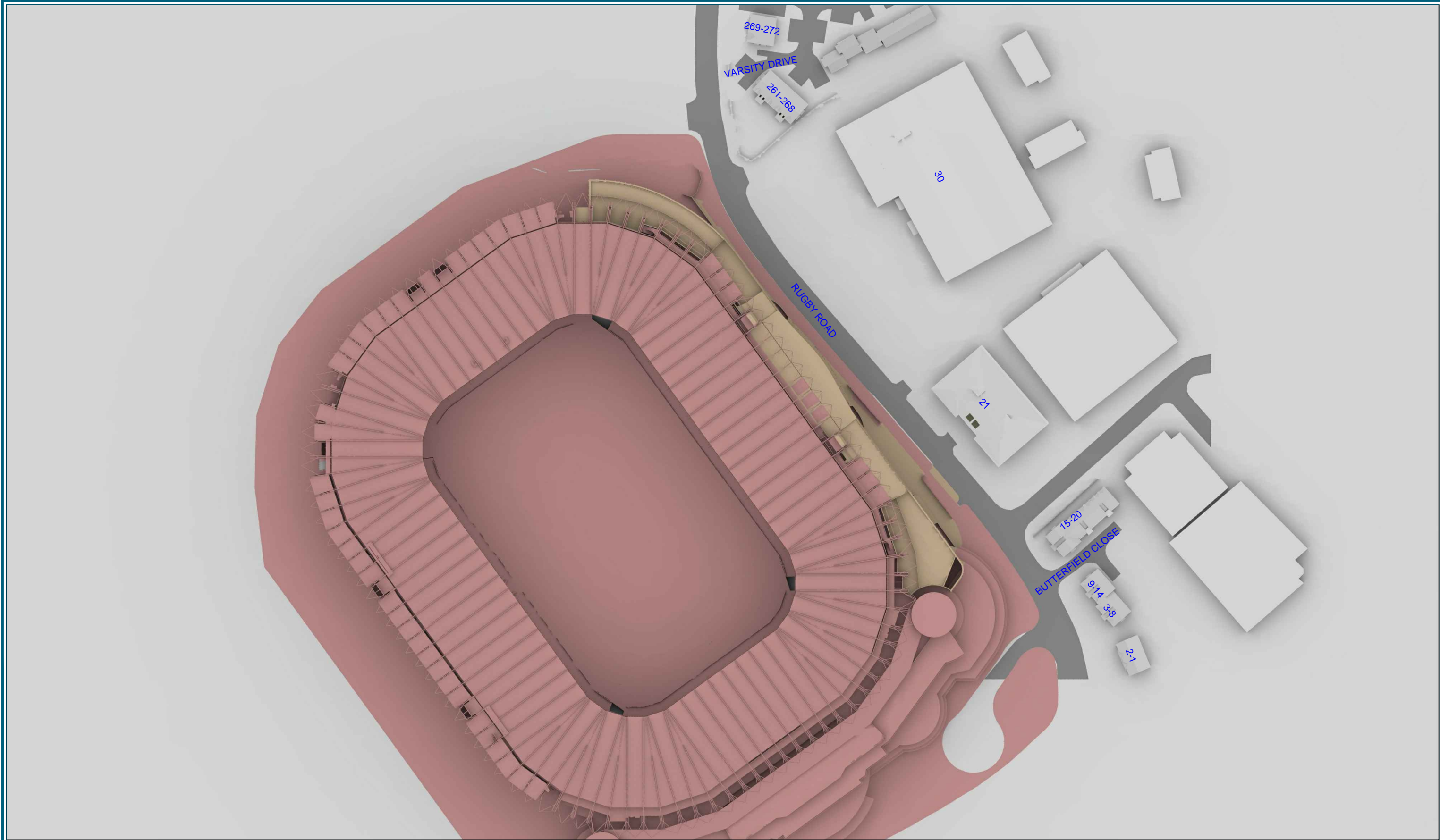
Drawn By: CGC/EVJ

Scale: NTS

Date: JUN 16

Dwg No: **P921/03**





Sources: Site Photos
Point Cloud Data

Ordnance Survey

15735 - ARCH Master - R16 - 160617.rvt
Set of information:
15735TwickenhamStadiumEastStandDevelopment_210879

Key: All the Heights in mm AOD
— Proposed Scheme
— Existing Buildings



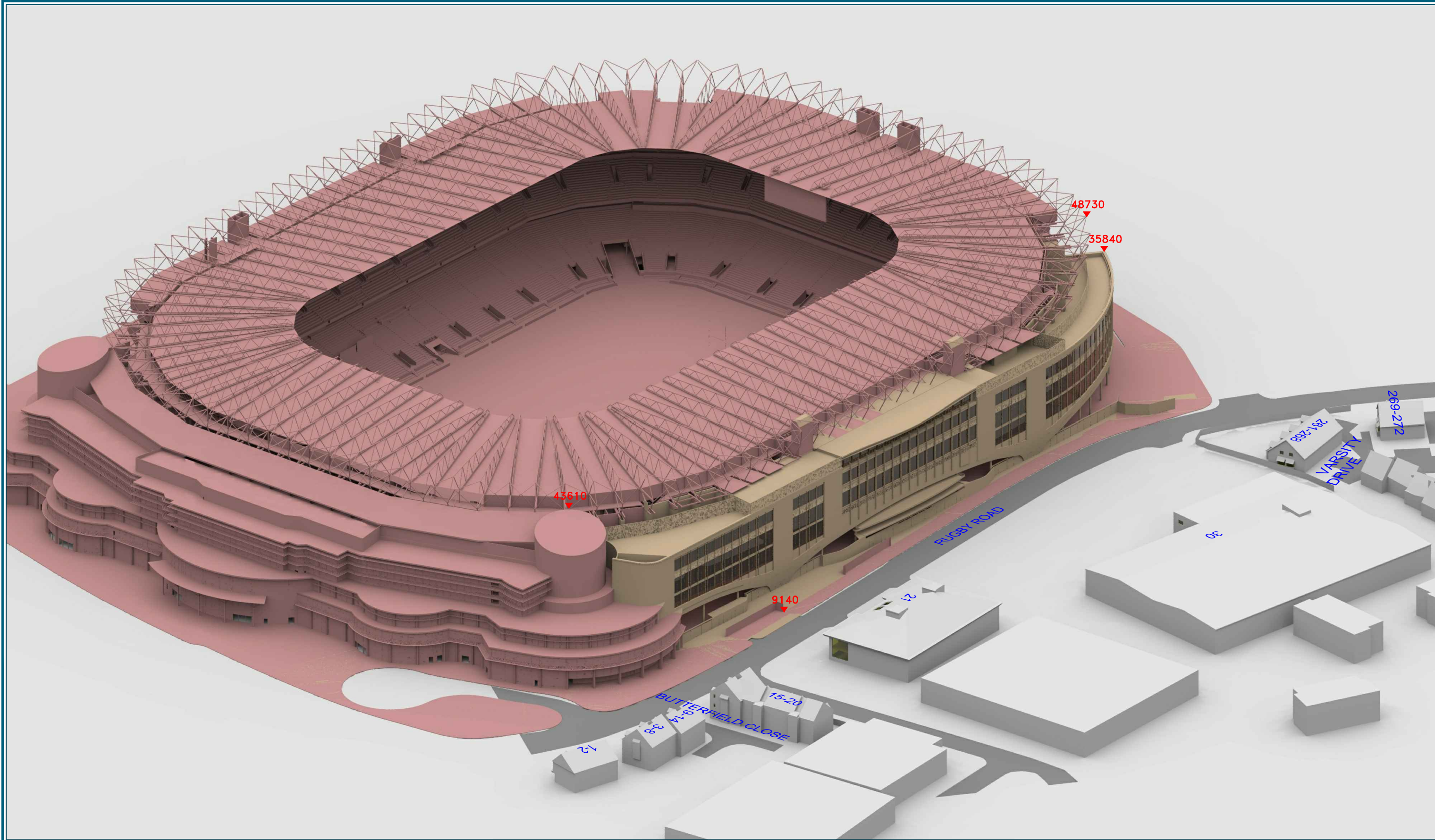
Project: Twickenham Stadium

Title: Site Plan
Proposed Scheme 20/06/16

Point 2 Surveyors Ltd,
3rd Floor,
17 Slingsby Place,
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Drawn By: CGC/EVJ	Scale: 1:1500	Date: JUN 16	Dwg No: P921/12
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Sources: Site Photos
Point Cloud Data

Ordnance Survey

15735 - ARCH Master - R16 - 160617.rvt
Set of information:
15735TwickenhamStadiumEastStandDevelopment_210879

Key: All the Heights in mm AOD
— Proposed Scheme
— Existing Buildings

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Project: Twickenham Stadium

Title: 3D View
Proposed Scheme 20/06/16

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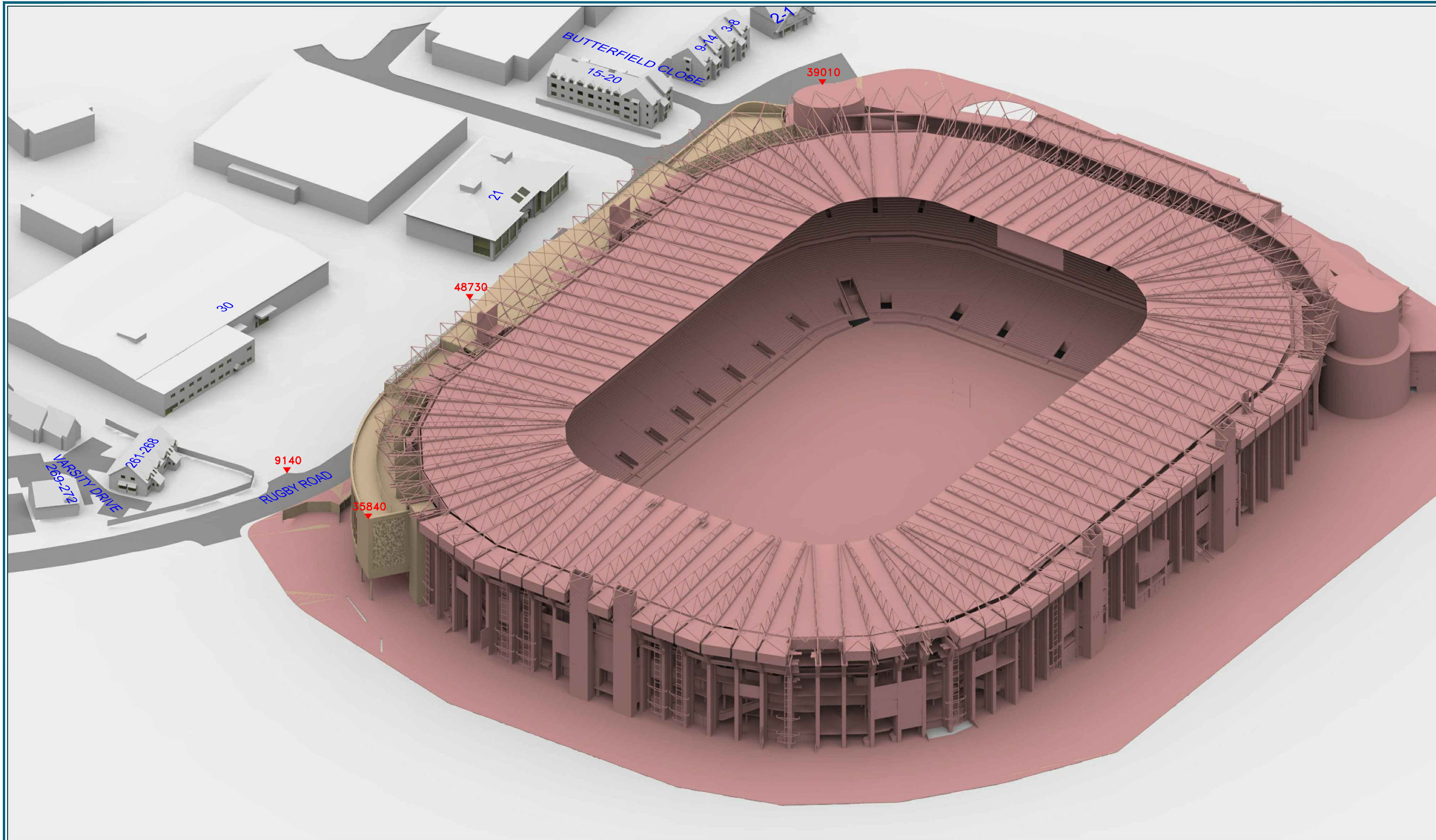


Drawn By: CGC/EVJ

Scale: NTS

Date: JUN 16

Dwg No: **P921/13**



Sources: Site Photos
Point Cloud Data

Ordnance Survey

15735 - ARCH Master - R16 - 160617.rvt
Set of information:
15735TwickenhamStadiumEastStandDevelopment_210879

Key: All the Heights in mm AOD
— Proposed Scheme
— Existing Buildings

Project: Twickenham Stadium

Title: 3D View
Proposed Scheme 20/06/16

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Scale: NTS

Date: JUN 16

Dwg No:

P921/14



Appendix 2 - Daylight and Sunlight Results



Room	Room Use	Window	EXISTING VSC	PROPOSED VSC	LOSS VSC	%LOSS VSC	Room	Room Use	Window	EXISTING ADF	TOTAL	PROPOSED ADF	TOTAL	TOTAL LOSS	%LOSS ADF
261-268 Varsity Drive							261-268 Varsity Drive								
R1/150	ASSUMED	W7/150	26.29	26.06	0.23	0.87	R1/150	ASSUMED	W7/150	2.52	2.52	2.50	2.50	0.02	0.64
R2/150	ASSUMED_KITCH	W1/150	34.09	34.09	0.00	0.00	R2/150	ASSUMED_KITCH	W1/150	2.05		2.05			
R2/150	ASSUMED_KITCH	W3/150	0.00	0.00	0.00	0.00	R2/150	ASSUMED_KITCH	W3/150	0.25		0.25			
R2/150	ASSUMED_KITCH	W5/150	21.10	21.10	0.00	0.00	R2/150	ASSUMED_KITCH	W5/150	0.41	2.71	0.41	2.71	0.00	0.00
R3/150	ASSUMED_KITCH	W2/150	33.96	33.95	0.01	0.03	R3/150	ASSUMED_KITCH	W2/150	2.03		2.03			
R3/150	ASSUMED_KITCH	W4/150	18.26	18.19	0.07	0.38	R3/150	ASSUMED_KITCH	W4/150	0.38		0.38			
R3/150	ASSUMED_KITCH	W6/150	0.00	0.00	0.00	0.00	R3/150	ASSUMED_KITCH	W6/150	0.25	2.66	0.25	2.66	0.00	0.04
R6/150	ASSUMED	W12/150	24.09	23.63	0.46	1.91	R6/150	ASSUMED	W12/150	1.46	1.46	1.43	1.43	0.02	1.51
R7/150	ASSUMED	W13/150	25.58	25.15	0.43	1.68	R7/150	ASSUMED	W13/150	1.53	1.53	1.51	1.51	0.02	1.31
R10/150	ASSUMED_KITCH	W19/150	0.00	0.00	0.00	0.00	R10/150	ASSUMED_KITCH	W19/150	0.18		0.17			
R10/150	ASSUMED_KITCH	W21/150	17.98	17.98	0.00	0.00	R10/150	ASSUMED_KITCH	W21/150	0.35		0.35			
R10/150	ASSUMED_KITCH	W23/150	26.83	26.68	0.15	0.56	R10/150	ASSUMED_KITCH	W23/150	1.63	2.15	1.62	2.14	0.01	0.46
R11/150	ASSUMED_KITCH	W20/150	14.61	14.26	0.35	2.40	R11/150	ASSUMED_KITCH	W20/150	0.29		0.28			
R11/150	ASSUMED_KITCH	W22/150	0.00	0.00	0.00	0.00	R11/150	ASSUMED_KITCH	W22/150	0.21		0.21			
R11/150	ASSUMED_KITCH	W24/150	26.36	26.22	0.14	0.53	R11/150	ASSUMED_KITCH	W24/150	1.62	2.12	1.61	2.10	0.01	0.61
R12/150	ASSUMED	W18/150	24.03	23.41	0.62	2.58	R12/150	ASSUMED	W18/150	2.34	2.34	2.30	2.30	0.04	1.80
R1/151	ASSUMED	W3/151	30.72	30.46	0.26	0.85	R1/151	ASSUMED	W3/151	1.98	1.98	1.97	1.97	0.02	0.76
R2/151	ASSUMED	W1/151	39.03	39.03	0.00	0.00	R2/151	ASSUMED	W1/151	1.15	1.15	1.15	1.15	0.00	0.00
R3/151	ASSUMED	W2/151	39.02	39.02	0.00	0.00	R3/151	ASSUMED	W2/151	1.14	1.14	1.14	1.14	0.00	0.00
R4/151	ASSUMED	W4/151	75.64	75.38	0.26	0.34	R4/151	ASSUMED	W4/151	2.91	2.91	2.90	2.90	0.01	0.41
R5/151	ASSUMED	W5/151	74.75	74.48	0.27	0.36	R5/151	ASSUMED	W5/151	2.86	2.86	2.85	2.85	0.01	0.38

Room	Room Use	Window	EXISTING VSC	PROPOSED VSC	LOSS VSC	%LOSS VSC	Room	Room Use	Window	EXISTING ADF	TOTAL	PROPOSED ADF	TOTAL	TOTAL LOSS	%LOSS ADF
R6/151	ASSUMED	W6/151	30.76	30.44	0.32	1.04	R6/151	ASSUMED	W6/151	1.34	1.34	1.33	1.33	0.01	0.89
R7/151	ASSUMED	W7/151	30.57	30.12	0.45	1.47	R7/151	ASSUMED	W7/151	1.32	1.32	1.31	1.31	0.02	1.14
R8/151	ASSUMED	W8/151	74.70	74.30	0.40	0.54	R8/151	ASSUMED	W8/151	2.83	2.83	2.81	2.81	0.02	0.60
R9/151	ASSUMED	W9/151	75.06	74.60	0.46	0.61	R9/151	ASSUMED	W9/151	2.92	2.92	2.90	2.90	0.02	0.69
R10/151	ASSUMED	W11/151	35.02	34.88	0.14	0.40	R10/151	ASSUMED	W11/151	1.03	1.03	1.02	1.02	0.00	0.29
R11/151	ASSUMED	W12/151	35.12	34.96	0.16	0.46	R11/151	ASSUMED	W12/151	1.02	1.02	1.01	1.01	0.00	0.39
R12/151	ASSUMED	W10/151	29.95	29.40	0.55	1.84	R12/151	ASSUMED	W10/151	2.08	2.08	2.05	2.05	0.03	1.63
1-12 & 15-20 Butterfield Close							1-12 & 15-20 Butterfield Close								
R1/120	ASSUMED	W1/120	32.81	32.66	0.15	0.46	R1/120	ASSUMED	W1/120	1.59	1.59	1.58	1.58	0.01	0.31
R2/120	ASSUMED	W2/120	32.78	32.62	0.16	0.49	R2/120	ASSUMED	W2/120	0.87	0.87	0.86	0.86	0.00	0.23
R3/120	ASSUMED	W3/120	32.59	32.41	0.18	0.55	R3/120	ASSUMED	W3/120	0.87	0.87	0.86	0.86	0.00	0.46
R4/120	ASSUMED	W4/120	32.33	32.11	0.22	0.68	R4/120	ASSUMED	W4/120	1.53	1.53	1.52	1.52	0.01	0.46
R5/120	ASSUMED	W5/120	32.08	31.83	0.25	0.78	R5/120	ASSUMED	W5/120	1.51	1.51	1.50	1.50	0.01	0.60
R6/120	ASSUMED	W6/120	31.93	31.63	0.30	0.94	R6/120	ASSUMED	W6/120	0.85	0.85	0.85	0.85	0.01	0.59
R7/120	ASSUMED	W7/120	31.64	31.27	0.37	1.17	R7/120	ASSUMED	W7/120	0.85	0.85	0.84	0.84	0.01	0.82
R8/120	ASSUMED	W8/120	30.02	29.68	0.34	1.13	R8/120	ASSUMED	W8/120	1.40	1.40	1.39	1.39	0.01	0.78
R9/120	ASSUMED	W9/120	31.24	30.64	0.60	1.92	R9/120	ASSUMED	W9/120	1.08	1.08	1.07	1.07	0.02	1.48

Room	Room Use	Window	EXISTING VSC	PROPOSED VSC	LOSS VSC	%LOSS VSC	Room	Room Use	Window	EXISTING ADF	TOTAL	PROPOSED ADF	TOTAL	TOTAL LOSS	%LOSS ADF
R10/120	ASSUMED	W10/120	31.37	30.68	0.69	2.20	R10/120	ASSUMED	W10/120	1.05	1.05	1.03	1.03	0.02	1.43
R11/120	ASSUMED	W11/120	30.88	30.01	0.87	2.82	R11/120	ASSUMED	W11/120	0.35		0.35			
R11/120	ASSUMED	W12/120	27.71	26.66	1.05	3.79	R11/120	ASSUMED	W12/120	1.30	1.66	1.26	1.61	0.04	2.48
R13/120	ASSUMED	W14/120	29.19	28.53	0.66	2.26	R13/120	ASSUMED	W14/120	1.33		1.31			
R13/120	ASSUMED	W15/120	31.59	31.59	0.00	0.00	R13/120	ASSUMED	W15/120	0.34	1.67	0.34	1.64	0.02	1.44
R1/121	ASSUMED	W1/121	34.26	34.15	0.11	0.32	R1/121	ASSUMED	W1/121	1.76	1.76	1.76	1.76	0.00	0.23
R2/121	ASSUMED	W2/121	34.06	33.94	0.12	0.35	R2/121	ASSUMED	W2/121	0.90	0.90	0.90	0.90	0.00	0.22
R3/121	ASSUMED	W3/121	33.86	33.72	0.14	0.41	R3/121	ASSUMED	W3/121	0.90	0.90	0.90	0.90	0.00	0.22
R4/121	ASSUMED	W4/121	33.64	33.48	0.16	0.48	R4/121	ASSUMED	W4/121	1.69	1.69	1.68	1.68	0.01	0.36
R5/121	ASSUMED	W5/121	33.39	33.19	0.20	0.60	R5/121	ASSUMED	W5/121	1.67	1.67	1.66	1.66	0.01	0.48
R6/121	ASSUMED	W6/121	33.21	32.95	0.26	0.78	R6/121	ASSUMED	W6/121	0.89	0.89	0.88	0.88	0.01	0.56
R7/121	ASSUMED	W7/121	32.98	32.66	0.32	0.97	R7/121	ASSUMED	W7/121	0.88	0.88	0.88	0.88	0.01	0.57
R8/121	ASSUMED	W8/121	31.43	31.10	0.33	1.05	R8/121	ASSUMED	W8/121	1.55	1.55	1.54	1.54	0.01	0.71
R9/121	ASSUMED	W9/121	32.66	32.13	0.53	1.62	R9/121	ASSUMED	W9/121	1.12	1.12	1.11	1.11	0.01	1.25
R10/121	ASSUMED	W10/121	32.77	32.14	0.63	1.92	R10/121	ASSUMED	W10/121	1.09	1.09	1.08	1.08	0.01	1.28
R11/121	ASSUMED	W11/121	32.31	31.53	0.78	2.41	R11/121	ASSUMED	W11/121	0.37		0.36			
R11/121	ASSUMED	W12/121	28.99	28.08	0.91	3.14	R11/121	ASSUMED	W12/121	1.40	1.76	1.37	1.73	0.04	2.10
R12/121	ASSUMED	W13/121	29.59	28.80	0.79	2.67	R12/121	ASSUMED	W13/121	2.47	2.47	2.42	2.42	0.05	2.11
R13/121	ASSUMED	W14/121	30.47	29.95	0.52	1.71	R13/121	ASSUMED	W14/121	1.46		1.44			
R13/121	ASSUMED	W15/121	34.27	34.27	0.00	0.00	R13/121	ASSUMED	W15/121	0.36	1.82	0.36	1.80	0.02	1.10

Room	Room Use	Window	EXISTING VSC	PROPOSED VSC	LOSS VSC	%LOSS VSC	Room	Room Use	Window	EXISTING ADF	TOTAL	PROPOSED ADF	TOTAL	TOTAL LOSS	%LOSS ADF
R1/122	ASSUMED	W1/122	35.29	35.22	0.07	0.20	R1/122	ASSUMED	W1/122	1.32	1.32	1.32	1.32	0.00	0.15
R2/122	ASSUMED	W2/122	34.90	34.81	0.09	0.26	R2/122	ASSUMED	W2/122	0.93	0.93	0.93	0.93	0.00	0.21
R3/122	ASSUMED	W3/122	34.69	34.57	0.12	0.35	R3/122	ASSUMED	W3/122	0.93	0.93	0.93	0.93	0.00	0.22
R4/122	ASSUMED	W4/122	34.59	34.45	0.14	0.40	R4/122	ASSUMED	W4/122	1.25	1.25	1.24	1.24	0.00	0.32
R5/122	ASSUMED	W5/122	34.34	34.16	0.18	0.52	R5/122	ASSUMED	W5/122	1.24	1.24	1.23	1.23	0.01	0.40
R6/122	ASSUMED	W6/122	33.98	33.76	0.22	0.65	R6/122	ASSUMED	W6/122	0.91	0.91	0.91	0.91	0.00	0.44
R7/122	ASSUMED	W7/122	33.73	33.45	0.28	0.83	R7/122	ASSUMED	W7/122	0.93	0.93	0.92	0.92	0.01	0.54
R8/122	ASSUMED	W8/122	33.37	33.14	0.23	0.69	R8/122	ASSUMED	W8/122	1.18	1.18	1.17	1.17	0.01	0.60
R9/122	ASSUMED	W9/122	33.75	33.39	0.36	1.07	R9/122	ASSUMED	W9/122	1.14	1.14	1.13	1.13	0.01	0.87
R10/122	ASSUMED	W10/122	25.48	24.97	0.51	2.00	R10/122	ASSUMED	W10/122	0.82	0.82	0.81	0.81	0.01	1.34
R11/122	ASSUMED	W11/122	32.99	32.37	0.62	1.88	R11/122	ASSUMED	W11/122	0.37		0.36			
R11/122	ASSUMED	W12/122	27.25	26.55	0.70	2.57	R11/122	ASSUMED	W12/122	1.18	1.55	1.15	1.52	0.03	1.94
R13/122	ASSUMED	W13/122	31.69	31.21	0.48	1.51	R13/122	ASSUMED	W13/122	1.50		1.48			
R13/122	ASSUMED	W14/122	36.66	36.66	0.00	0.00	R13/122	ASSUMED	W14/122	0.38	1.88	0.38	1.86	0.02	0.90
9-14 Rugby Road							9-14 Rugby Road								
R1/130		W1/130	22.82	22.47	0.35	1.53	R1/130		W1/130	0.89	0.89	0.87	0.87	0.01	1.36
R2/130	ASSUMED	W2/130	30.94	30.65	0.29	0.94	R2/130	ASSUMED	W2/130	1.32	1.32	1.31	1.31	0.01	0.68
R4/130	ASSUMED	W5/130	28.89	28.75	0.14	0.48	R4/130	ASSUMED	W5/130	1.22	1.22	1.21	1.21	0.00	0.25

Room	Room Use	Window	EXISTING VSC	PROPOSED VSC	LOSS VSC	%LOSS VSC	Room	Room Use	Window	EXISTING ADF	TOTAL	PROPOSED ADF	TOTAL	TOTAL LOSS	%LOSS ADF
R1/131	ASSUMED	W1/131	28.35	28.10	0.25	0.88	R1/131	ASSUMED	W1/131	1.02	1.02	1.01	1.01	0.01	0.78
R2/131	ASSUMED	W2/131	32.44	32.21	0.23	0.71	R2/131	ASSUMED	W2/131	1.35	1.35	1.34	1.34	0.01	0.52
R4/131	ASSUMED	W4/131	30.78	30.70	0.08	0.26	R4/131	ASSUMED	W4/131	1.25	1.25	1.25	1.25	0.00	0.16
R1/132	ASSUMED	W1/132	25.57	25.39	0.18	0.70	R1/132	ASSUMED	W1/132	0.87	0.87	0.86	0.86	0.01	0.69
R2/132	ASSUMED	W2/132	31.74	31.59	0.15	0.47	R2/132	ASSUMED	W2/132	0.88	0.88	0.87	0.87	0.00	0.46
R3/132	ASSUMED	W3/132	31.71	31.62	0.09	0.28	R3/132	ASSUMED	W3/132	0.85	0.85	0.85	0.85	0.00	0.23
3-8 Rugby Road			3-8 Rugby Road												
R5/130	ASSUMED	W6/130	32.23	32.08	0.15	0.47	R5/130	ASSUMED	W6/130	1.21	1.21	1.20	1.20	0.01	0.41
R7/130	ASSUMED	W9/130	31.30	31.27	0.03	0.10	R7/130	ASSUMED	W9/130	1.61	1.61	1.61	1.61	0.00	0.00
R5/131	ASSUMED	W5/131	33.50	33.40	0.10	0.30	R5/131	ASSUMED	W5/131	1.25	1.25	1.25	1.25	0.00	0.24
R7/131	ASSUMED	W7/131	32.96	32.94	0.02	0.06	R7/131	ASSUMED	W7/131	1.62	1.62	1.62	1.62	0.00	0.00
R4/132	ASSUMED	W4/132	32.37	32.30	0.07	0.22	R4/132	ASSUMED	W4/132	0.79	0.79	0.79	0.79	0.00	0.13
R5/132	ASSUMED	W5/132	32.29	32.26	0.03	0.09	R5/132	ASSUMED	W5/132	1.15	1.15	1.14	1.14	0.00	0.09