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The Arc

Reading

Initial Solar Reflective Glare Report

Overshadowing

• Daylight & Sunlight • Light Pollution •

Solar Glare • Daylight Design

Director:	Liam Dunford
Client:	James Croucher
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Introduction

1.1 Point 2 Surveyors Ltd have been instructed to undertake a Solar Reflective Glare study in relation to the proposed 'The Arc' development in Reading.

1.2 The calculations in this report have been based on the 3D models provided. We note that the context model does not include the recently redeveloped Reading station.

1.3 The illustrative results of the assessments are given at Appendix B, C and D.

2 Methodology

2.1 The BRE Guidelines makes the following statement regarding the potential for reflected solar glare on a development:

> *"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."*

2.2 The CIE (Commission Internationale de L'Eclairage) 1507:2002 Collection on glare states:

> *"Disability glare is glare that impairs vision (CIE, 1987). It is caused by scattering of light inside the eye [...]. The veiling luminance of scattered light will have a significant effect on visibility when intense light sources are present in the peripheral visual field and the contrast of objects to be seen is low. "*
>
> *"Disability glare is most often of importance at night when contrast sensitivity is low and there may well be one or more bright light sources near to the line of sight, such as car headlights, streetlights or floodlights. But even in daylight conditions disability glare may be of practical significance: think of traffic lights when the sun is close to them, or the difficulty viewing paintings hanging next to windows."*

2.3 The BRE guidelines outline a brief methodology for evaluation of the scale of a solar glare issue: "If it is likely that a building may cause solar dazzle the exact scale of the problem should be evaluated...by identifying key locations such as road junctions and windows of nearby buildings, and working out the number of hours of the year that sunlight can be reflected to these points."

2.4 Solar glare assessments simulate the path of the sun for the entire year around a proposed development in order to establish the locations, times, duration and direction of solar reflections and identify where these may affect sensitive locations, with a particular focus on road users or railways.

2.5 The assessment is carried out using a specialist software applied to a three dimensional AutoCAD model of the building and its surrounding context. In the first instance, the glazing in the building is replaced by red coloured mirrors. This will then clearly 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.

2.6 A further (worst case scenario) solar glare assessment is then undertaken from each of these viewpoints based on the actual façade treatment of the proposed development. An image for the viewpoint is then produced indicating the area which sees reflection at any point during the year. The diagram illustrates a focal point at 10° from the centre of the visual axis, and concentric circles from 20° to 90°. These provide a reference from which potential issues can be judged.

2.7 In order to understand the overall effect in solar glare terms, all of the instances, duration of those instances and angles of those instances as seen from the assessment points are plotted onto a grid, creating the Calendar Graphs for each viewpoint.

2.8 The Calendar Graphs' axes show the days of the year along the X axis and time of day on the Y axis. The graph has 365 segments along the X axis, one for each day and 720 segments on the Y axis each representing 2 minutes of the 24hr period per day. The light grey illustrates the times of daylight during each day and the dark grey illustrates the times of night. The yellow, green, orange and red colours indicate when Solar Glare may occur, and, depending on the colour, the angle at which it is likely to occur from the receptor. If a band of colour is tall it means that solar glare is likely to occur for an extended period of time during that day. If the band of colour is thin and long on the graph, it means solar glare may occur on each day but only for a limited time.

3 Significance Criteria

3.1 There are no quantitative criteria within the 2011 BRE Guidelines regarding acceptable levels of solar glare. There is, however, research which suggests that the significance of a glare occurrence is largely dependent upon its angle from the line of sight and the relevance of this with respect to the human field of vision:

> *"The fovea centralis, also generally known as the fovea, is a part of the eye, located in the centre of the macula region of the retina. The fovea is responsible for sharp central vision (also called foveal vision), which is necessary in humans for reading, watching television or movies, driving, and any activity where visual detail is of primary importance."*

(B. Colbert, et al., *Anatomy, Physiology, and Disease, An Interactive Journey for Health Professions*, 1st edn, 2016)

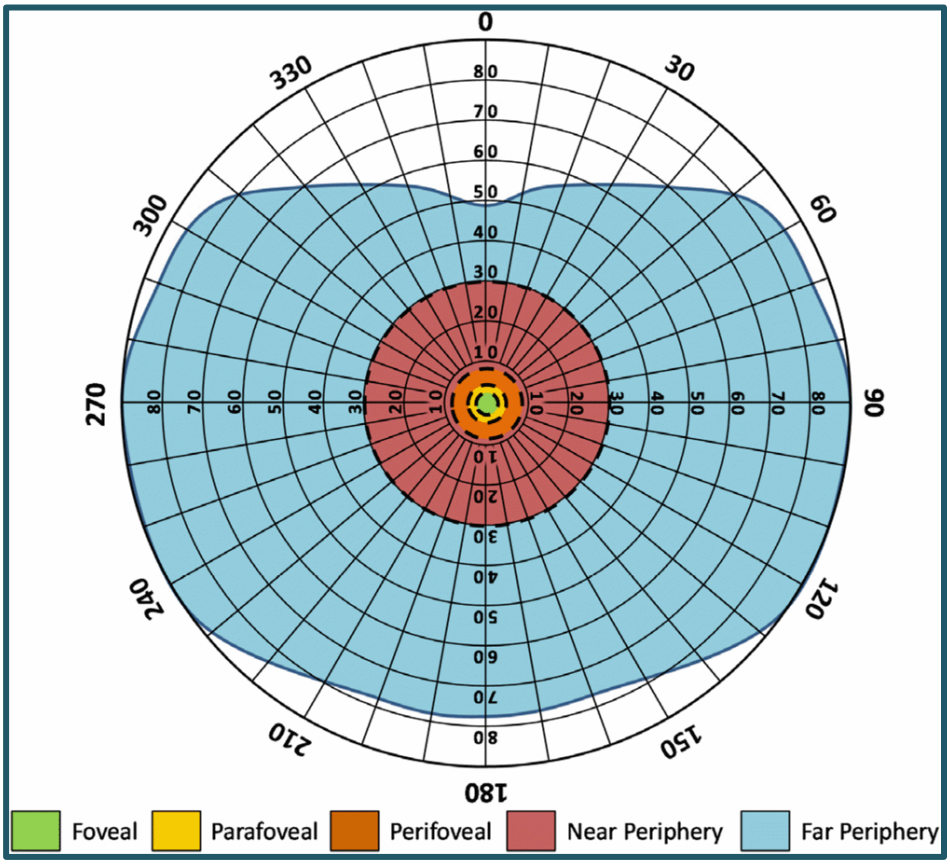


PLATE 02 – REGIONS WITHIN HUMAN BINOCULAR FIELD OF VIEW (J. JONES, ET AL., *PERIPHERAL STIMULATION AND ITS EFFECT ON PERCEIVED SPATIAL SCALE IN VIRTUAL ENVIRONMENTS)*

3.2 Glare occurrences that could encroach on the foveal view (3° from the visual axis) are likely to cause significant visual impairment or distraction. It is also likely that the viewer's line of sight will vary from the chosen view direction at each Viewpoint. To account for this along with the likely range of movement of the eye, it is considered that lengthy occurrences within approximately 10° of the centre of the visual axis are potentially the most hazardous. In this scenario, the adverse impact would often be considered major and mitigation would be required.

3.3 Between 10° and 30° corresponds to Near Periphery field of view based on Plate 02 and therefore where glare occurs between these angles, the impact would be considered minor or moderate depending upon the location and use of the adjacent sensitive receptor and the period of time the glare occurs for.

3.4 An angle of greater than 30° corresponds to the Far Periphery field of view (based on Plate 02) and therefore the risk of reflective solar glare causing a hazard is reduced. As such, the impact would be considered to be of very minor significance.

4 Assumptions and Limitations

4.1 It is important to note that at this stage we have no information on the location of rail signals on the approach to the site. For practical reasons a representative selection of such locations are considered. Whilst the chosen Viewpoint locations provide a good representation of the overall impacts there will be similar effects in the vicinity.

4.2 Where potential impact are identified, further work and accurate source data relating to signal locations will subsequently be required. It will be necessary to consider the Rail Safety and Standards Board (RSSB) document titled "Signal Sighting Assessment Requirements One: June 2016" as a guideline to better understand the signal sighting requirements. However, we are not rail safety experts and our interpretations of the document would need to be confirmed by RSSB and Network Rail.

4.3 There are no established analytical or numerical acceptability criteria for the assessment of solar glare.

4.4 Manufacturer's details about material reflectance are rarely available in sufficient detail. Therefore, the intensity of the reflections is not calculated. However, given the brightness of sunlight, it is assumed that any potential instances of glare are bright enough to cause discomfort or distraction.

4.5 The duration of each glare occurrence assumes a stationary viewer at the specified Viewpoint. Within this study, the viewer (train driver) will move through the reflected beam quickly, but glare impacts may be more significant if the train is travelling along the path of a long reflected beam or if it is stationary at a junction.

4.6 We have assumed a clear sky throughout the year for our assessment. Frequently, the sky will be overcast, particularly in the winter months, which is often when the most significant adverse effects occur due to the sun's low altitude. The assessment therefore represents a worst-case scenario, which in the UK winter, will rarely occur.

5 The Site

5.1 The site is located to the south of Kings Meadow Road, to the east of Reading Station.

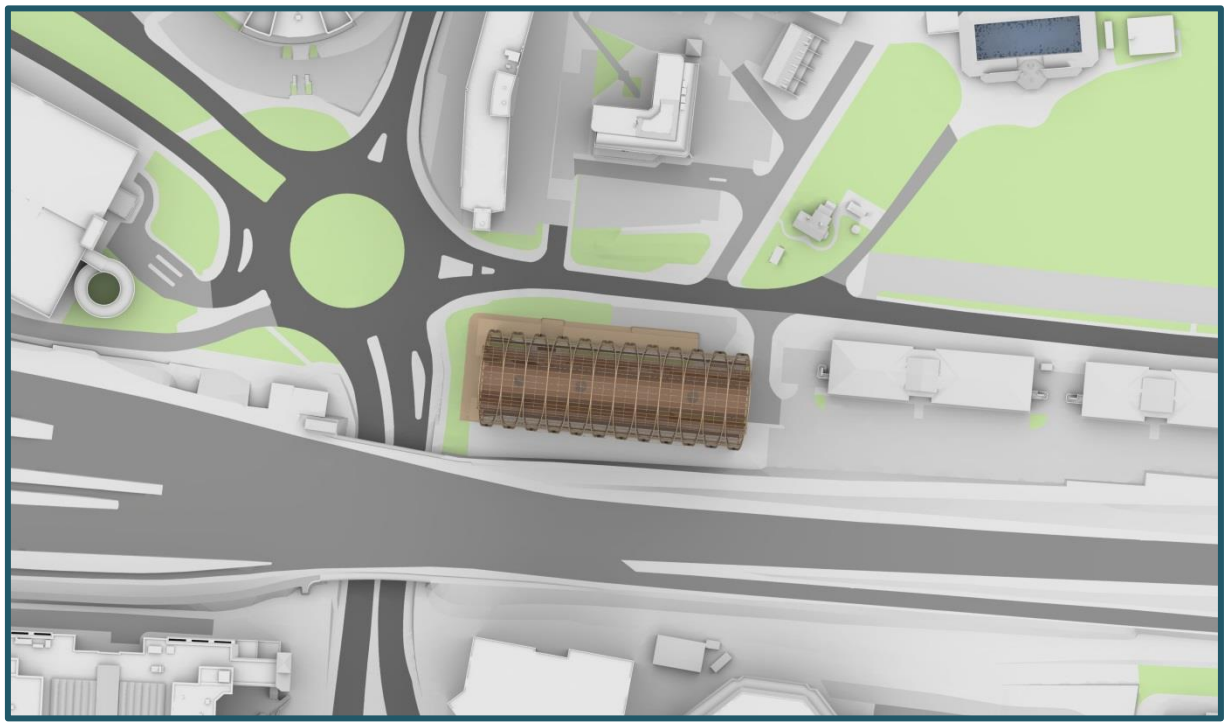


PLATE 01 – SITE PLAN SHOWING PROPOSAL

5.2 Our understanding of the site location can be seen within drawings P1507/01,02 &03 which can be found within Appendix A.

6 Assessments Results

6.1 A solar glare analysis has been undertaken, the results of which are illustrated within Appendices B, C and D of this report.

6.2 Initially, an annual sequence of images is generated for the proposed scheme, taken at 15-minute intervals on the 21st of each month for half the year, with the other half being symmetric. These images visually depict solar reflections as patches of reflected light on the buildings and terrain surrounding the site at 15 minute intervals. The annual sequence is used to identify sensitive locations in the proposed condition at which the glare reflection or reflections appear more intense. 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 and so in reality, they overstate any potential glare.

6.3 The annual sequence assessment results show that:-

- During the course of the year there will be some reflections from the Proposed Development on both the railway and at the road junctions approaching the neighbouring roundabouts.

- The most noticeable instances of glare are those that reflect directly along the railway line during the early morning and evening when the sun is lower in the sky.

- By reference to each 15-minute interval, it is clear that there will be some prolonged periods of solar glare running perpendicular to the railway tracks. Since these are unlikely to be in a required direction of view, these are unlikely to be a problem.

- There are instances of reflections running along the tracks, and these are therefore likely to fall within the required directions of view. Whilst these are more transient in nature, it is possible that these could interfere with signal visibility and will therefore require further consideration.

- Plate 02 (full drawing P1507/SGA/00 in Appendix C) identifies the locations of the chosen sensitive viewpoints.

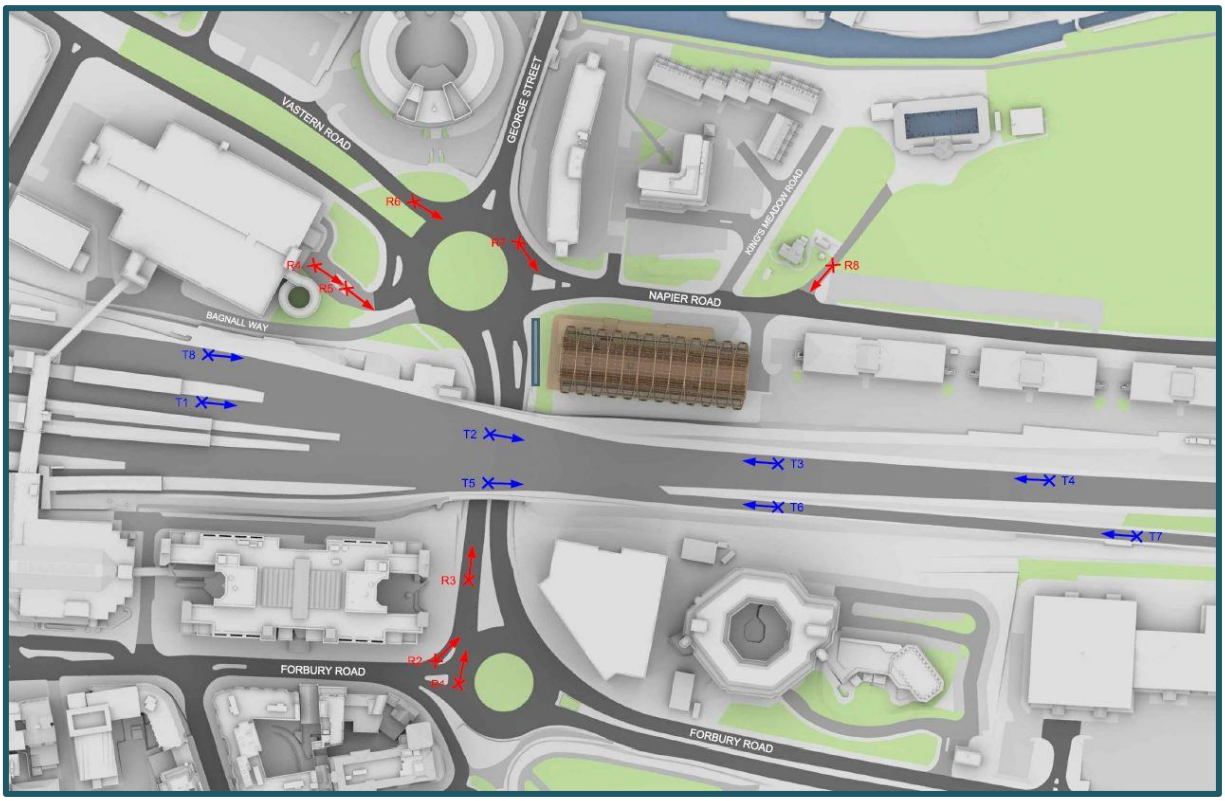


PLATE 02 – KEY PLAN SHOWING SOLAR REFLECTIVE GLARE ANALYSIS POINTS

6.4 Along the railway the chosen viewpoints are positioned 2.75m above railway level to represent the approximate eye level of a train driver. Similarly on the roads the viewpoints are positioned 1.5m above the road.

6.5 For the assessments undertaken at each viewpoint, calendar graphs showing the times of the year at which Solar Glare could occur, and the duration for which that the glare could occur, have been undertaken. The calendar graphs also show the angle at which the glare is likely to occur so that the criteria set out at section 4 can be applied. Drawings P1507/SGA/01-16 show the calendar graphs.

Drawings P1507/GSV/01-16 show more detailed visualisations of the glare effects, undertaken from each of the identified viewpoints at sample times (worst case scenario) of the year which have been identified by the calendar graphs.

6.6 From our analysis of key viewpoints along the train line and neighbouring roads, any instances of glare are generally limited to early morning and evening periods when the sun is lower in the sky.

6.7 We also note that the construction of the proposal is likely to block instances of glare caused by direct sunlight at certain times.

7 Conclusion

7.1 In relation to the neighbouring roads, while there will be isolated instances of glare approaching the adjacent roundabouts which at times could potentially cause a nuisance, this situation is not unusual in an urban area.

7.2 Due to the large area of glazing and proximity to the railway line there will be some instances of solar glare which could be an issue in relation to the visibility of railway signalling, which is potentially a safety issue.

7.3 These will therefore need to be considered in more detail in relation to the location of signals, and with reference to the Rail Safety and Standards Board (RSSB) document titled "Signal Sighting Assessment Requirements One: June 2016"

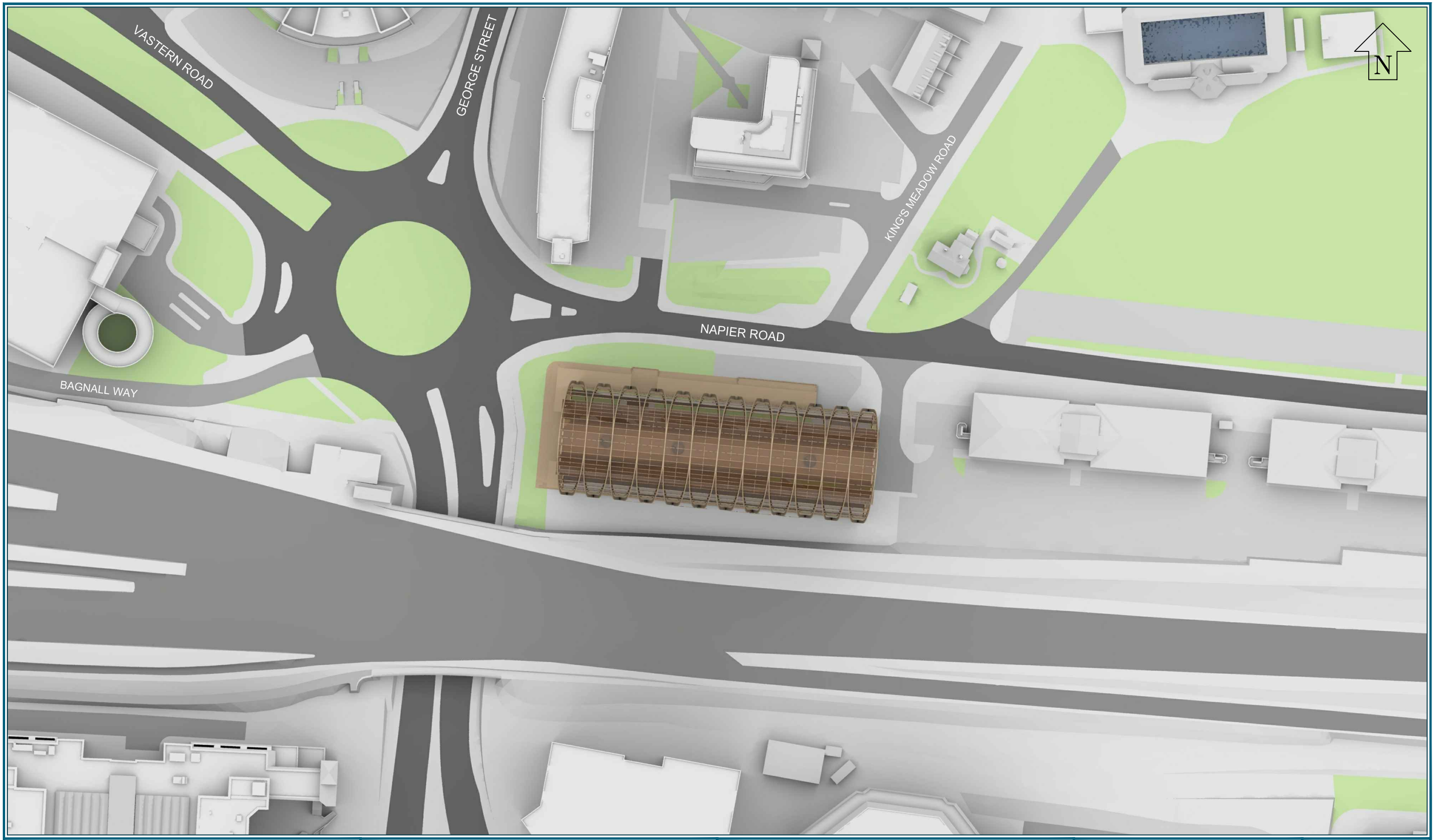
7.4 We note that the proposal will also block instances of glare caused by direct sunlight at certain times of the year. These should be investigated in more detail, as they may be deemed to mitigate instances of reflected solar glare.

7.5 Given that the study has identified potentially problematic reflections, we recommend further investigation, particularly in relation to the railway line.

7.6 Possible mitigation measures include the addition of louvres to the proposal, especially on the east and west facades.

7.7 We recommend that any further analysis is undertaken in relation to an up-to-date context model, showing the recently redeveloped Reading Station.

Appendix A – Existing and Proposed Plans & 3D Views



Sources: Zmapping Ltd.
3D Context Model (dated August 2016)
Reading_230816_Solids.dwg

Scott Brownrigg
Proposed 3D Model (received 20/08/17)
16367-A17-C_SwanHeights [bound].rvt

Key: Existing Buildings
Proposed Scheme

Project: The Arc
Reading

Title: Site Plan
Proposed Scheme 30/08/17

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Scheme Confirmed: -

Date : -

Drawn By: BW

Scale: 1:1000 @ A3

Date: Sept 17

Dwg No: **P1507/01**

Rel: 1



Sources: Zmapping Ltd.
3D Context Model (dated August 2016)
Reading_230816_Solids.dwg

Scott Brownrigg
Proposed 3D Model (received 20/08/17)
16367-A17-C_SwanHeights [bound].rvt

Key: Existing Buildings
Proposed Scheme
All Heights in mm AOD

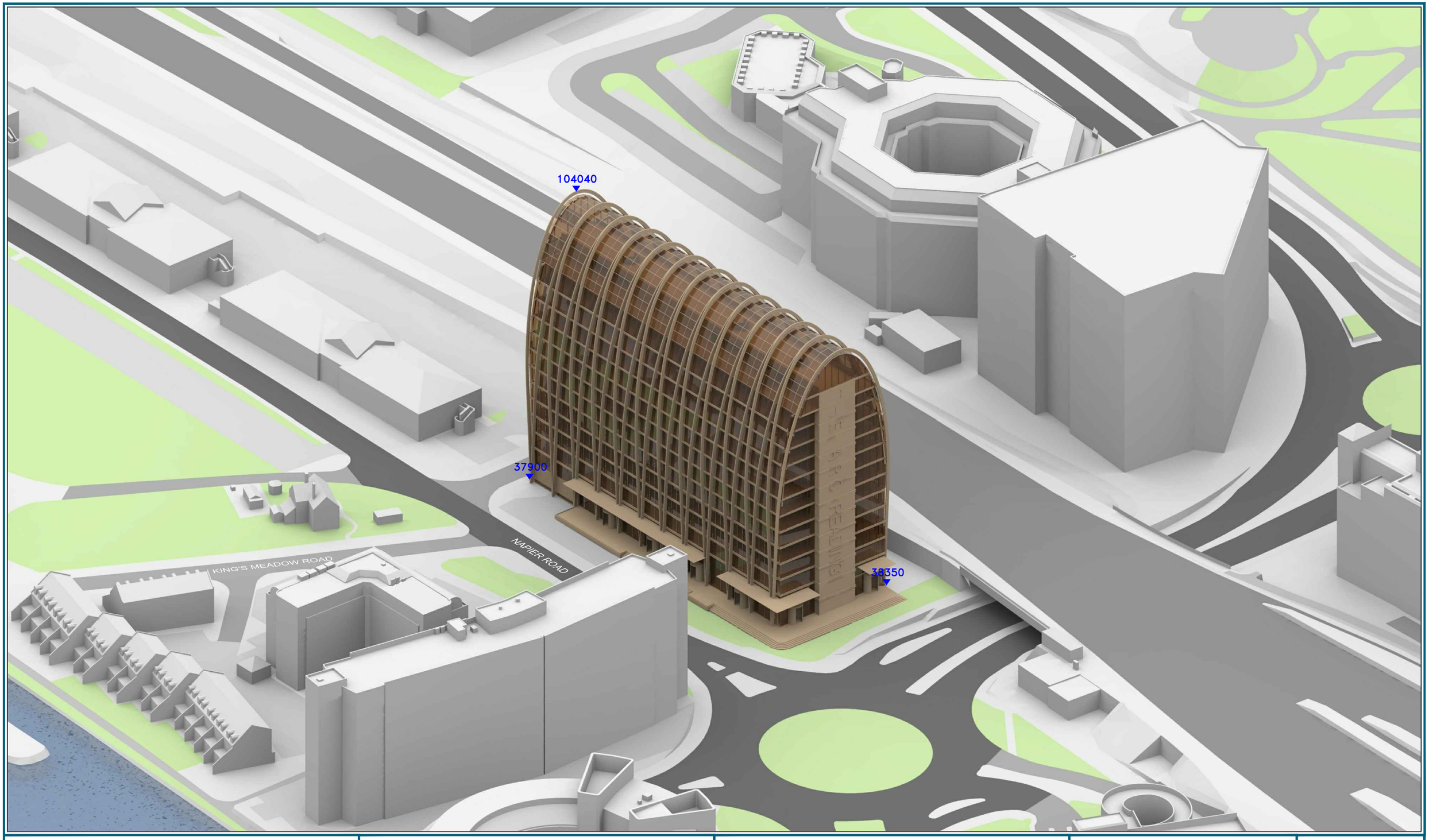
Project: The Arc
Reading

Title: 3D View
Proposed Scheme 30/08/17

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Scheme Confirmed: - Date : -

Drawn By: BW | Scale: N/S @ A3 | Date: Sept 17 | Dwg No: **P1507/02** | Rel: 1



Sources: Zmapping Ltd.
3D Context Model (dated August 2016)
Reading_230816_Solids.dwg

Scott Brownrigg
Proposed 3D Model (received 20/08/17)
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Proposed Scheme
All Heights in mm AOD

Project: The Arc
Reading

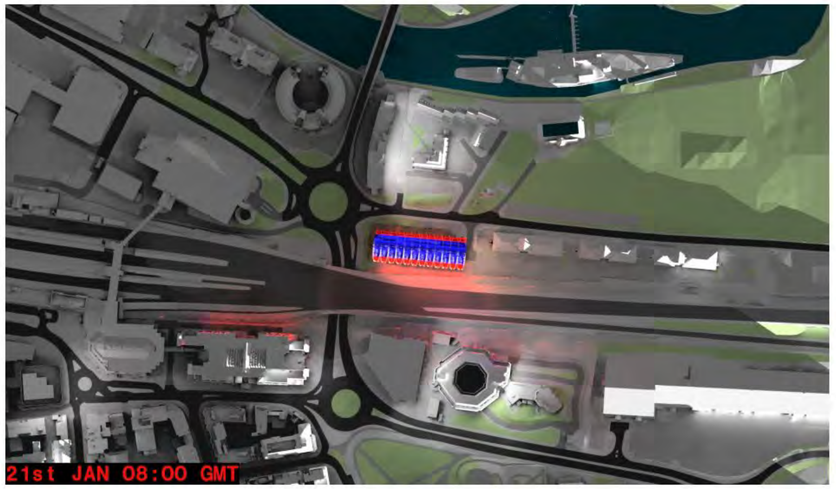
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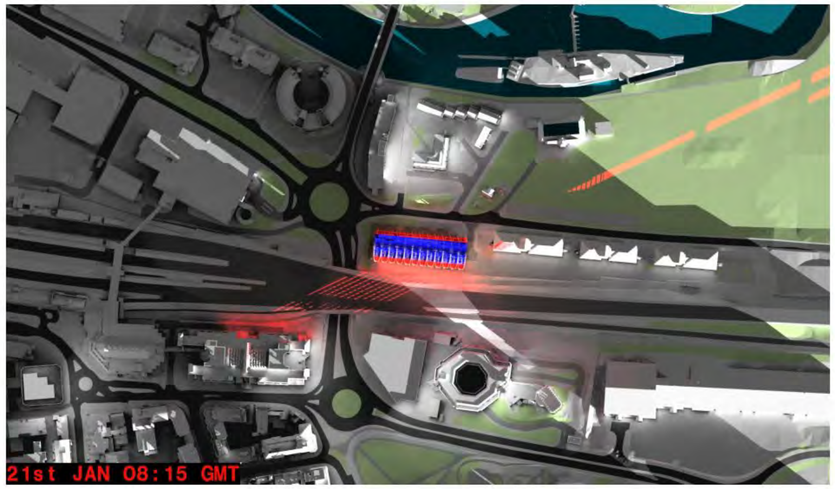
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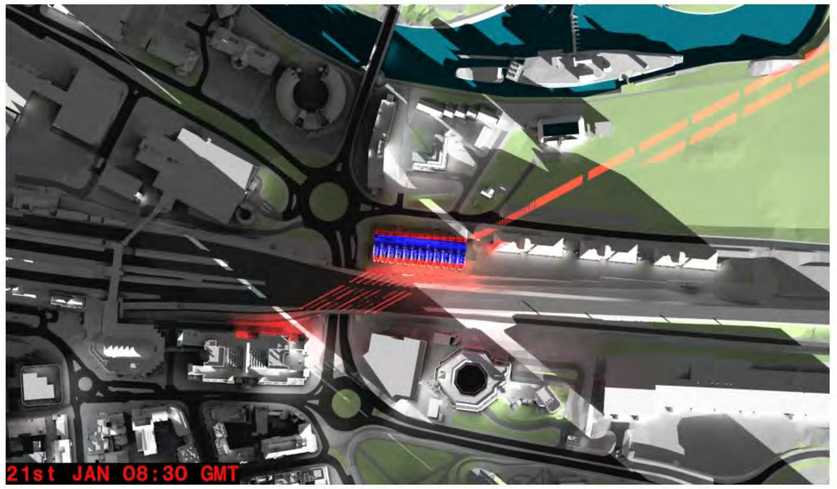
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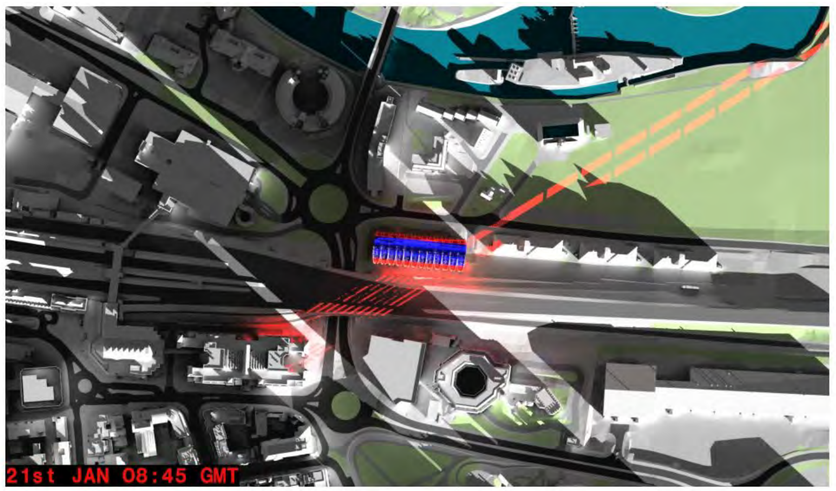
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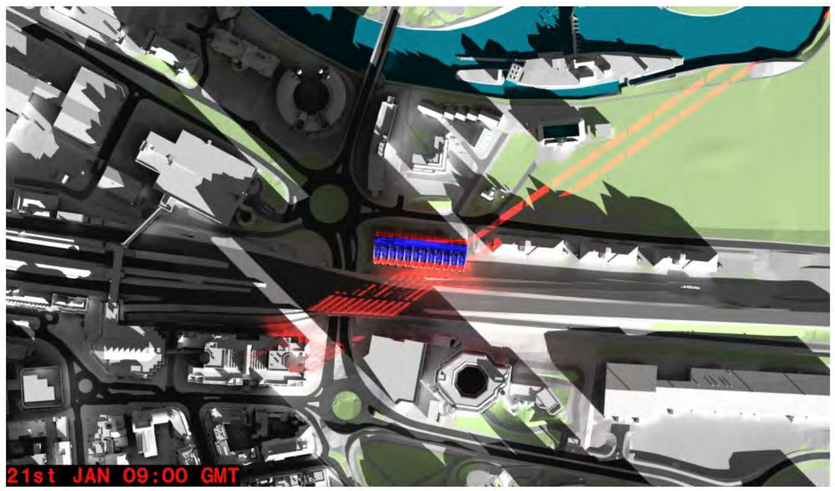
Appendix B – Solar Reflective Glare Annual Sequences

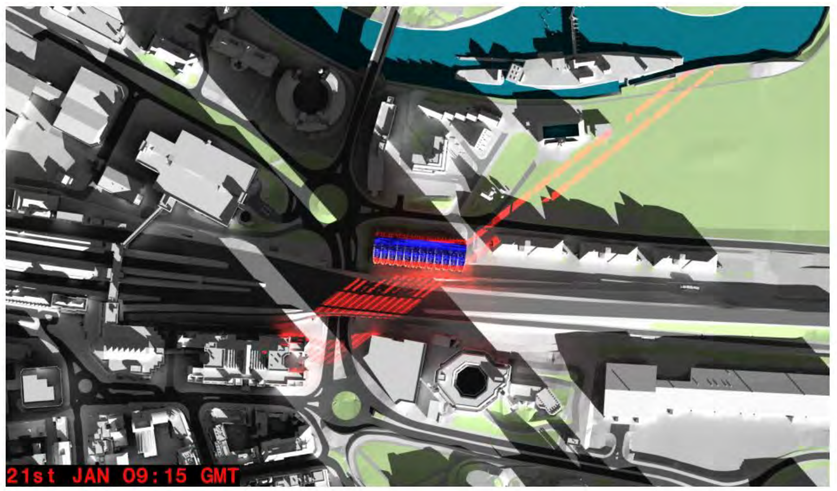

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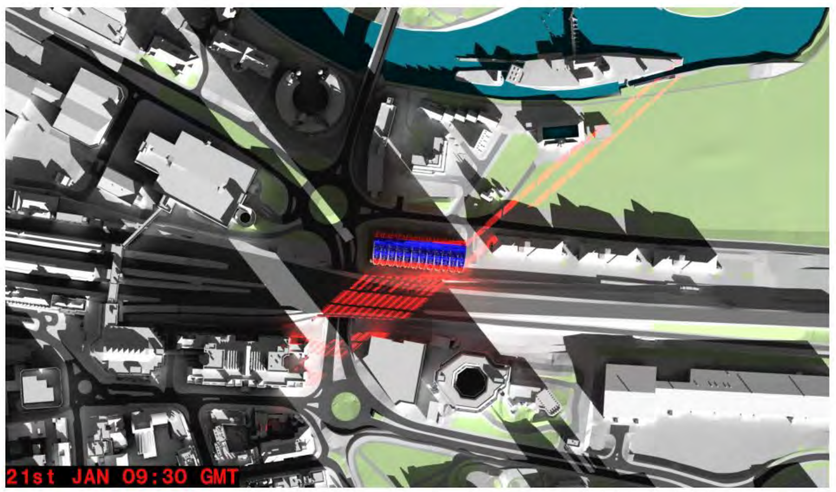

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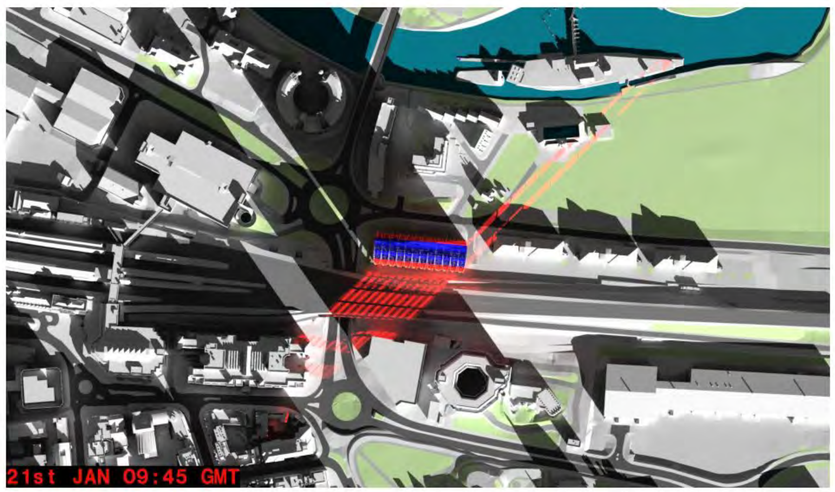

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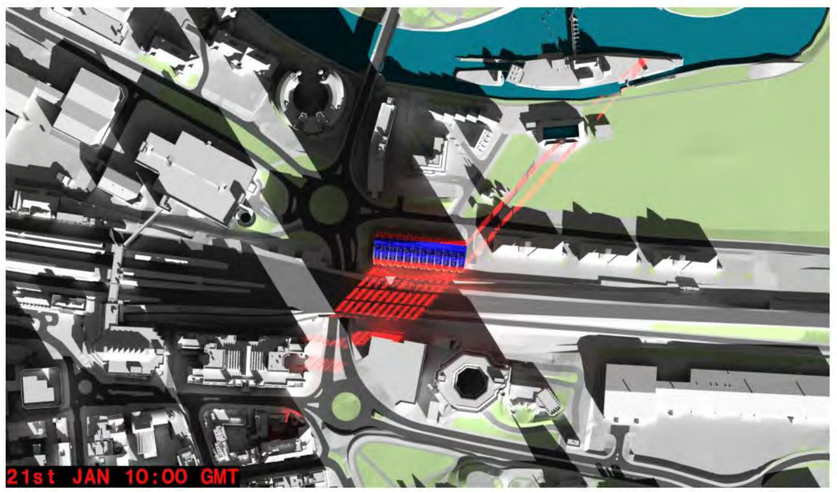

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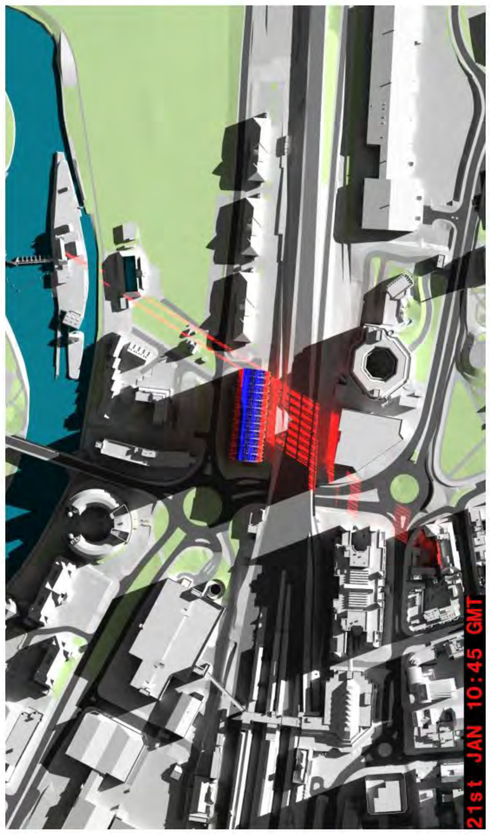

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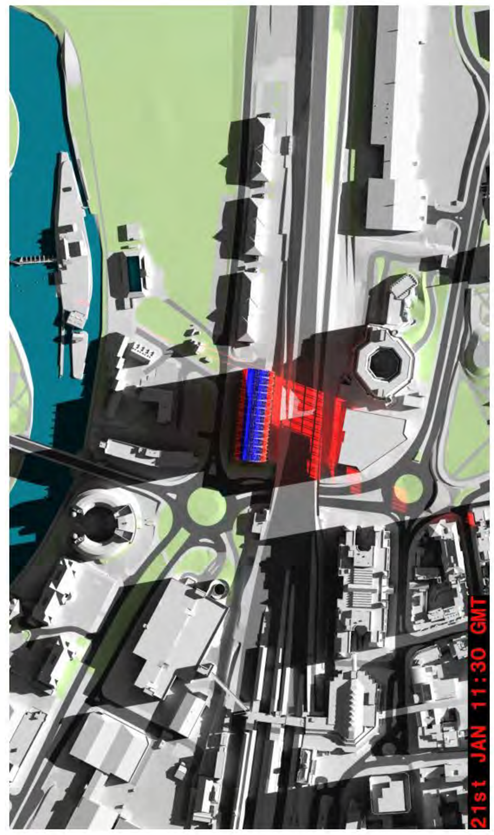

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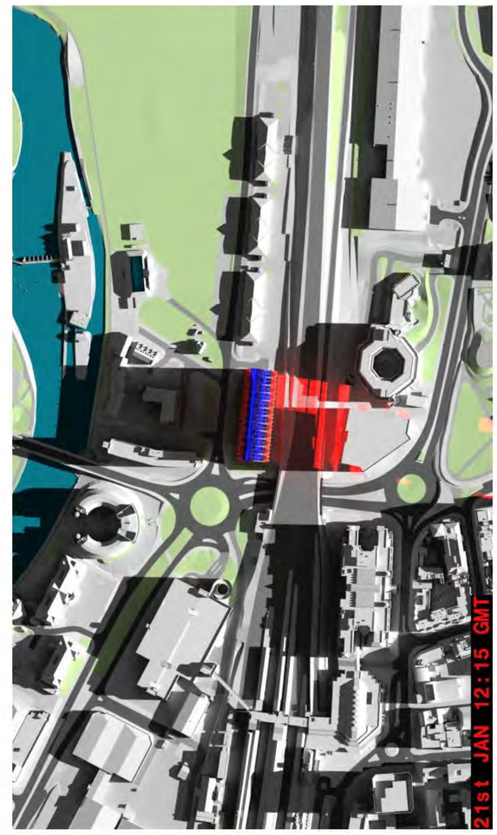

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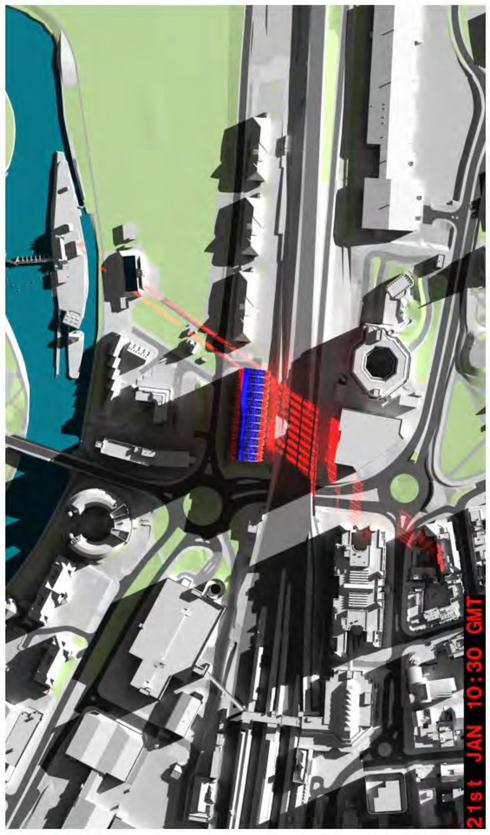

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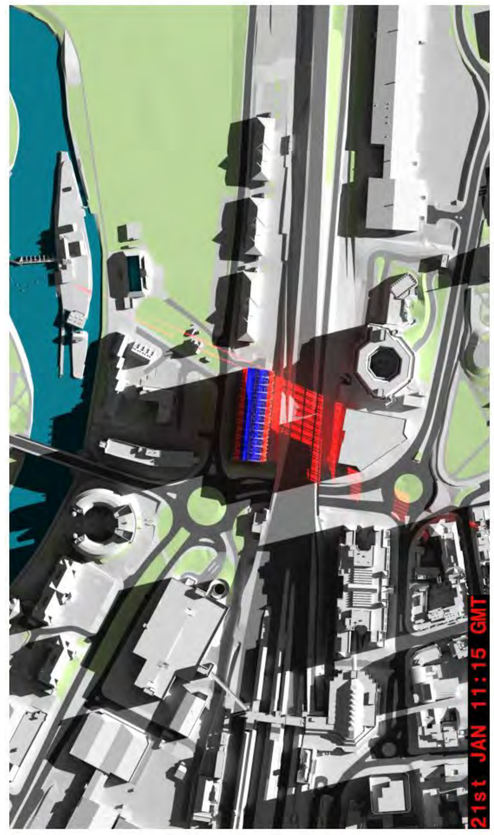

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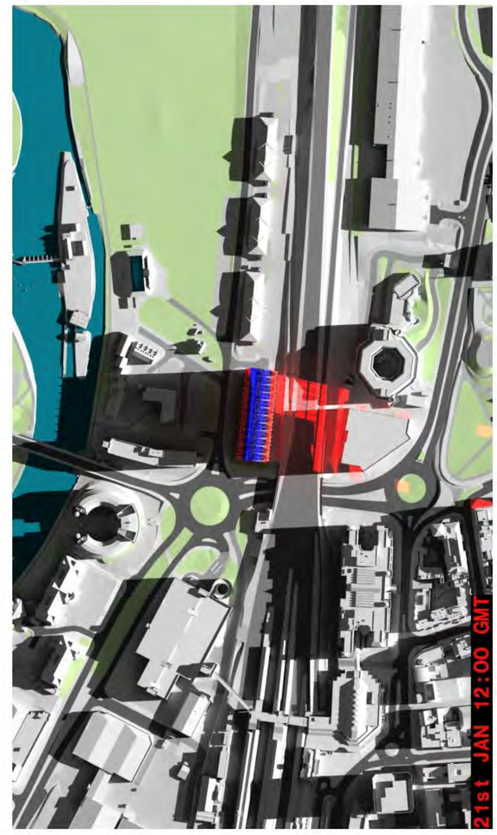

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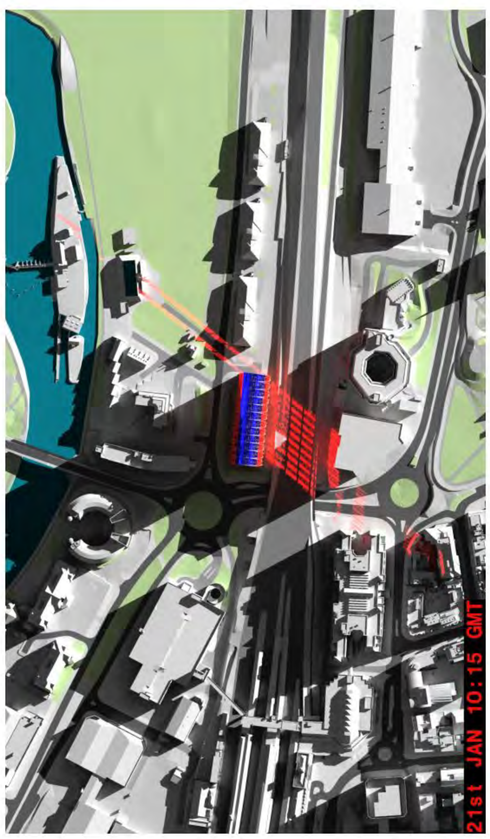

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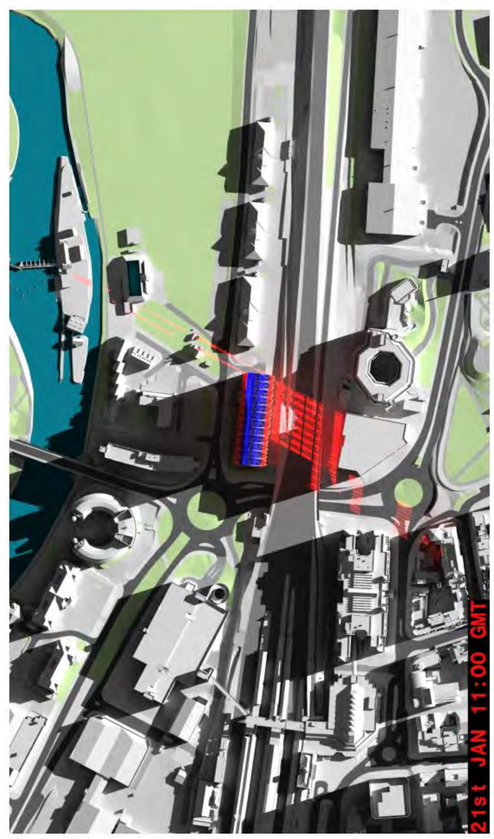

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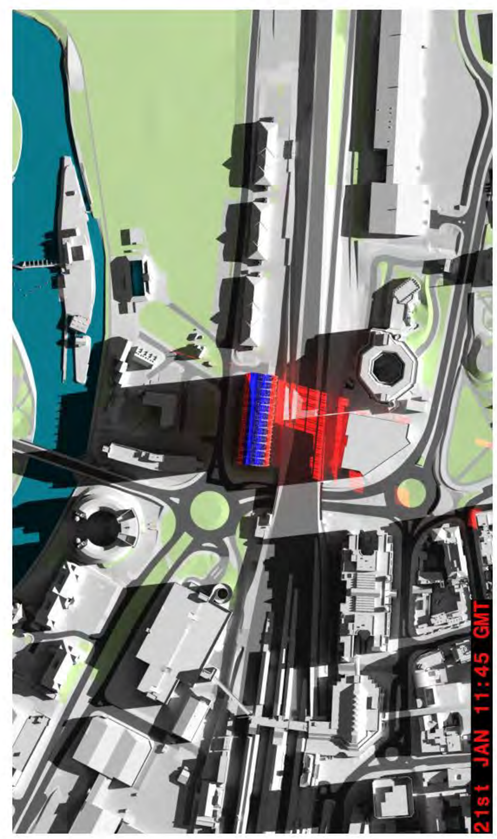

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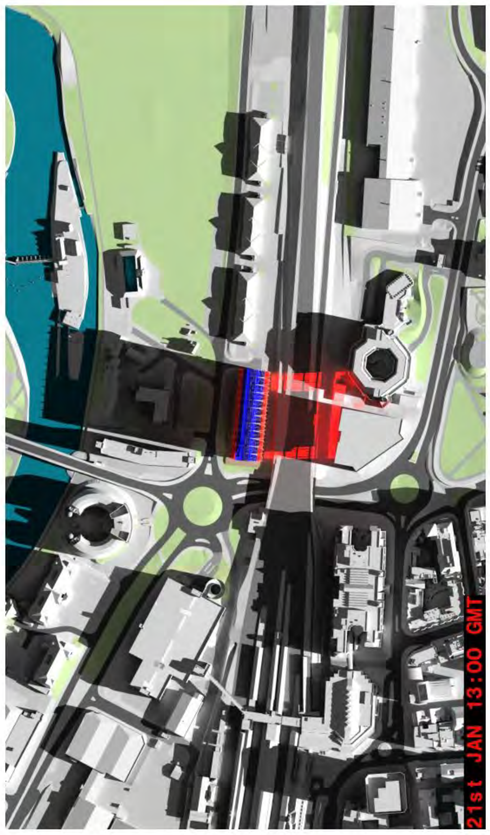

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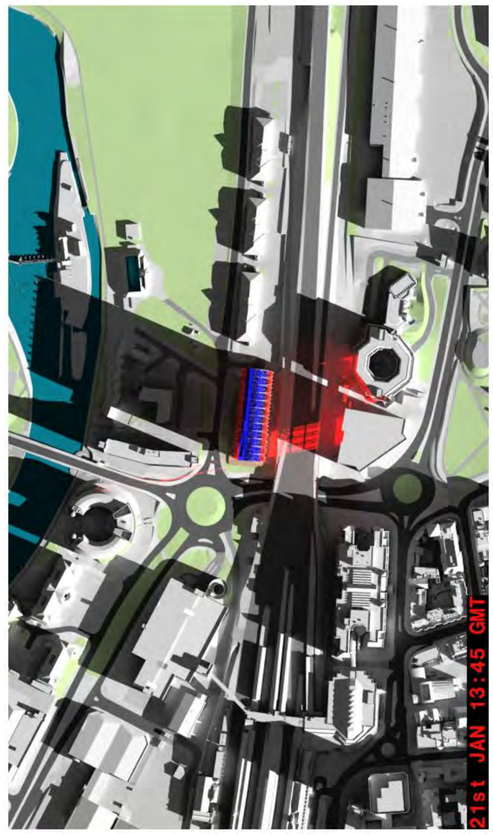

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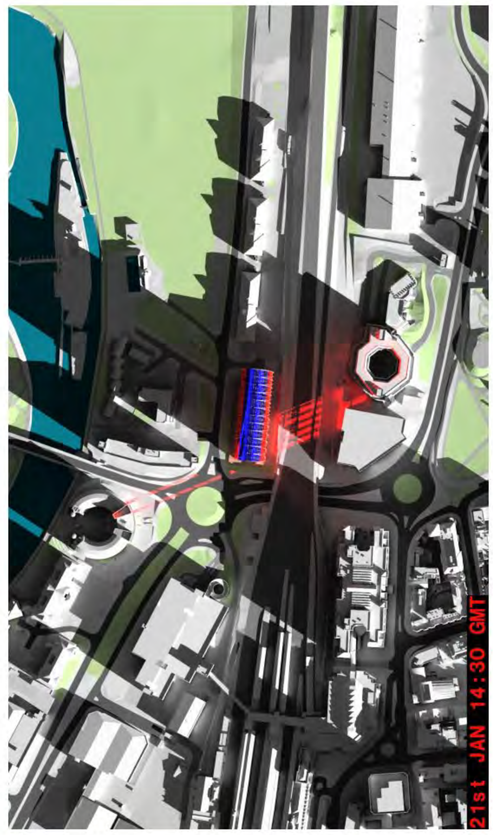

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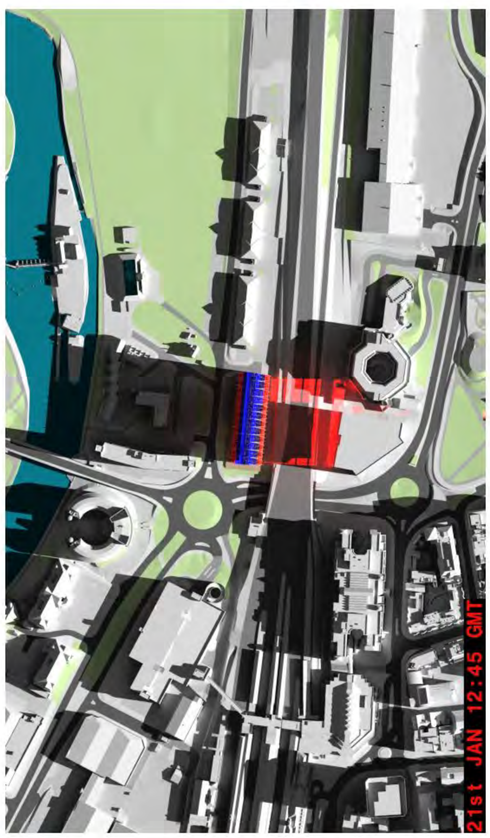

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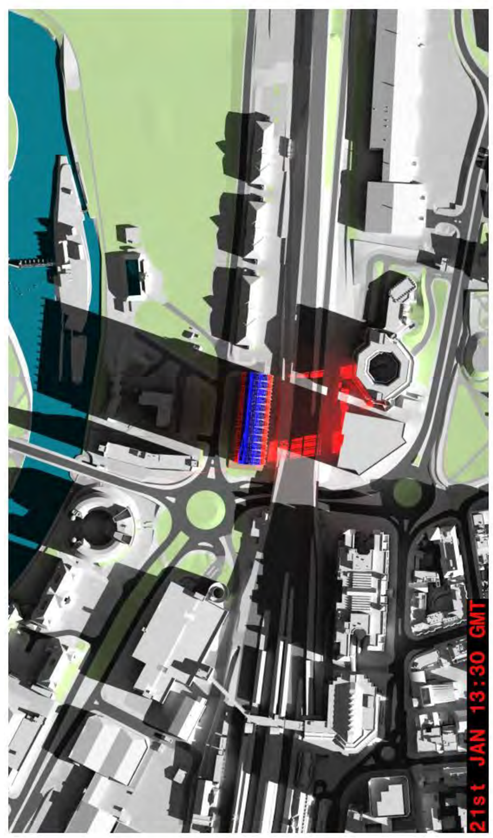

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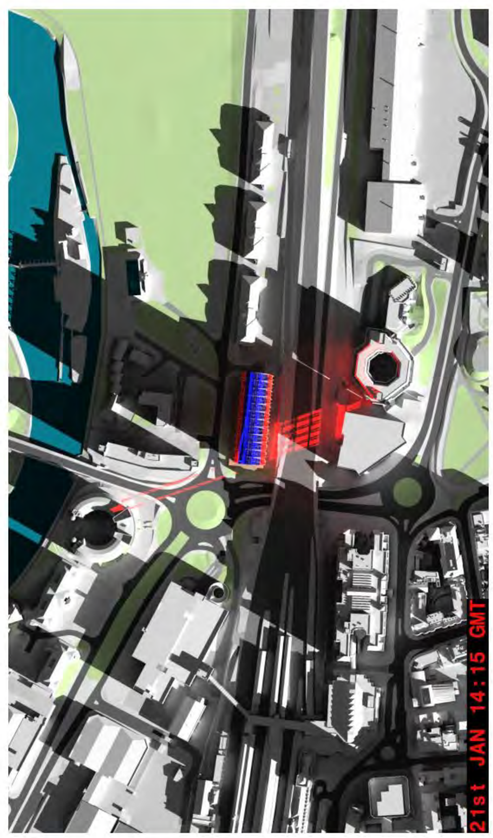

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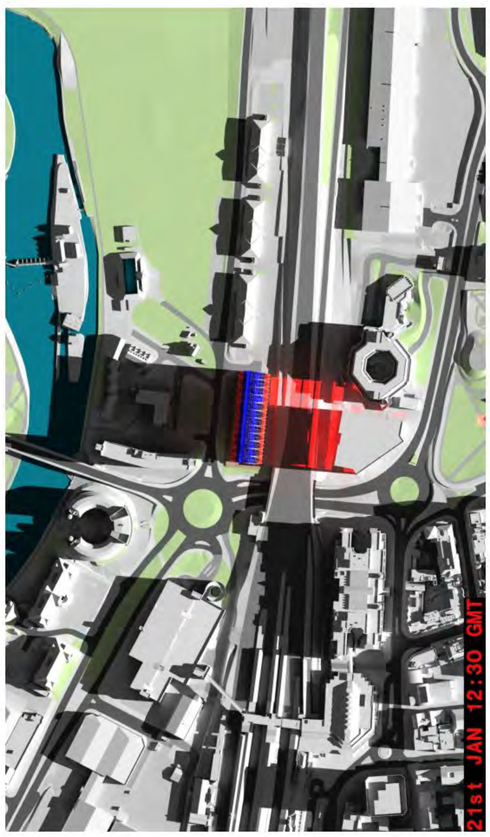

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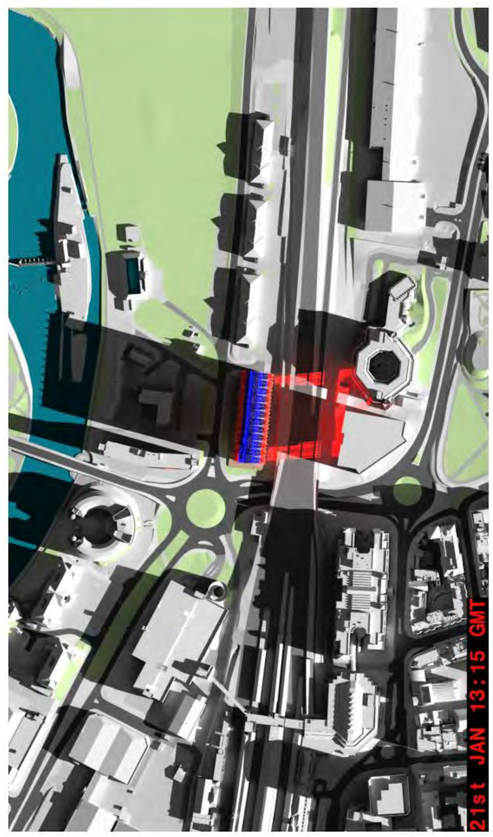

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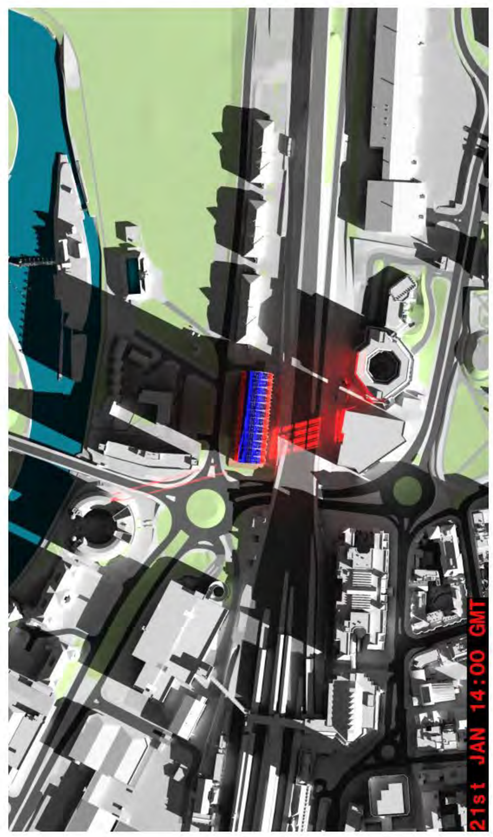

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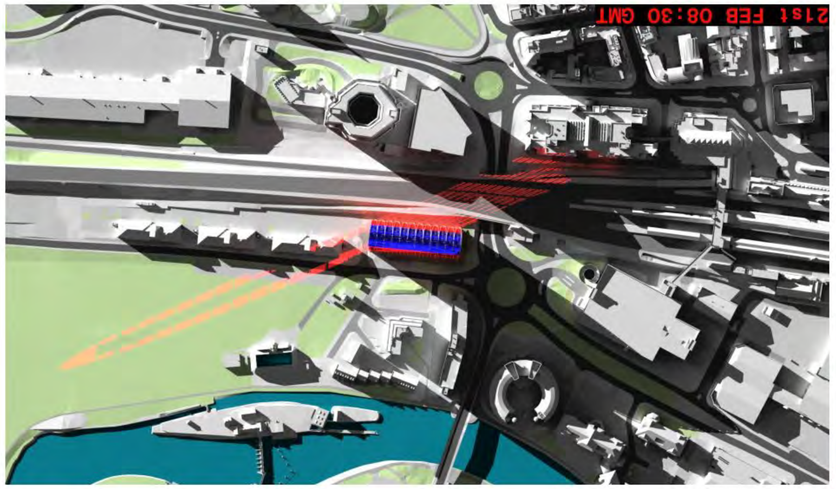

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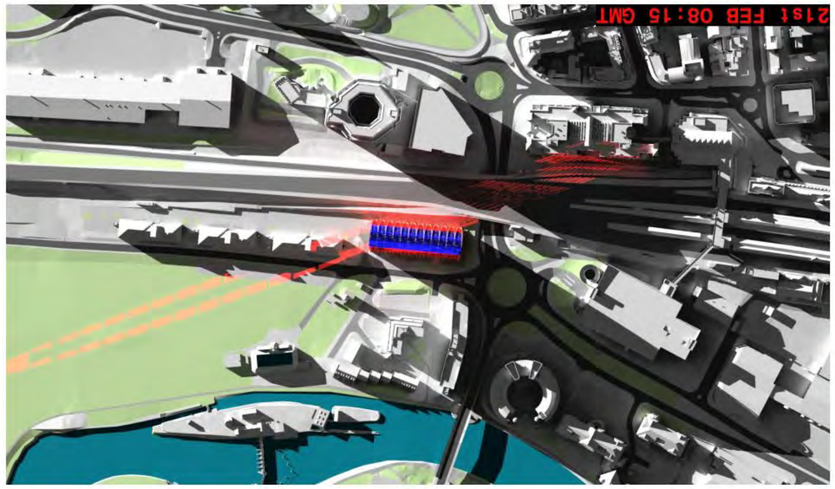

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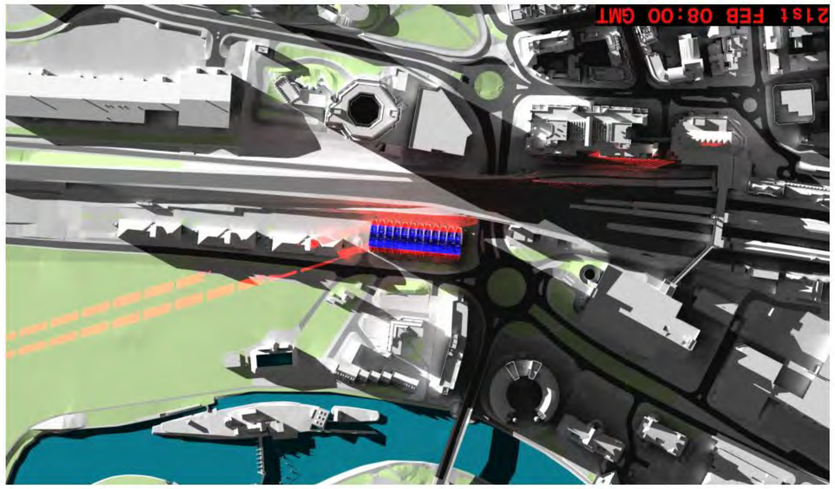

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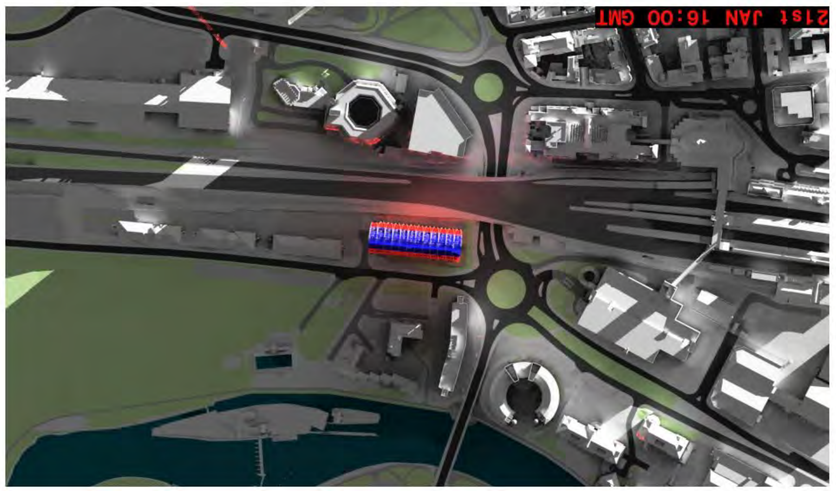

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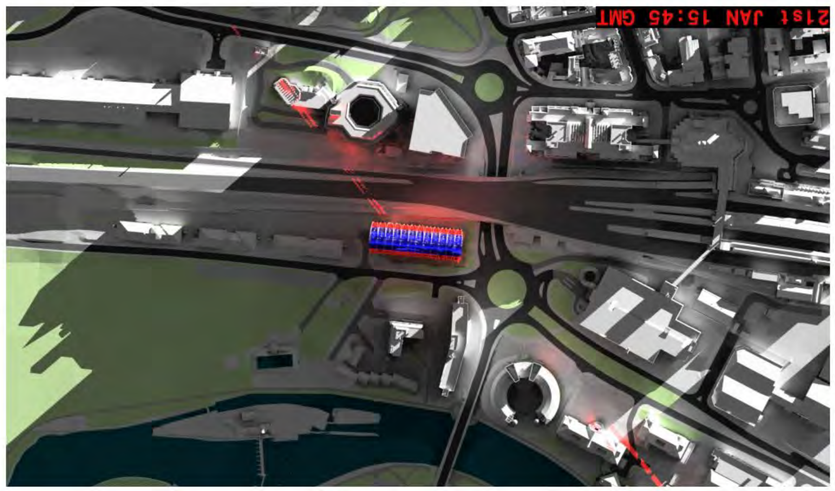

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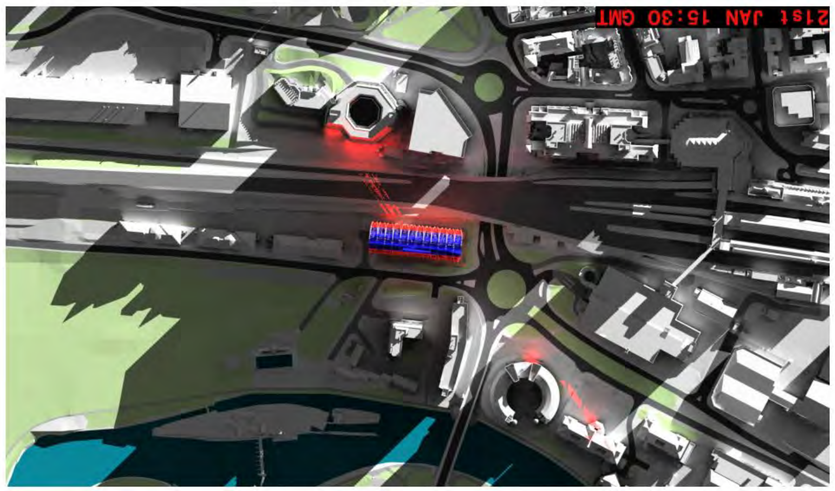

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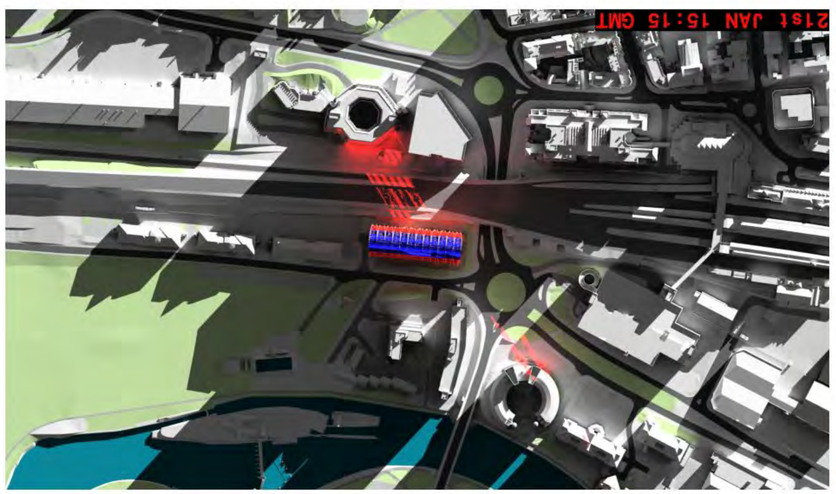

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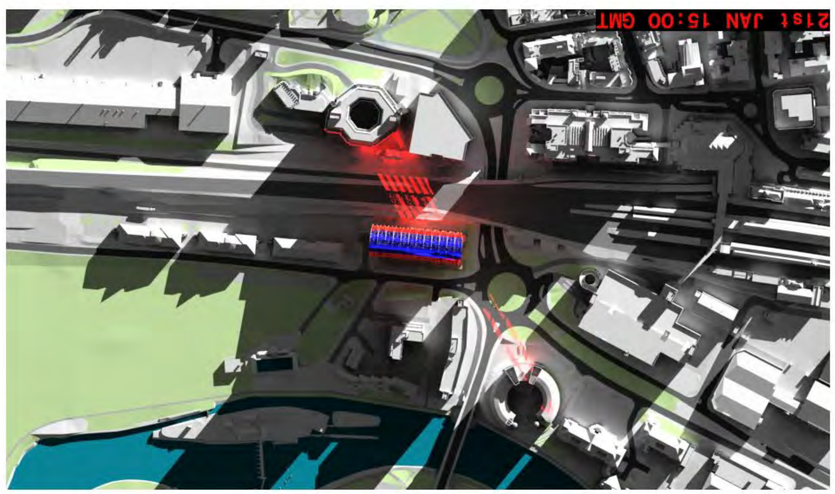

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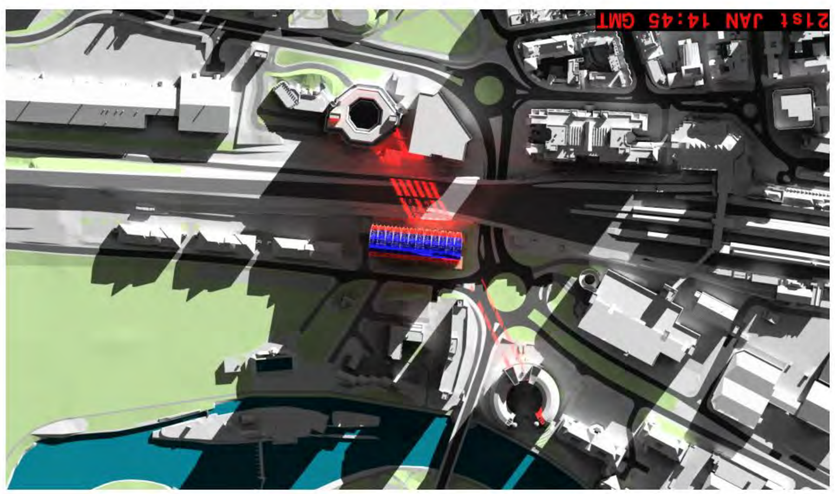

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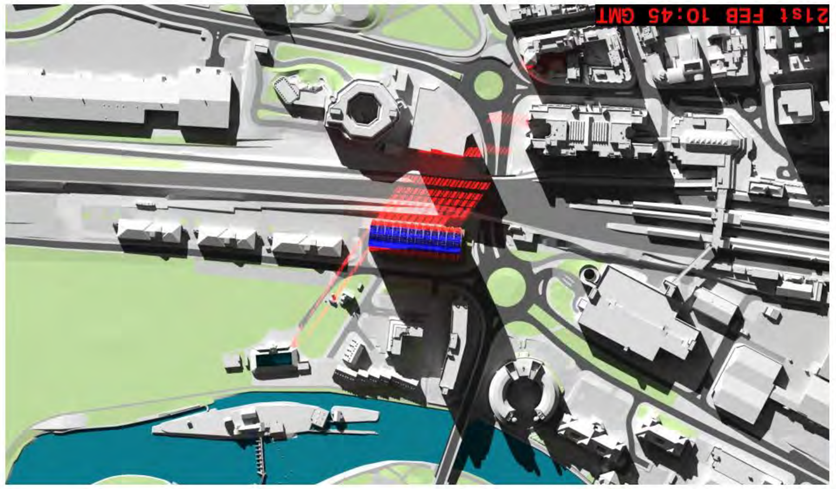

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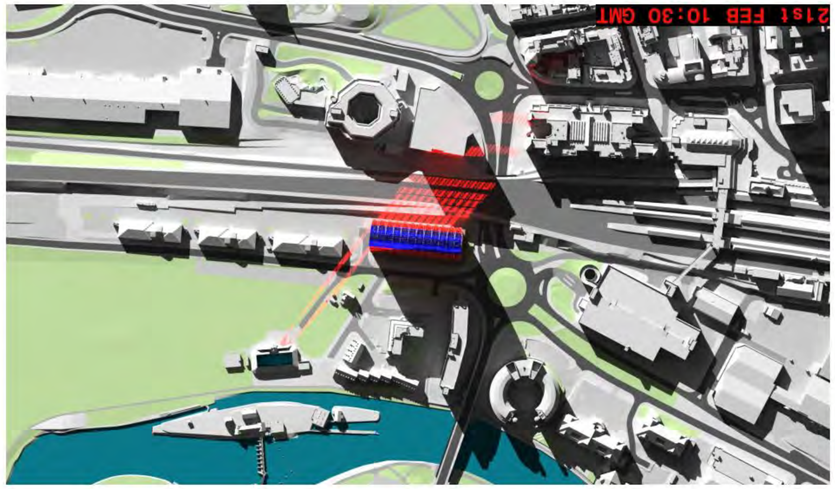

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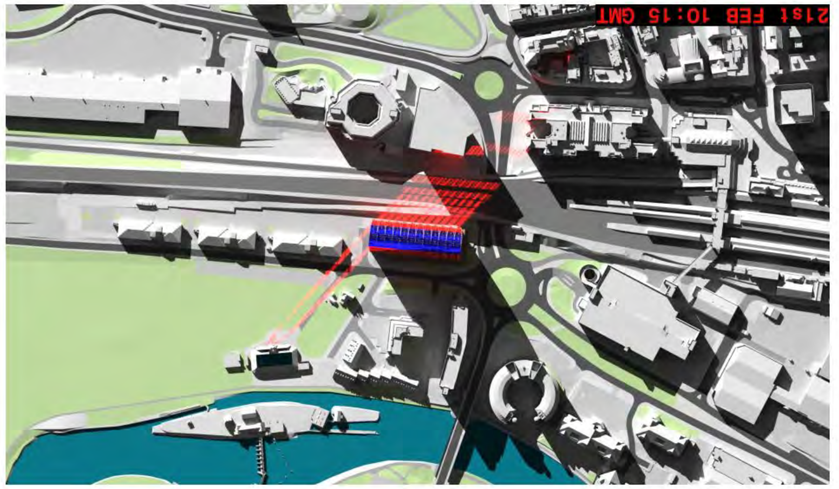

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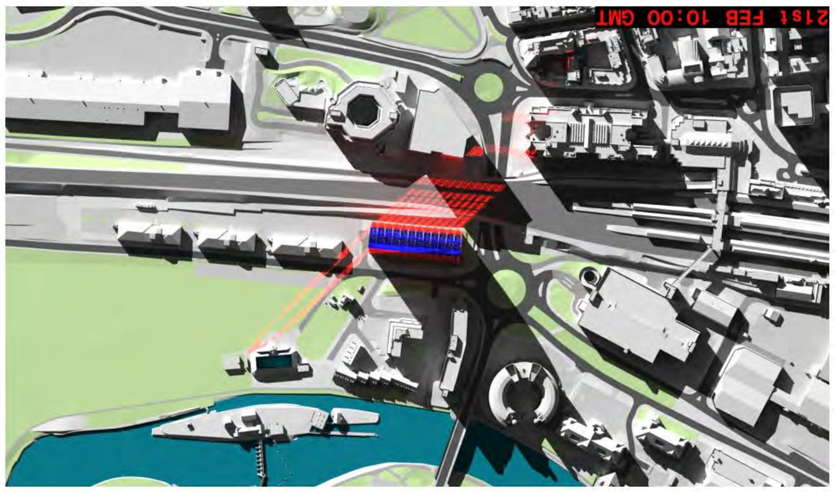

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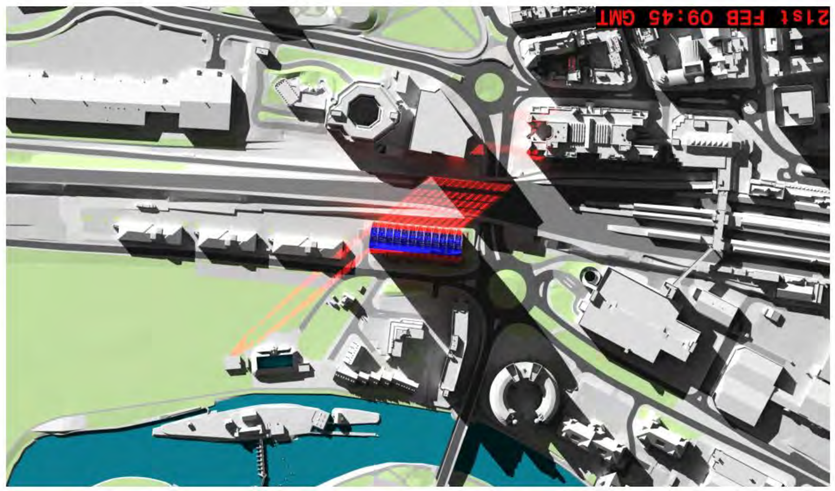

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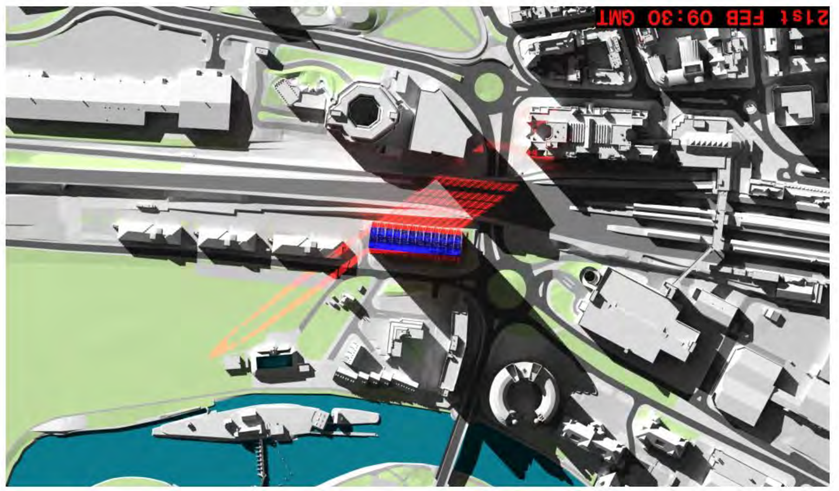

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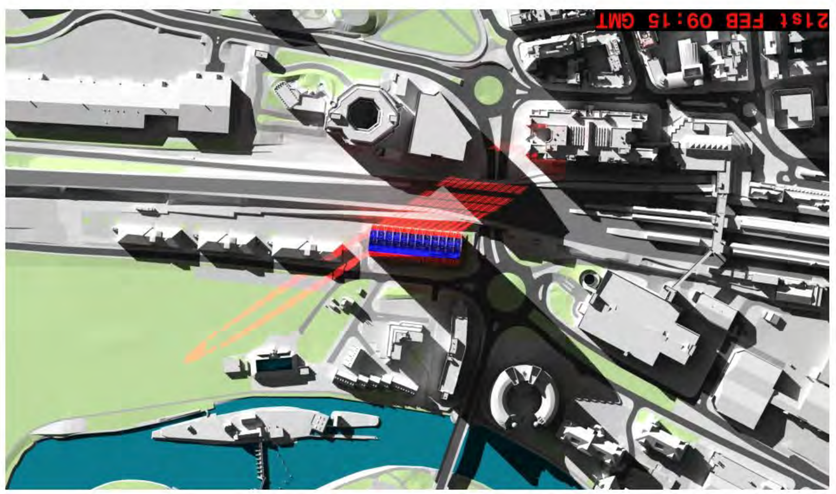

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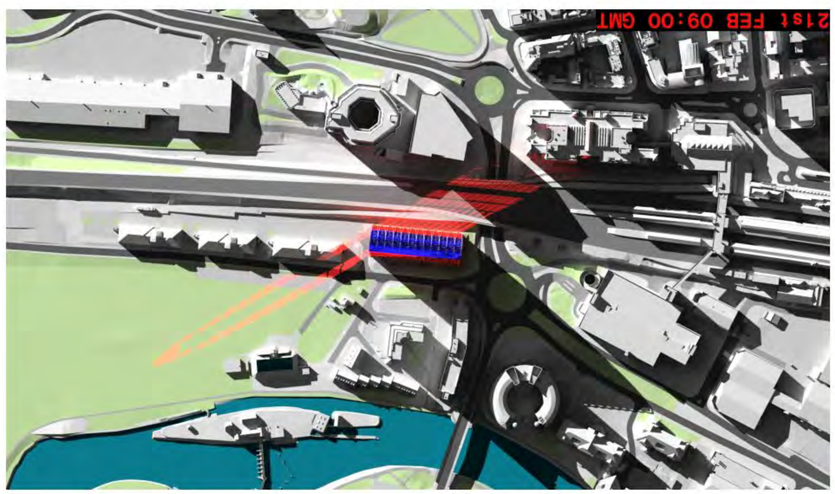

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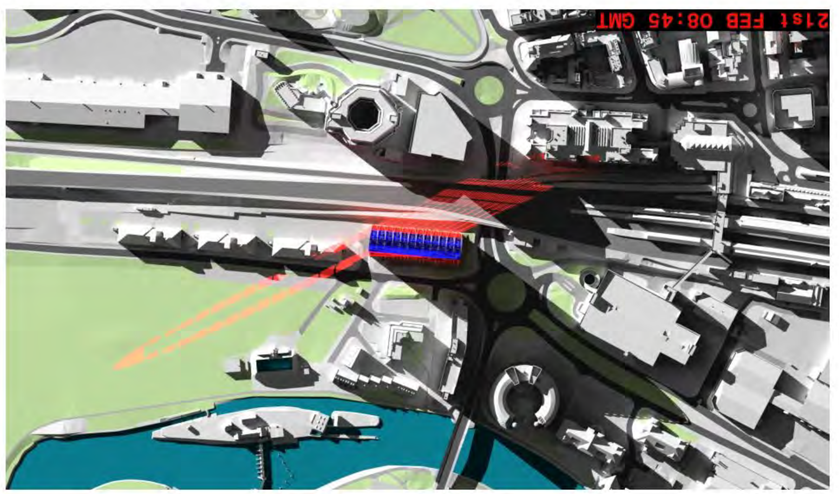

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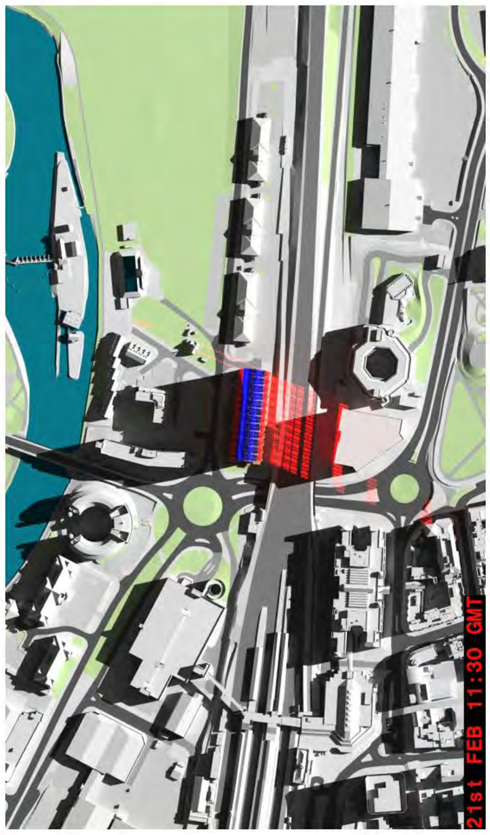

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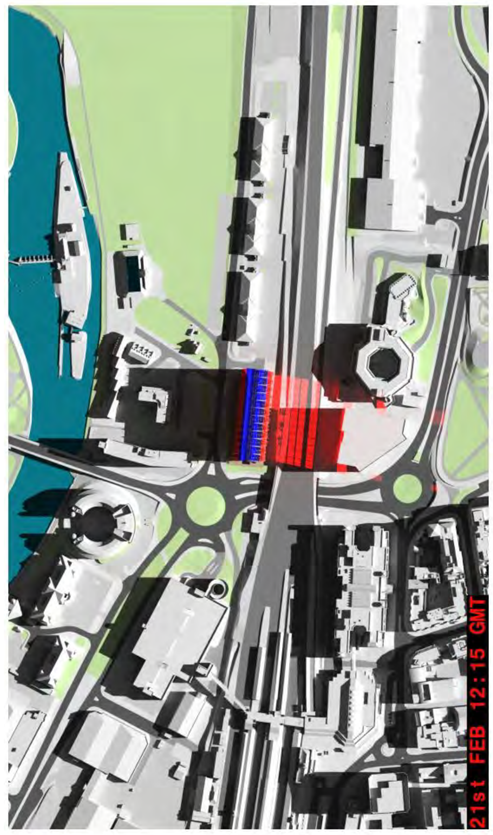

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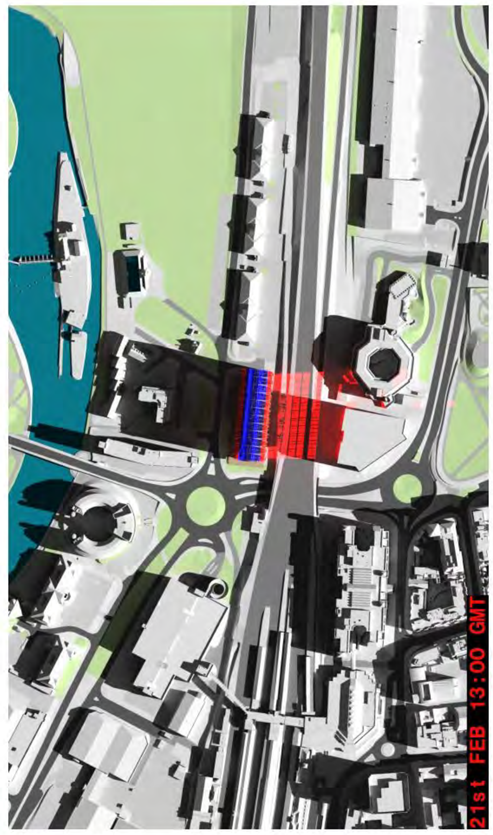

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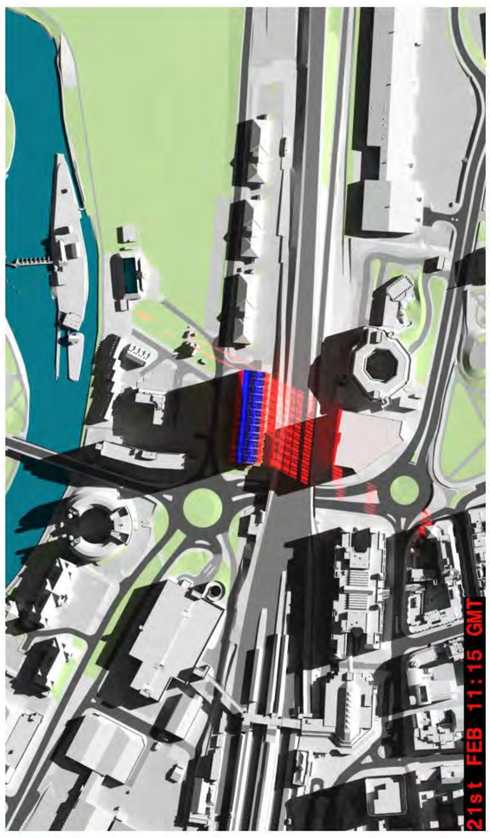

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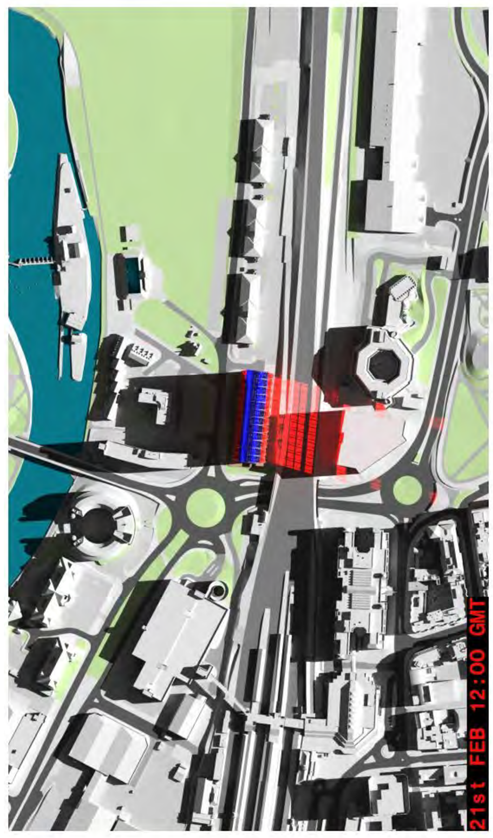

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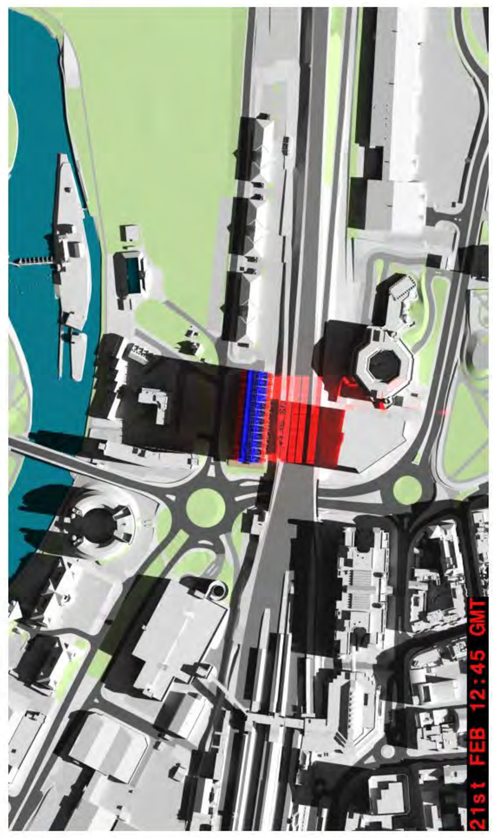

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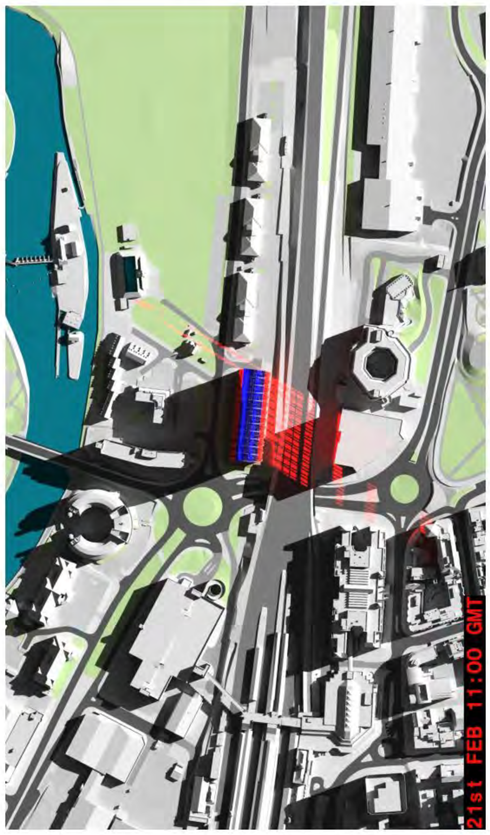

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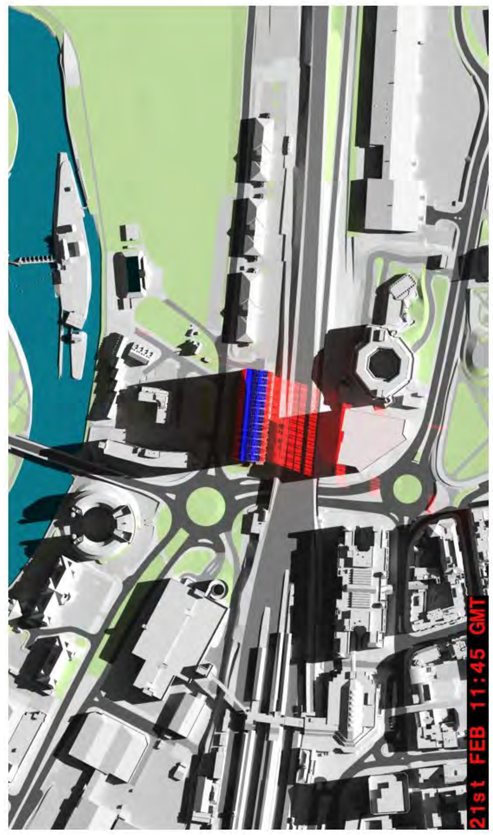

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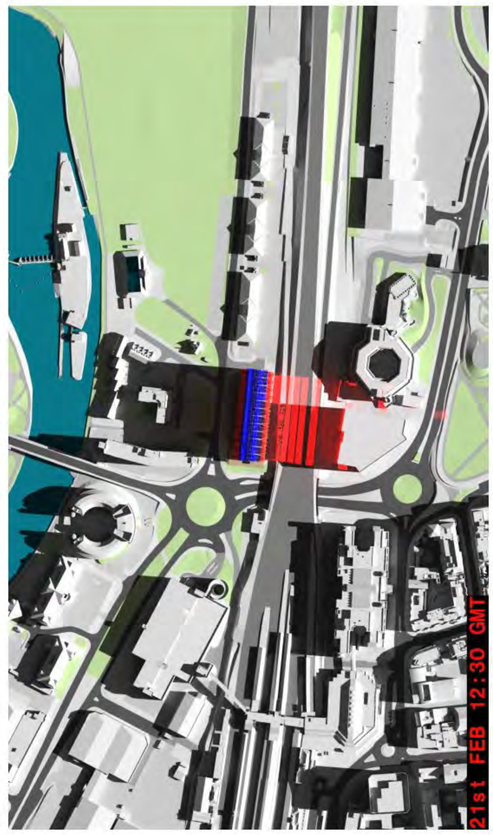

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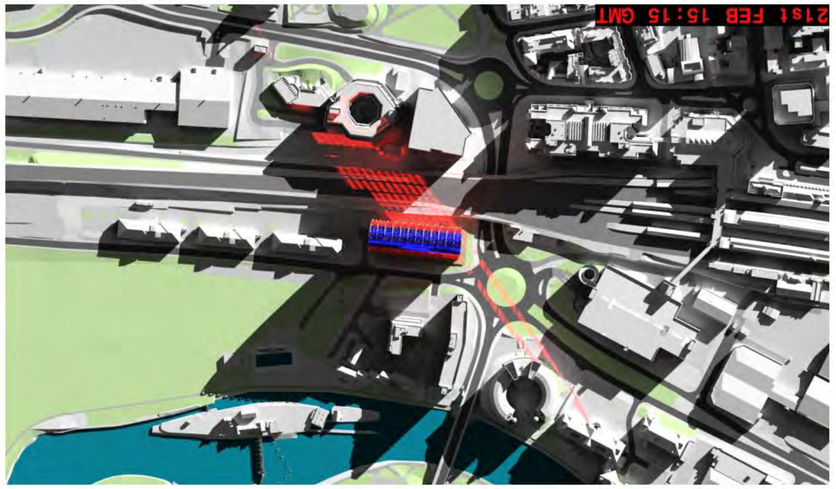

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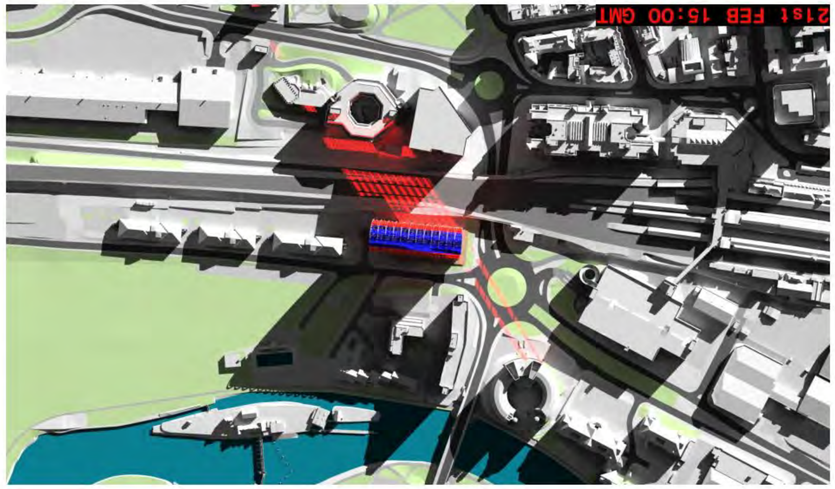

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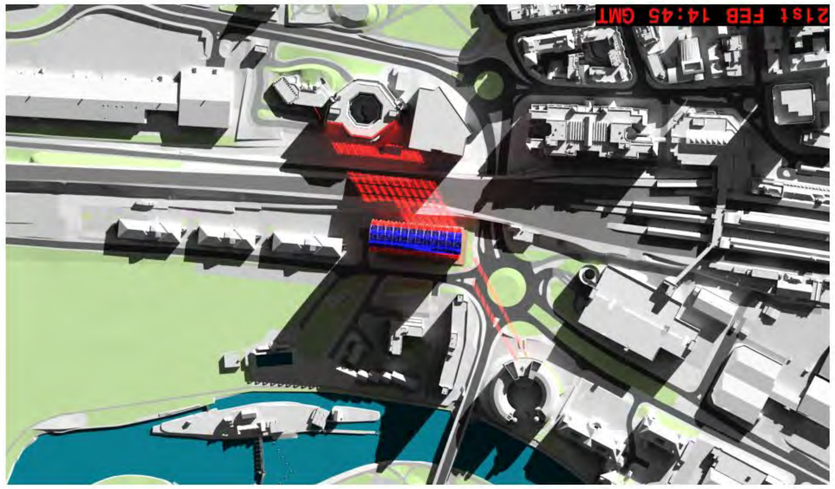

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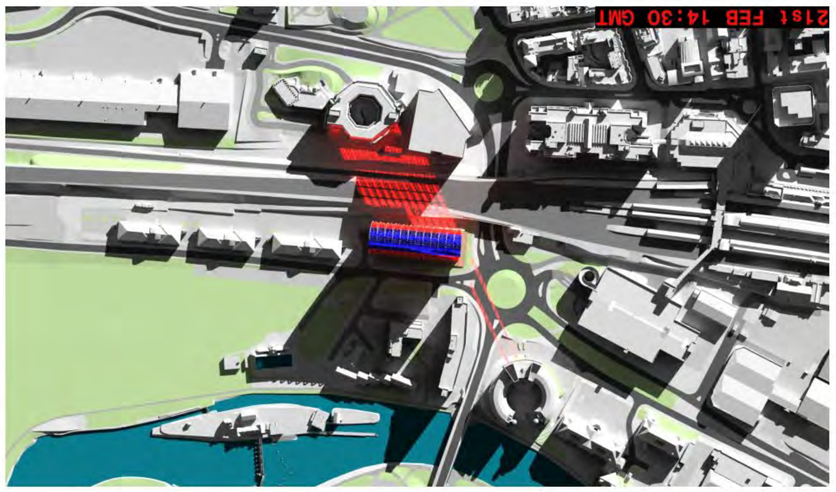

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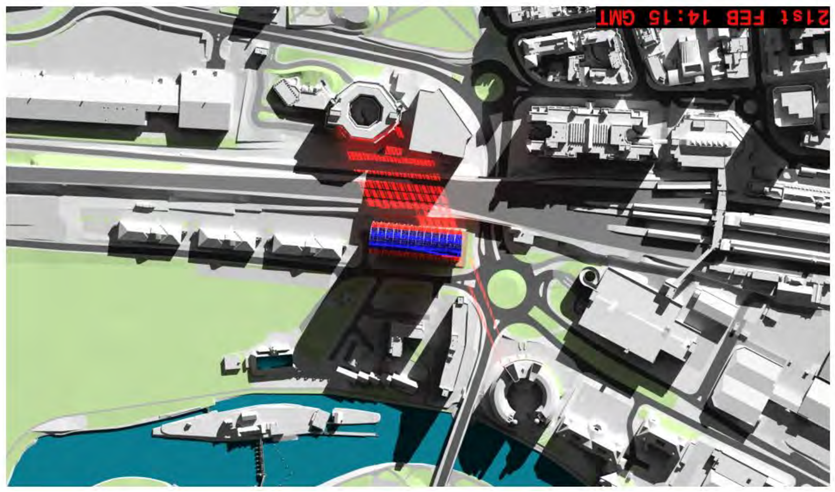

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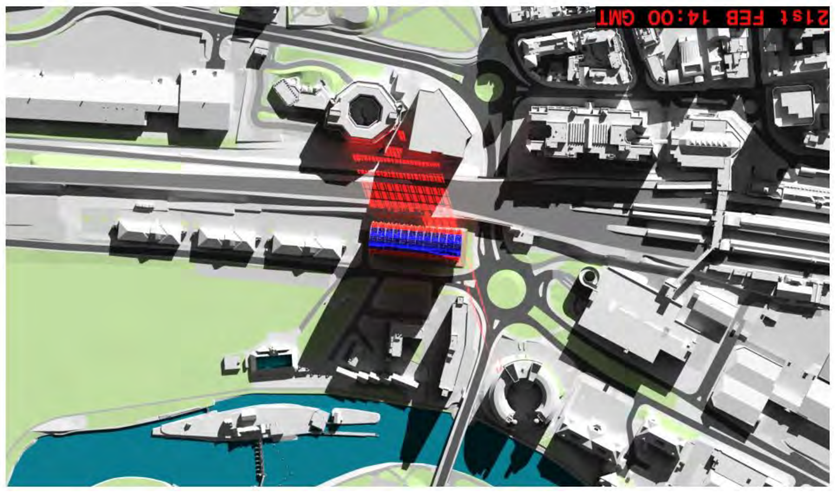

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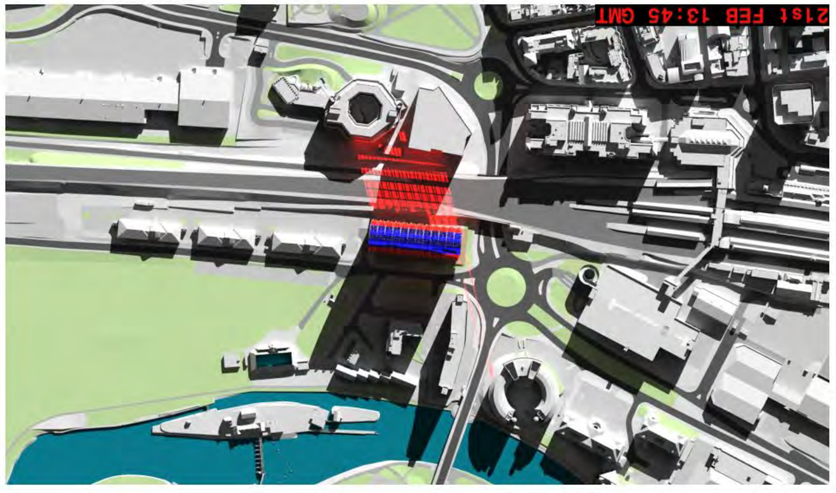

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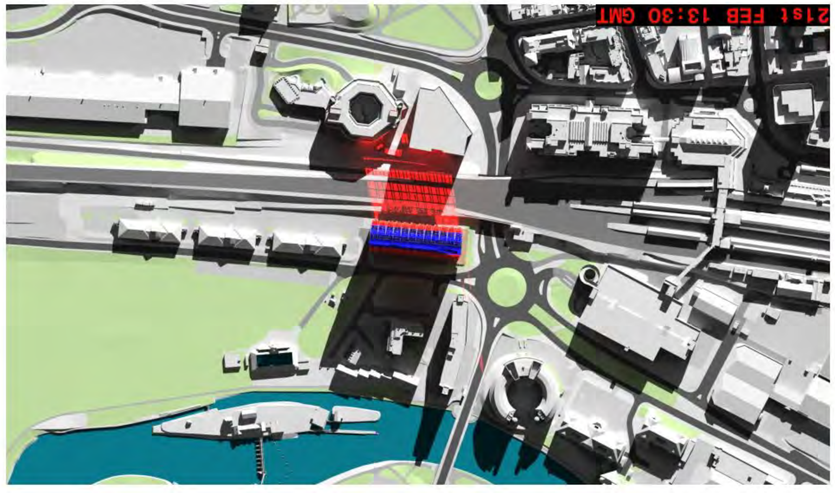

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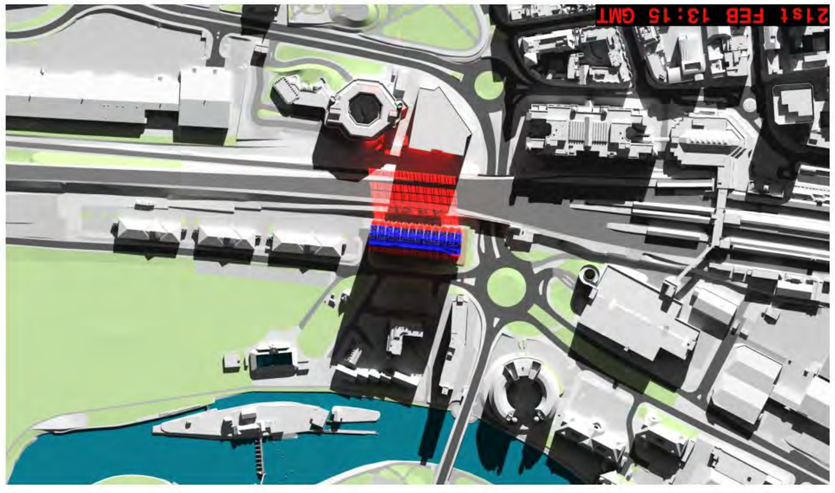

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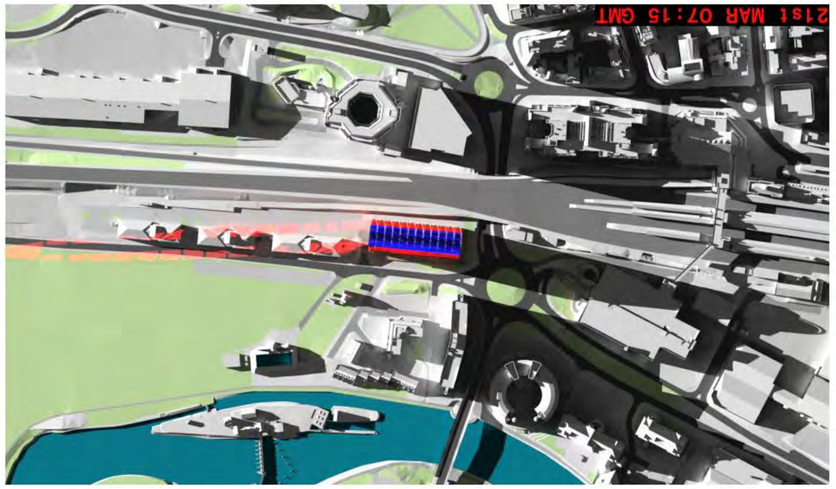

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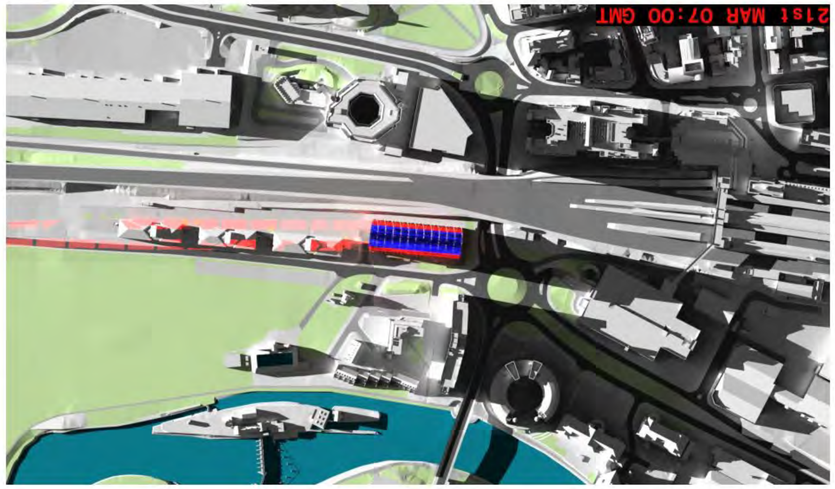

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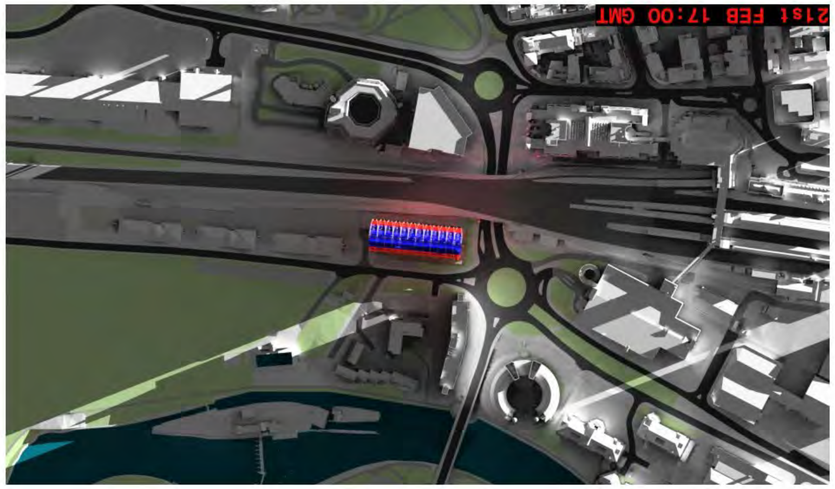

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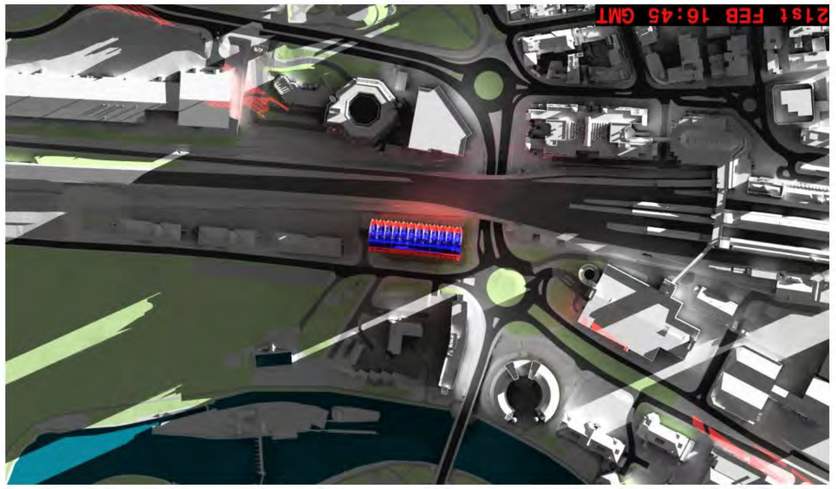

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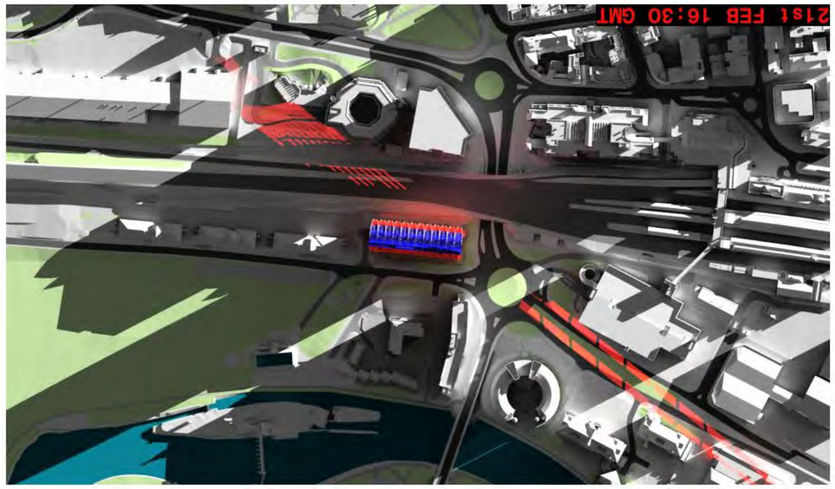

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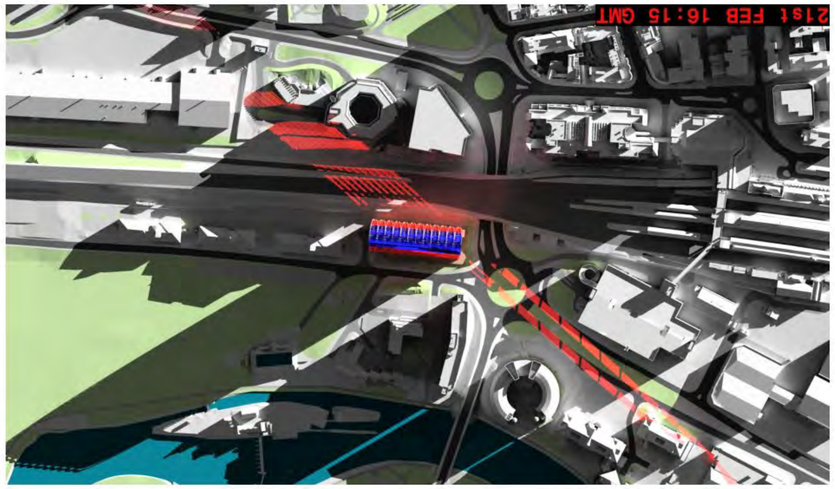

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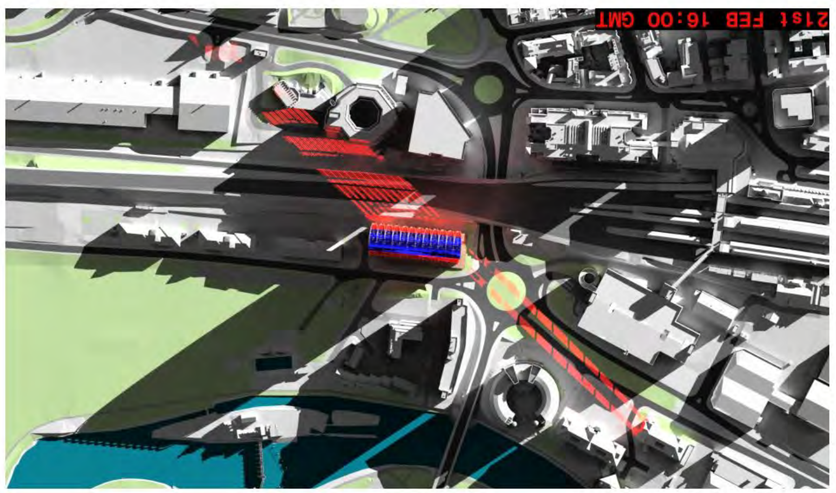

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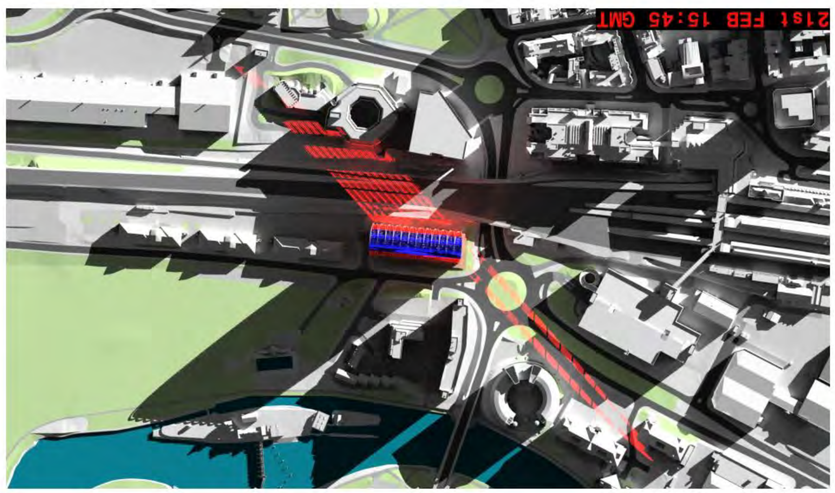

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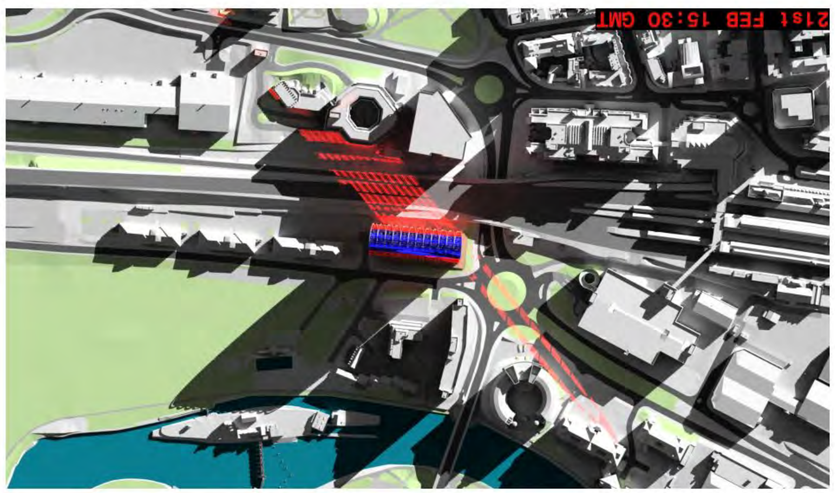

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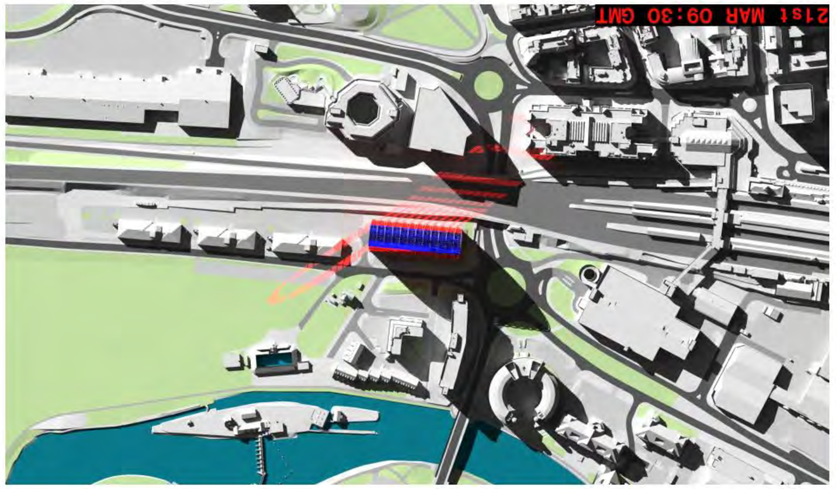

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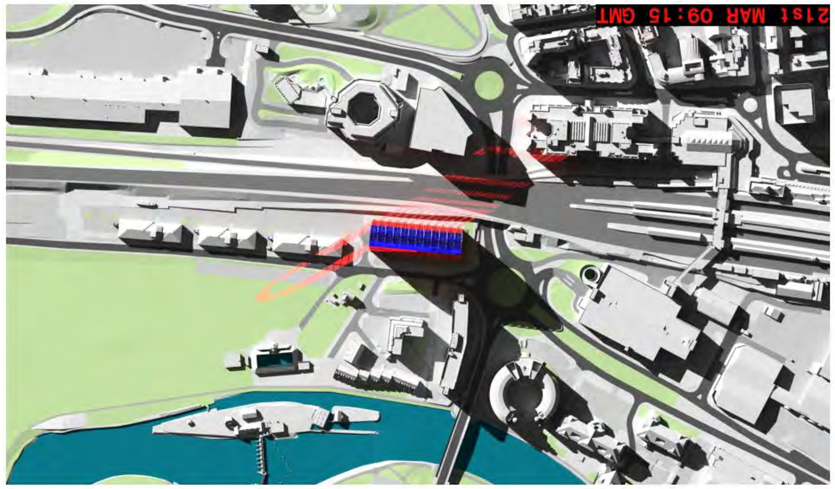

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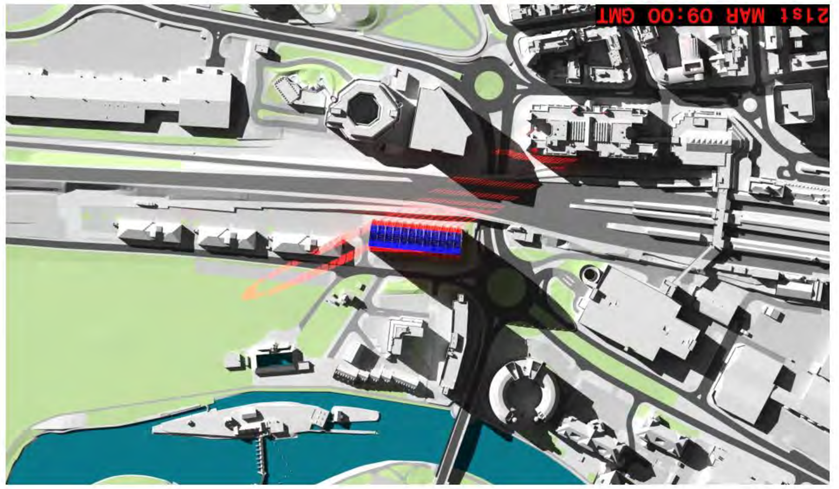

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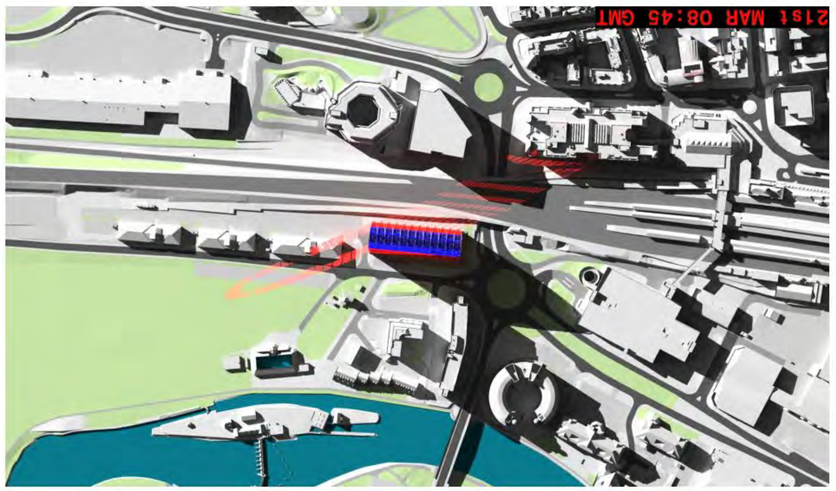

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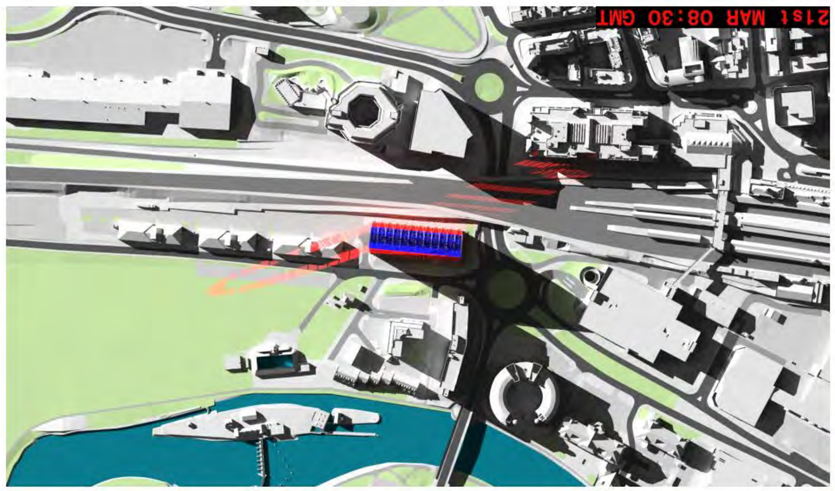

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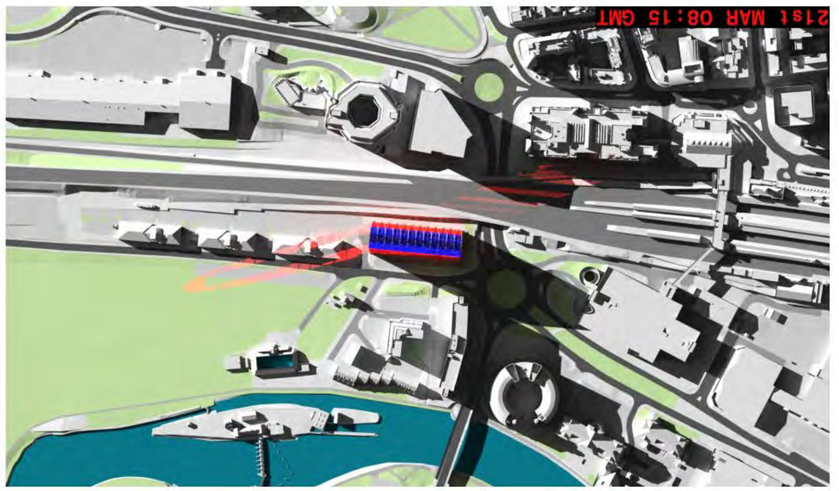

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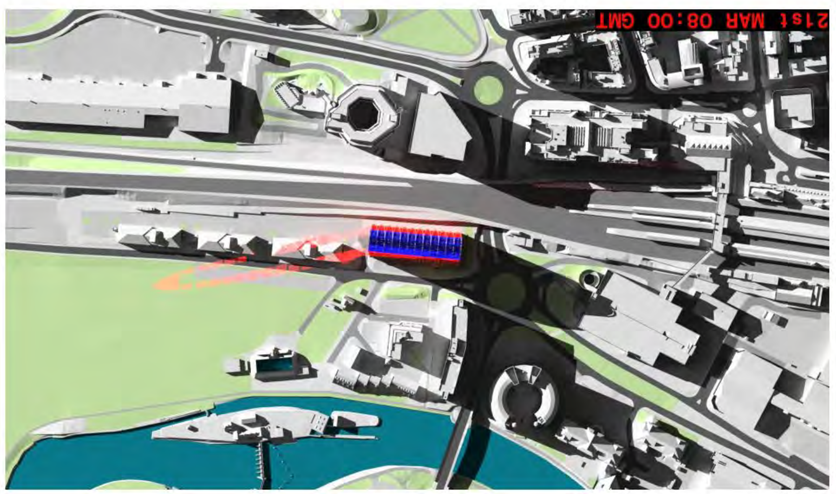

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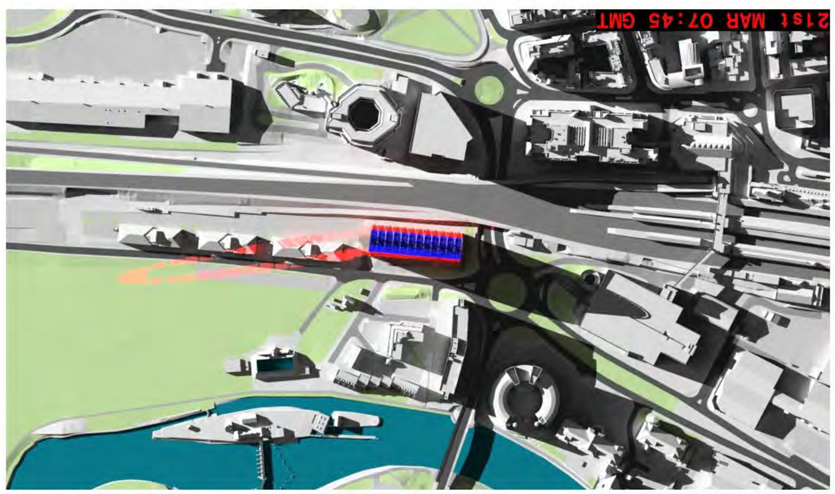

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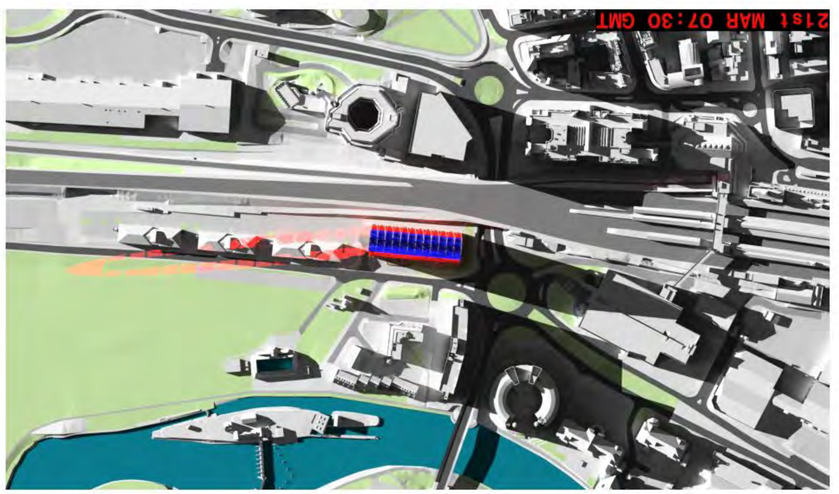

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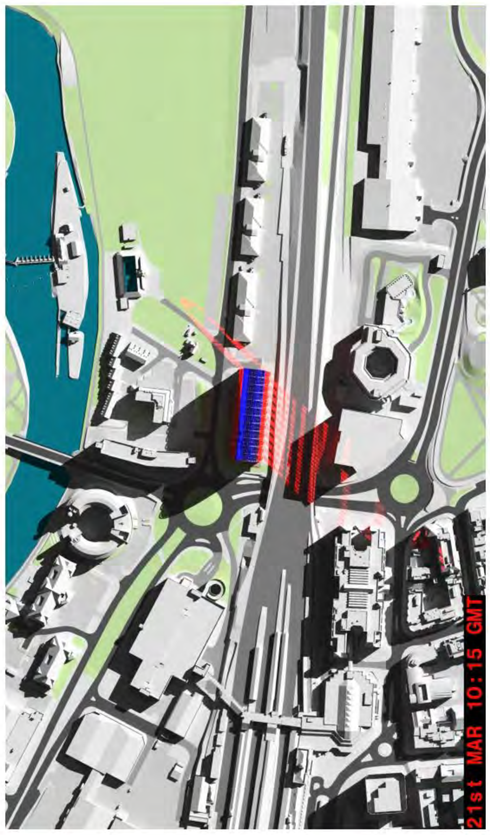

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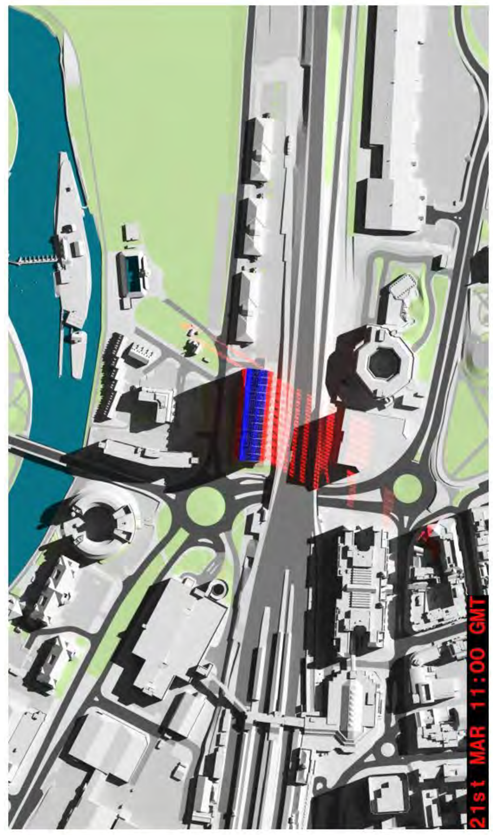

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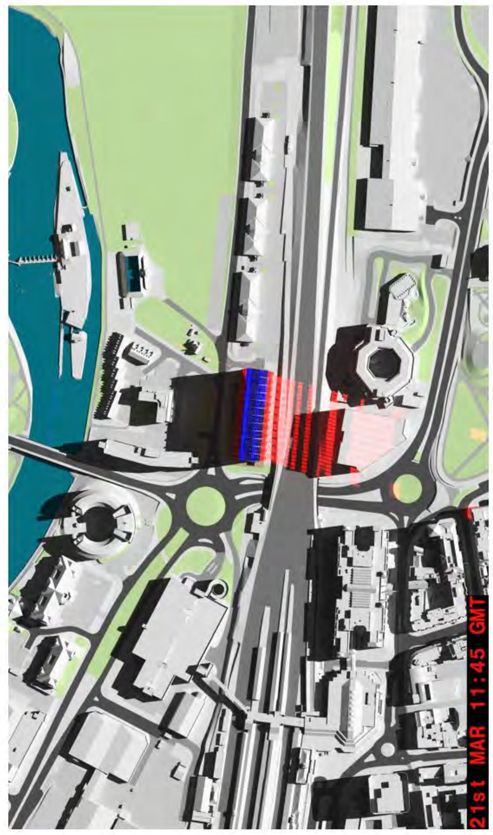

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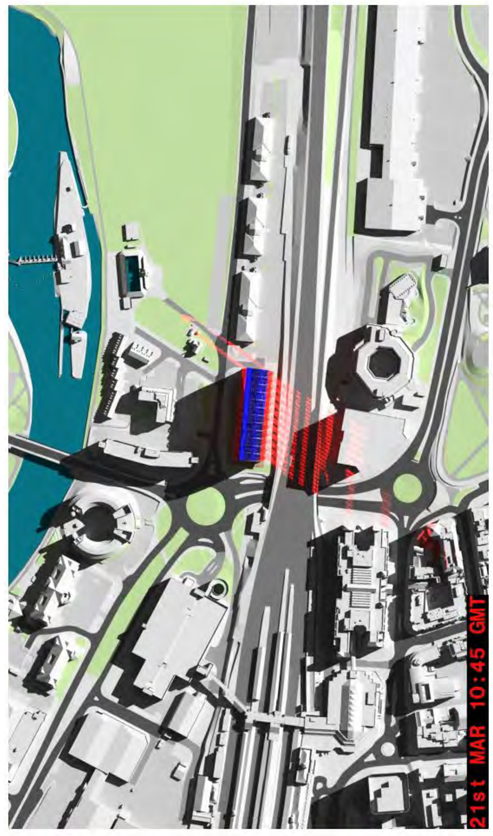

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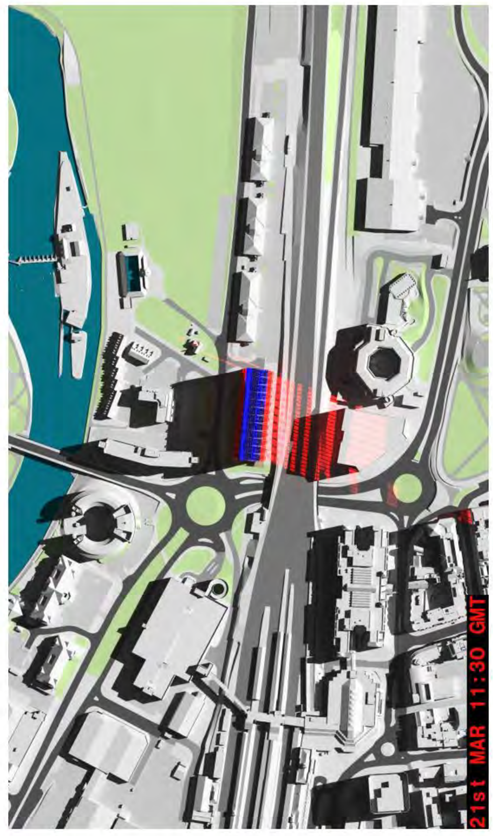

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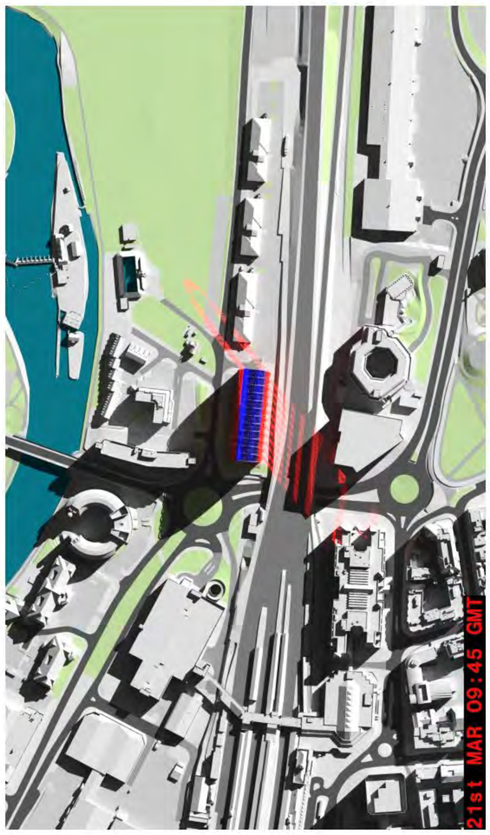

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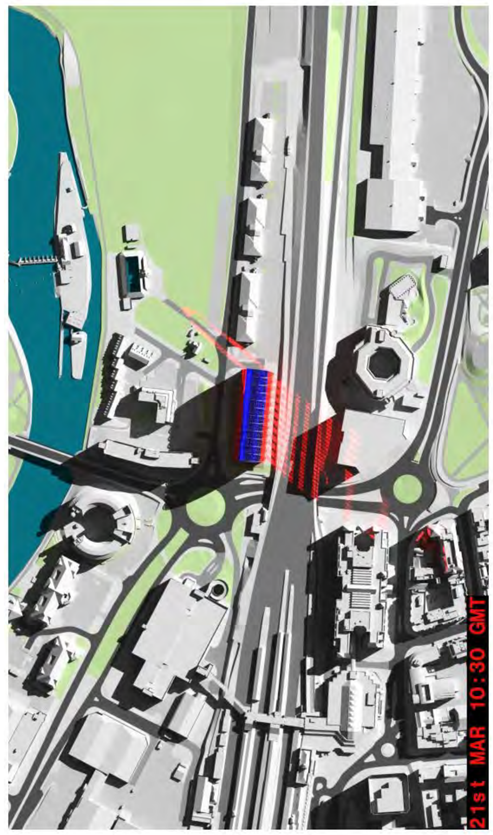

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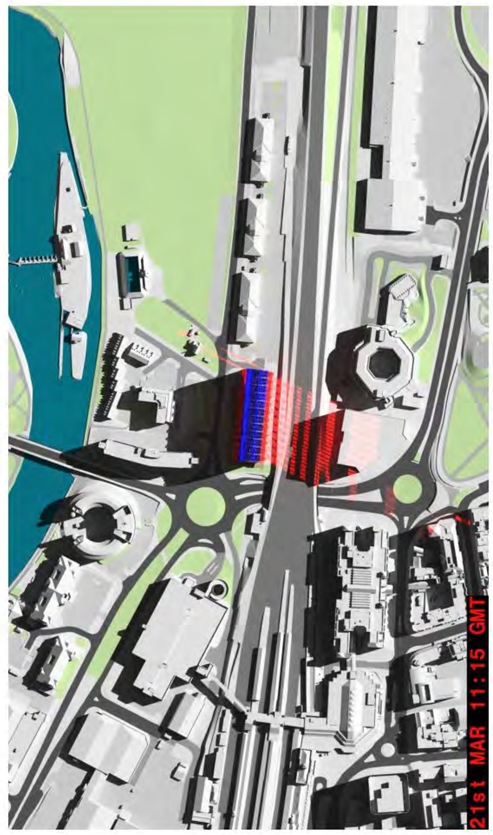

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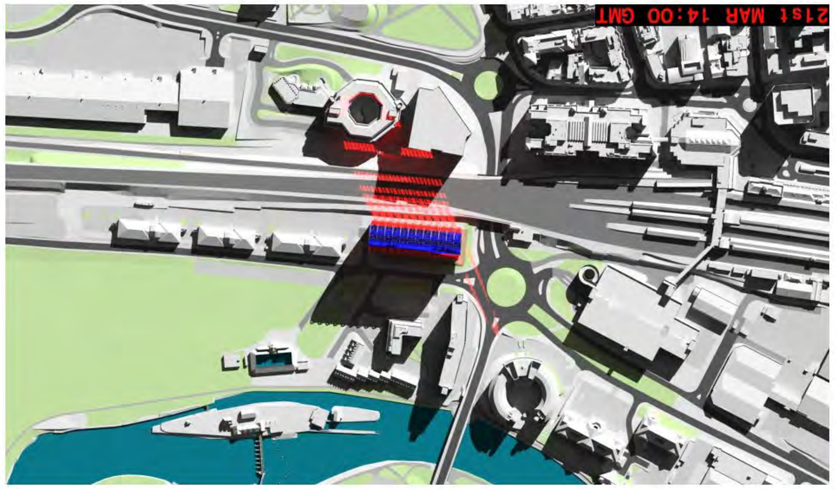

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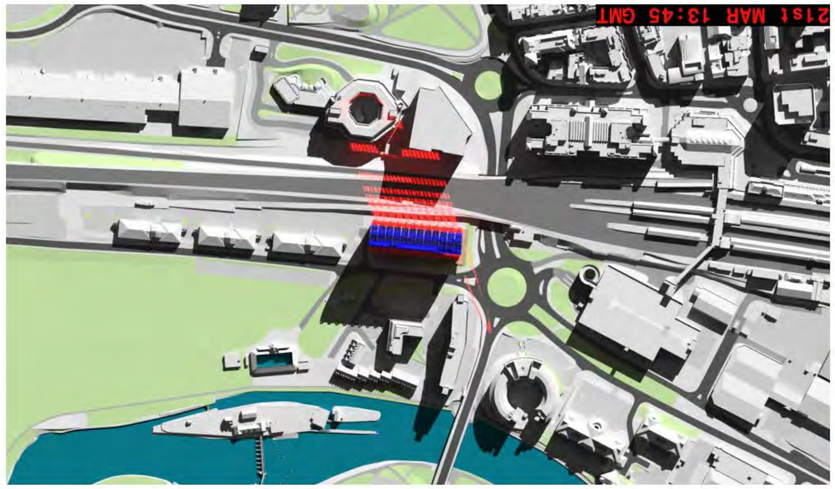

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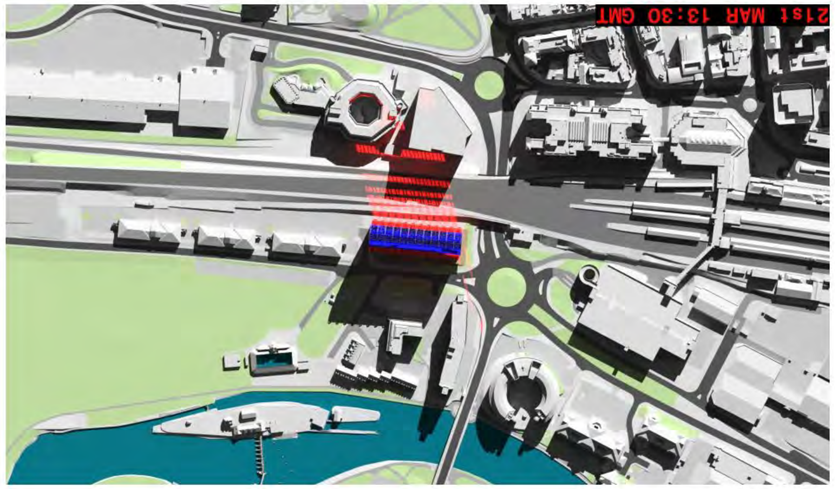

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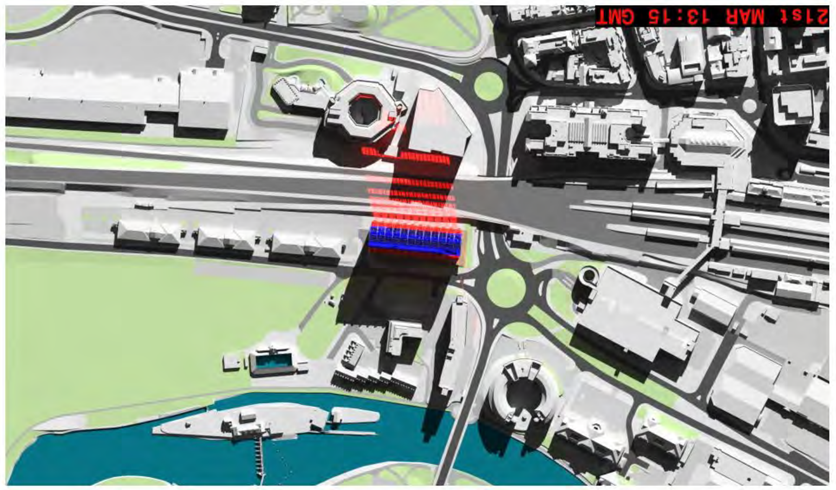

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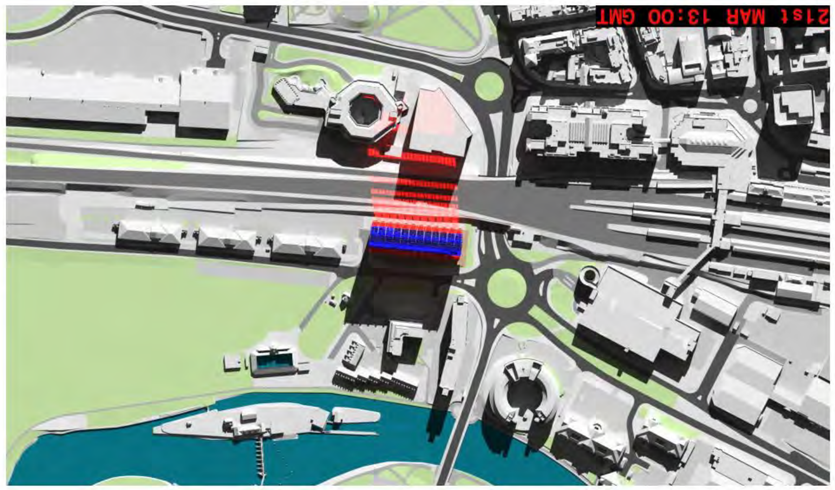

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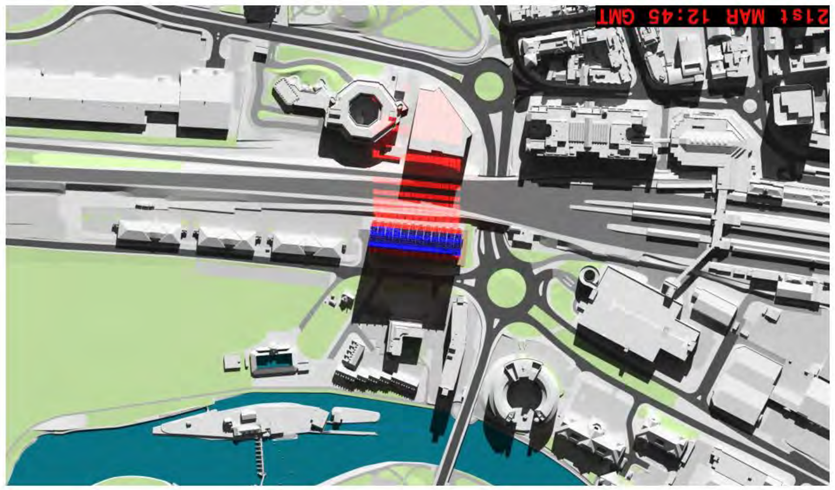

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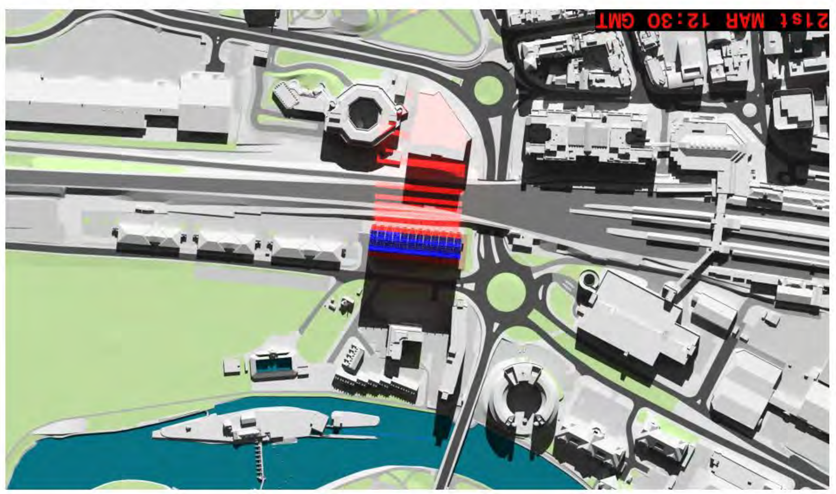

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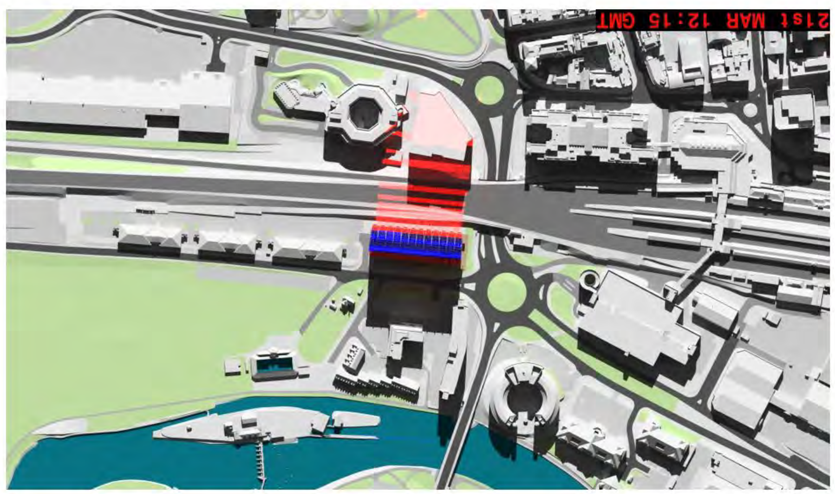

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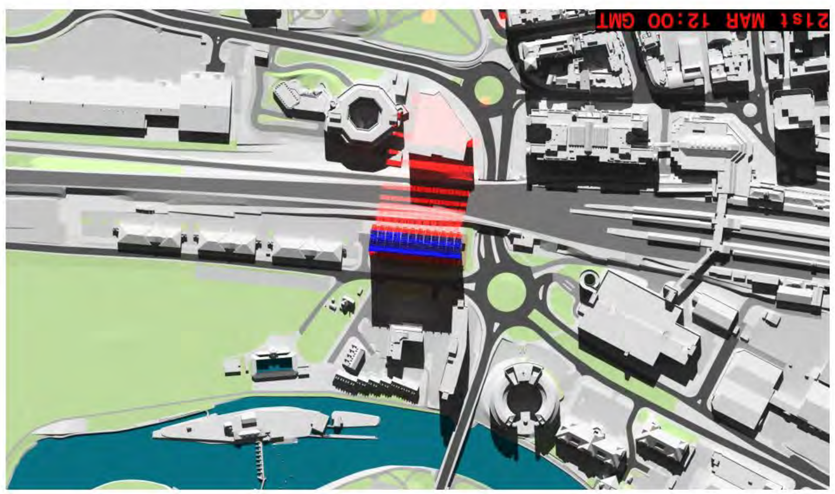

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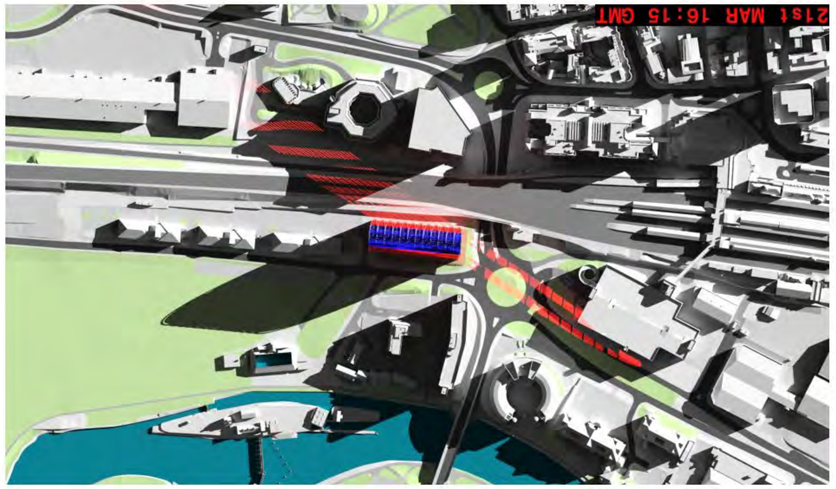

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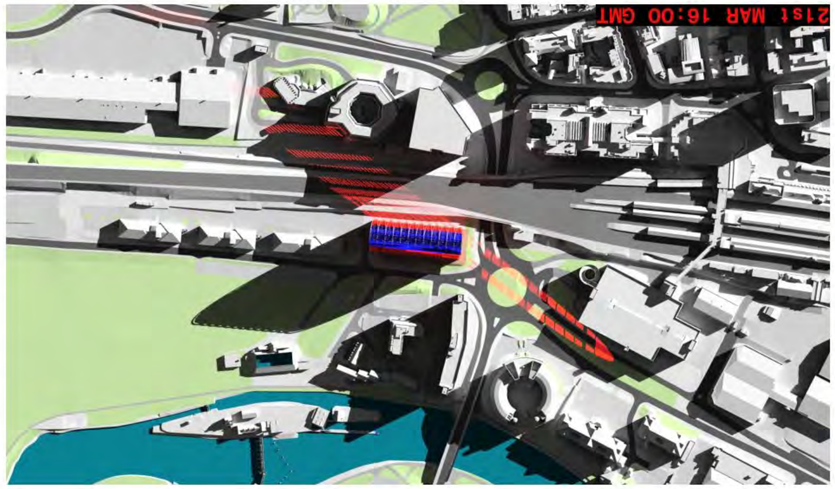

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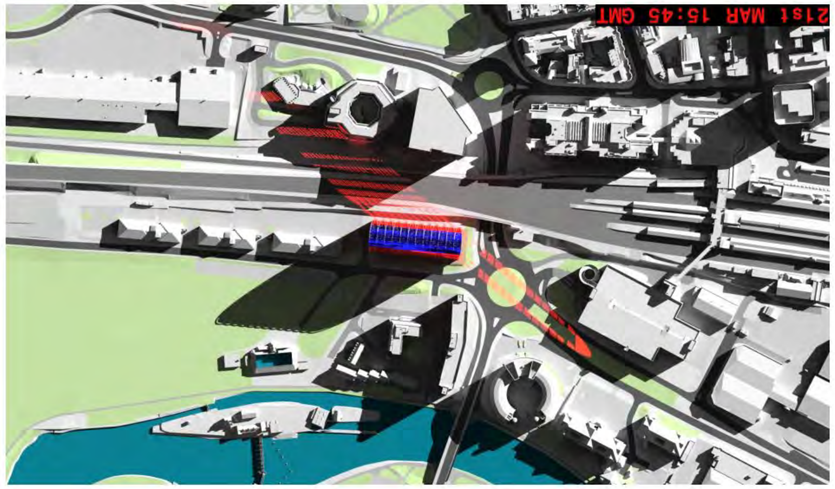

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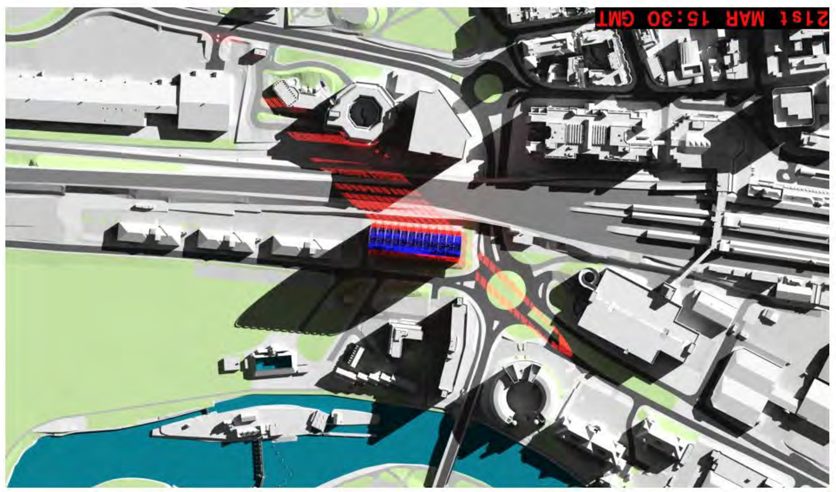

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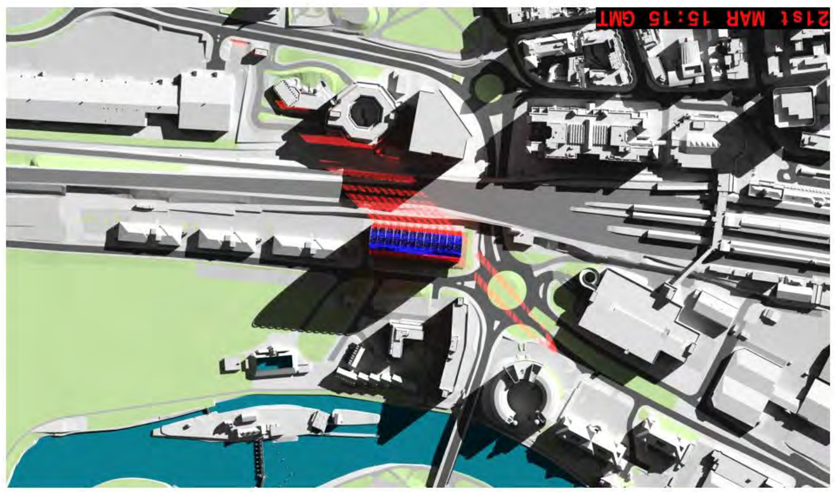

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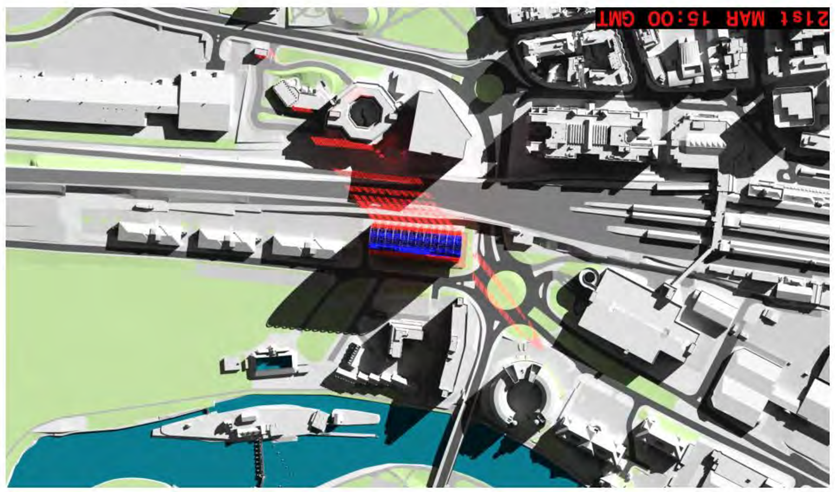

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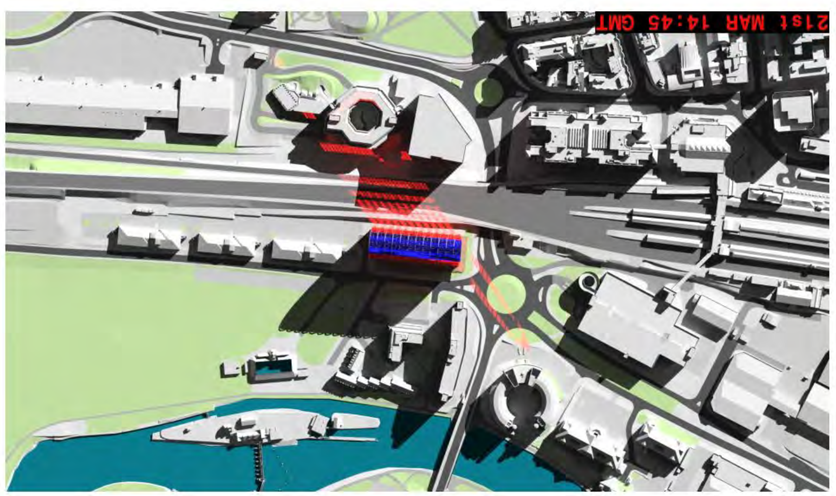

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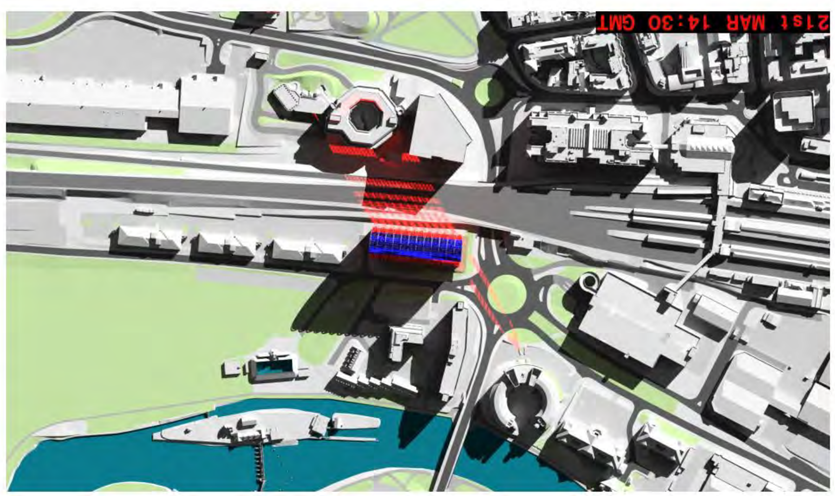

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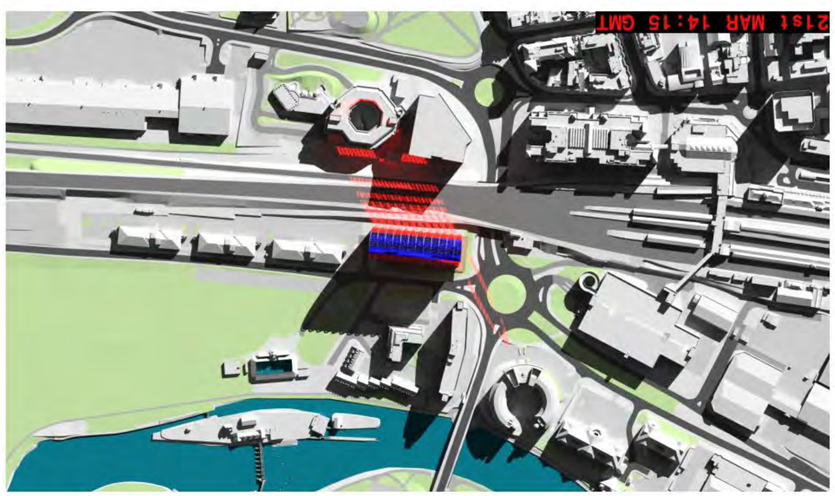

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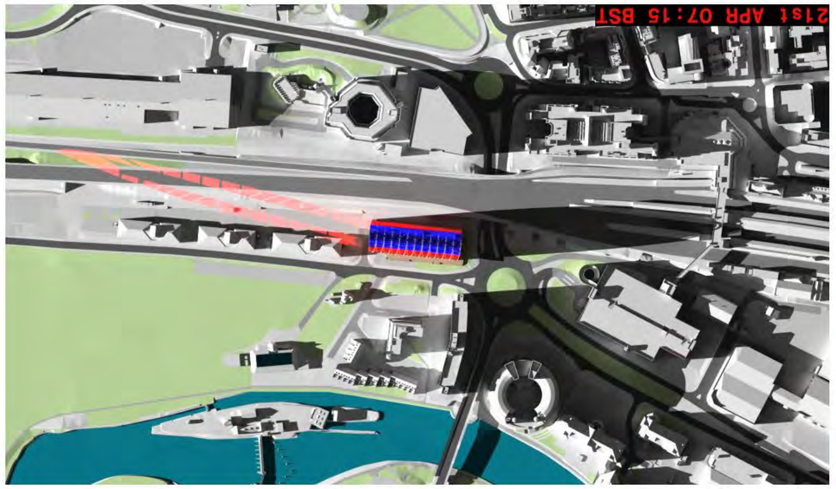

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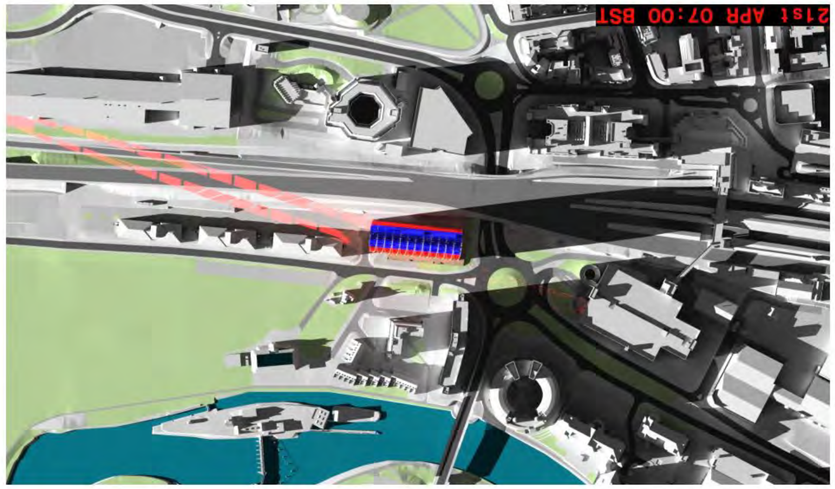

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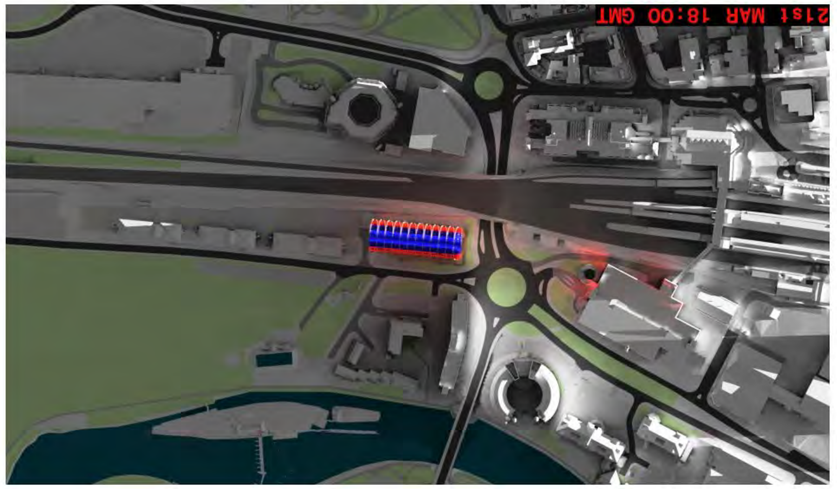

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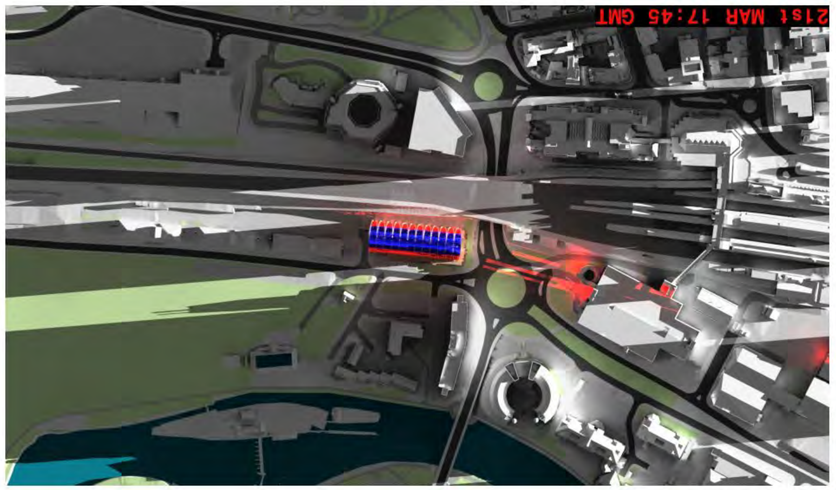

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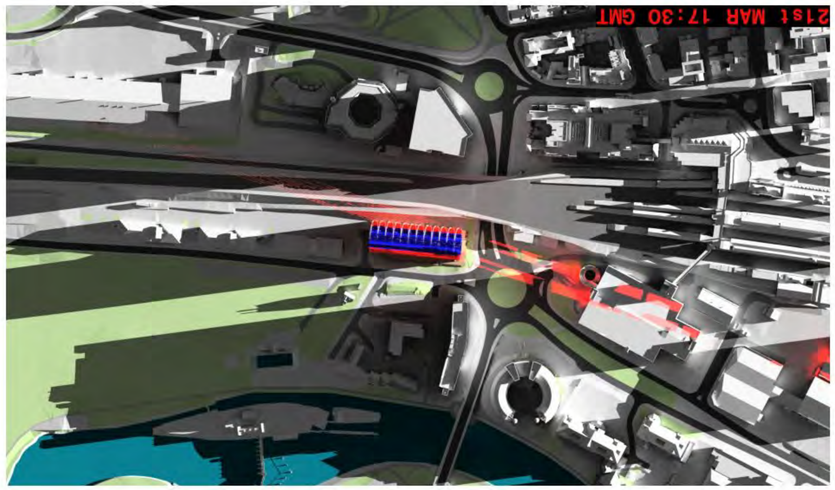

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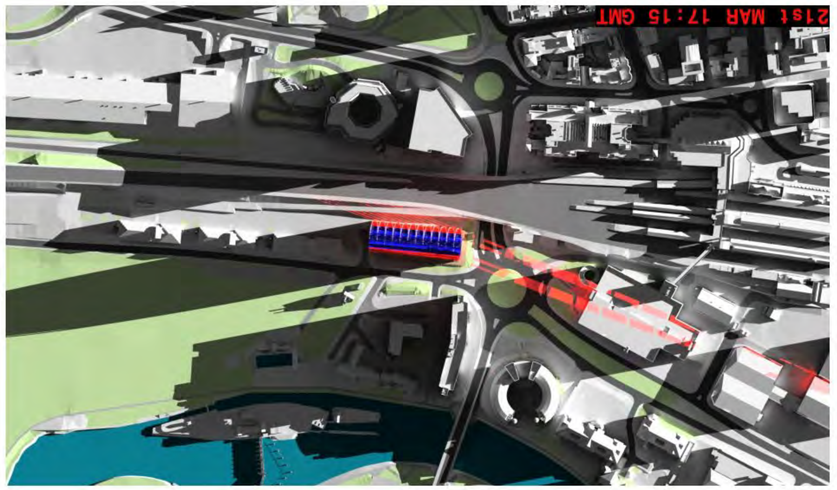

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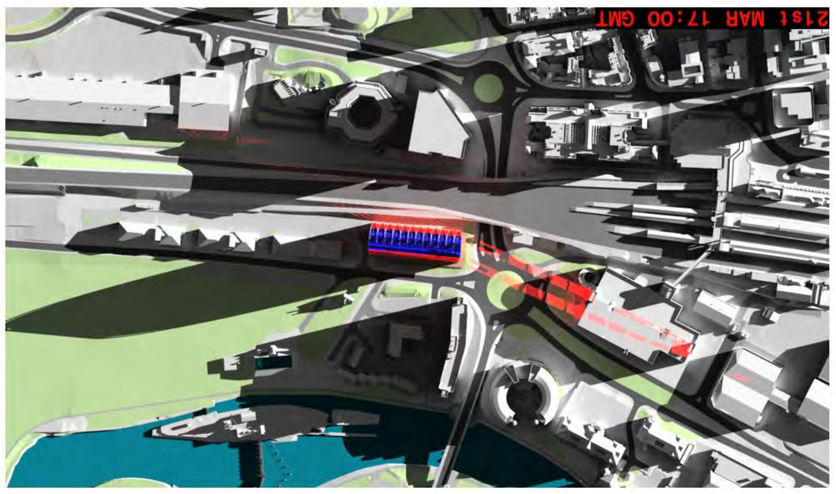

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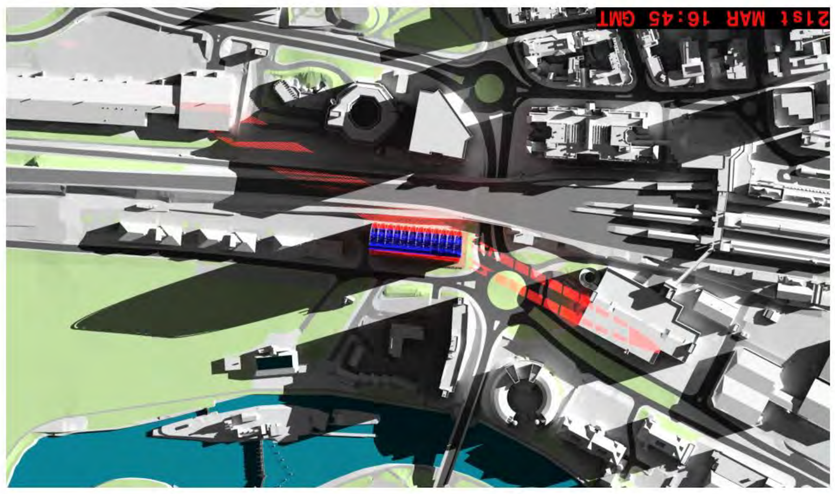

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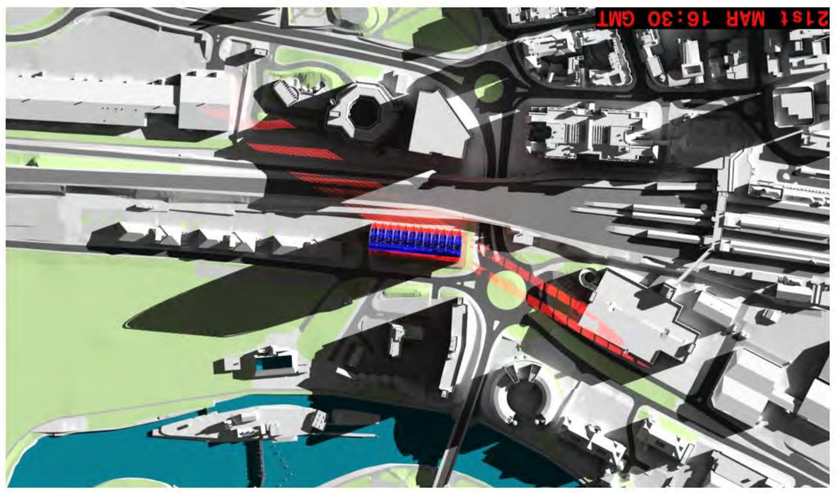

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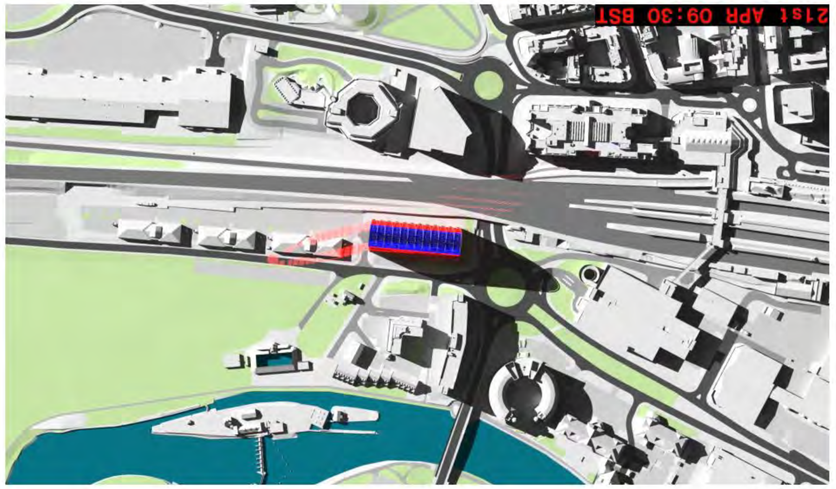

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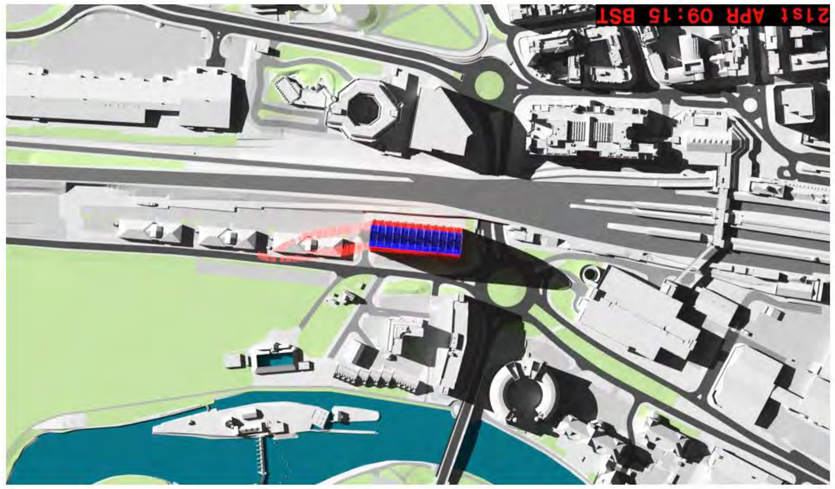

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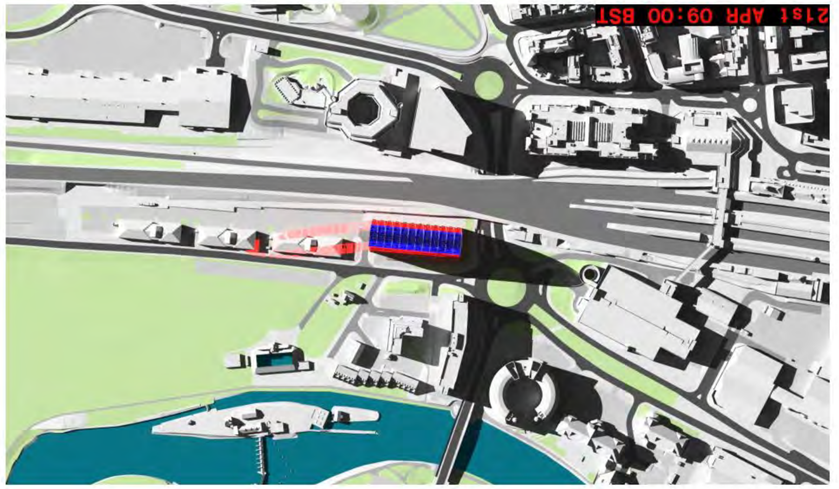

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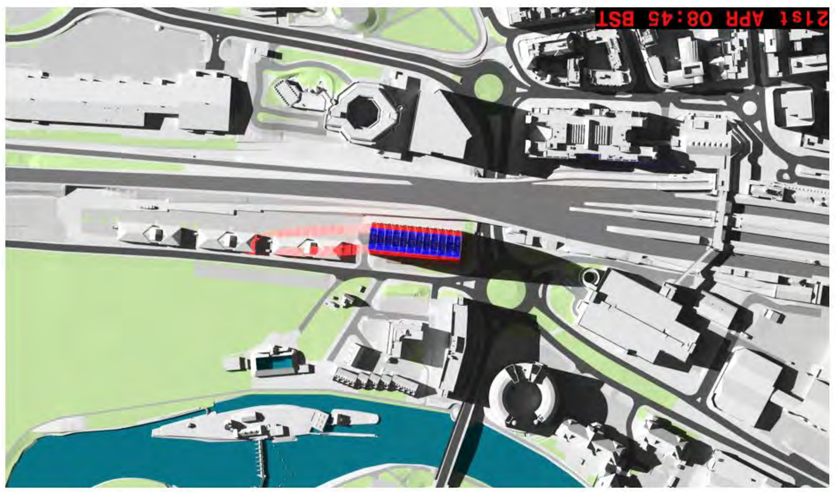

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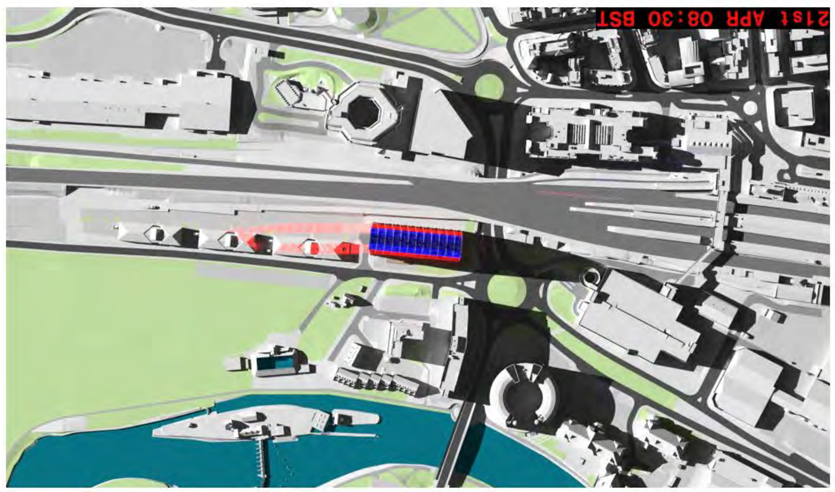

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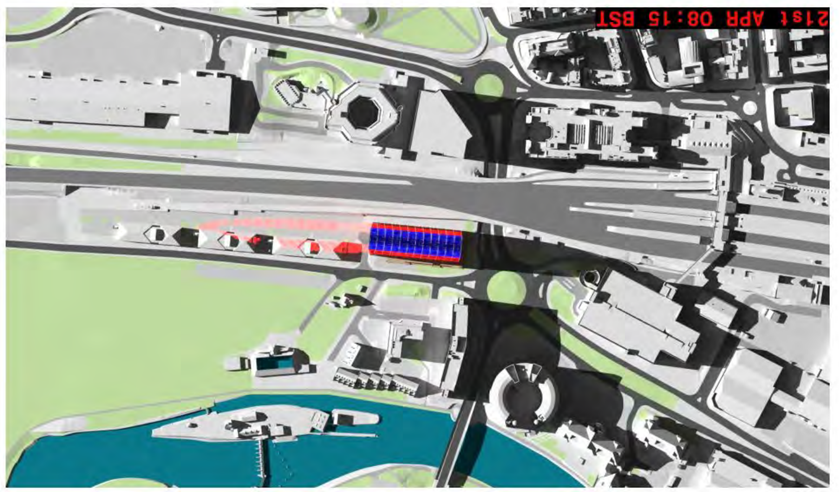

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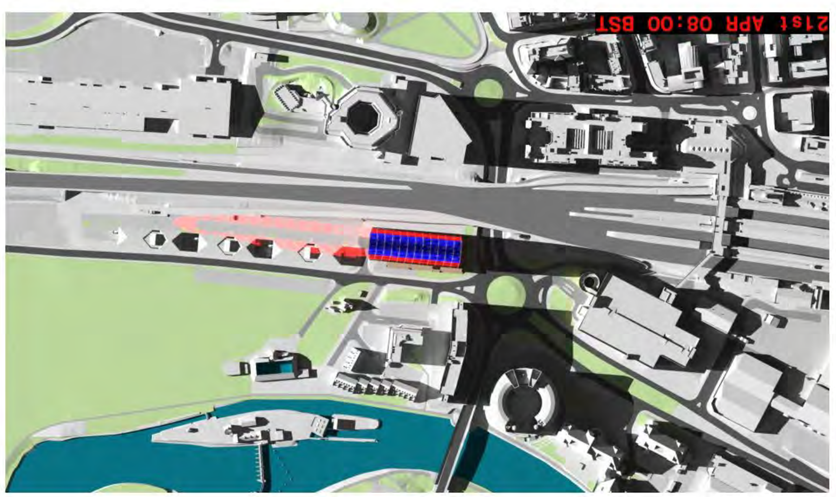

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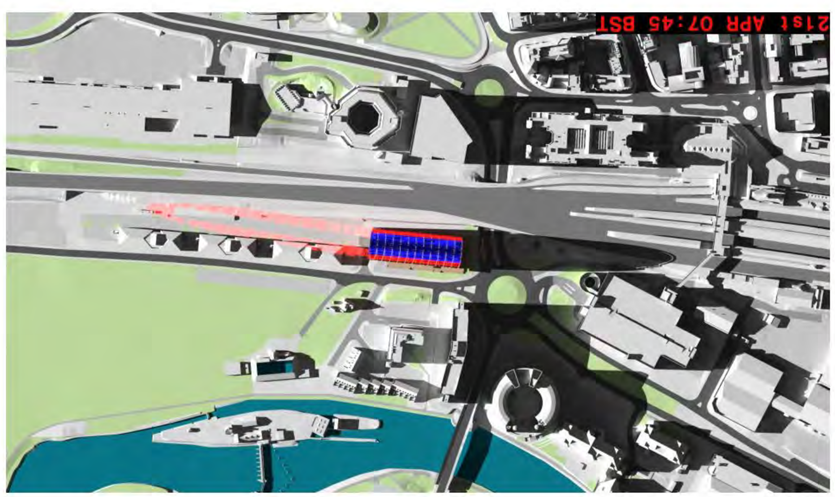

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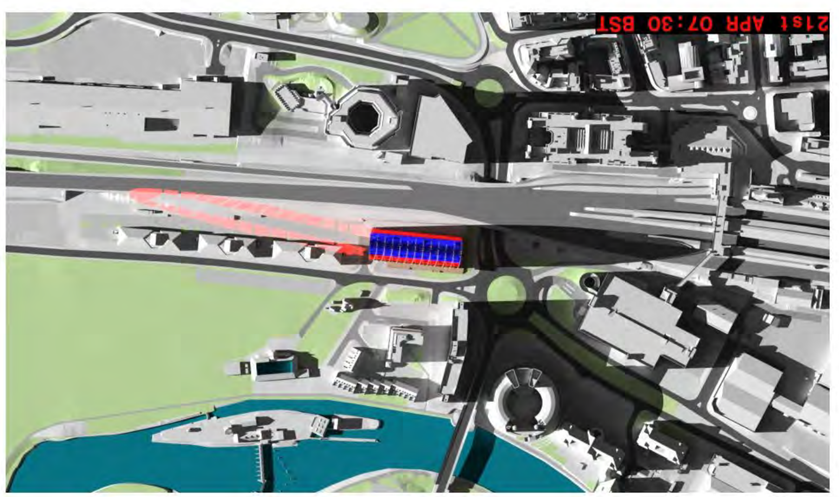

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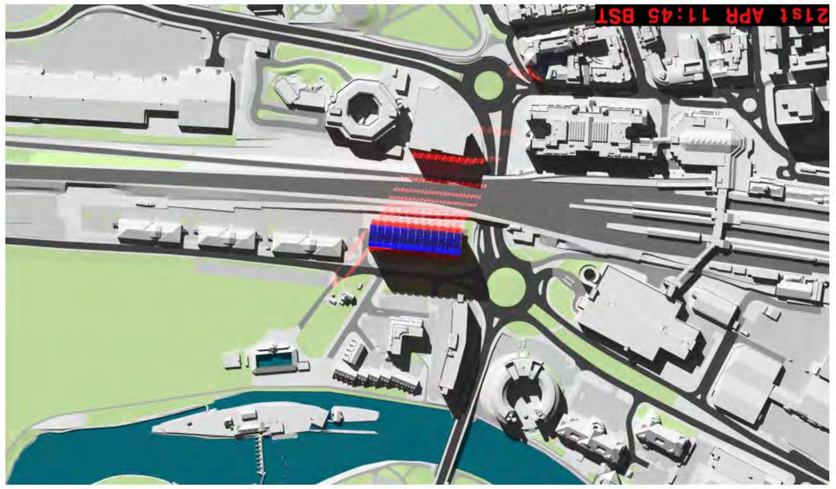

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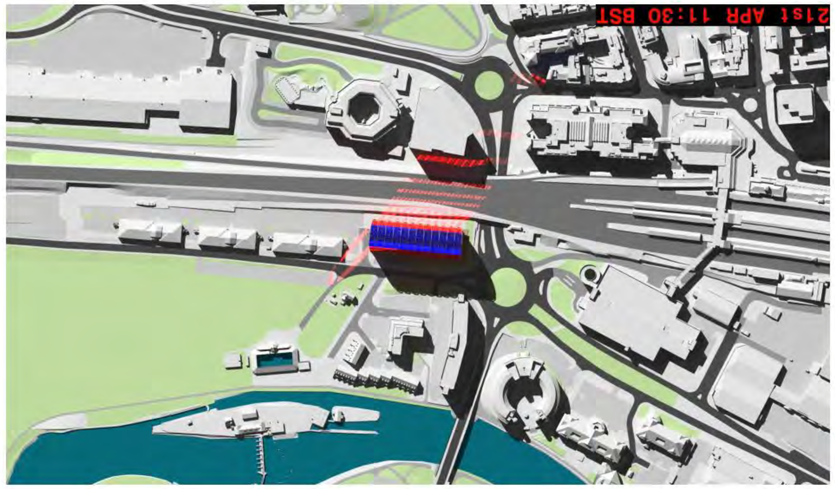

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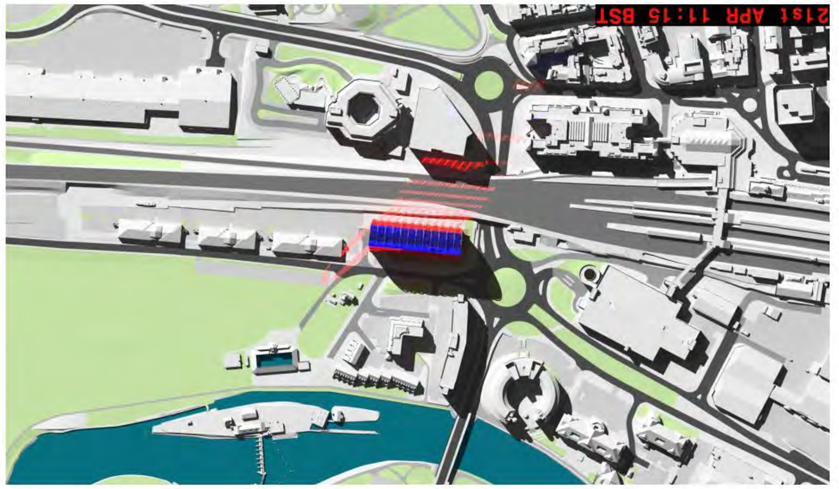

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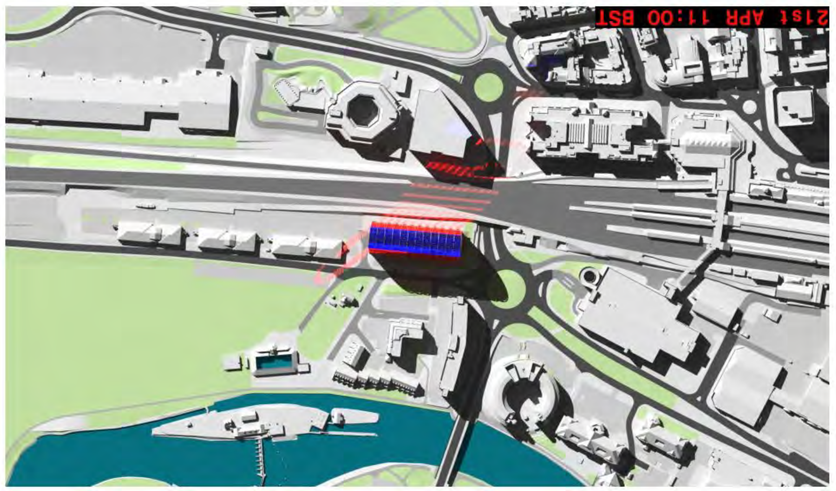

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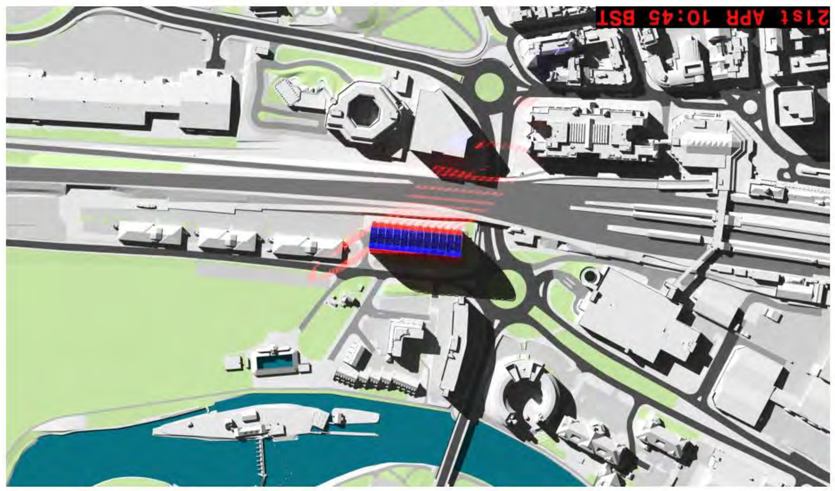

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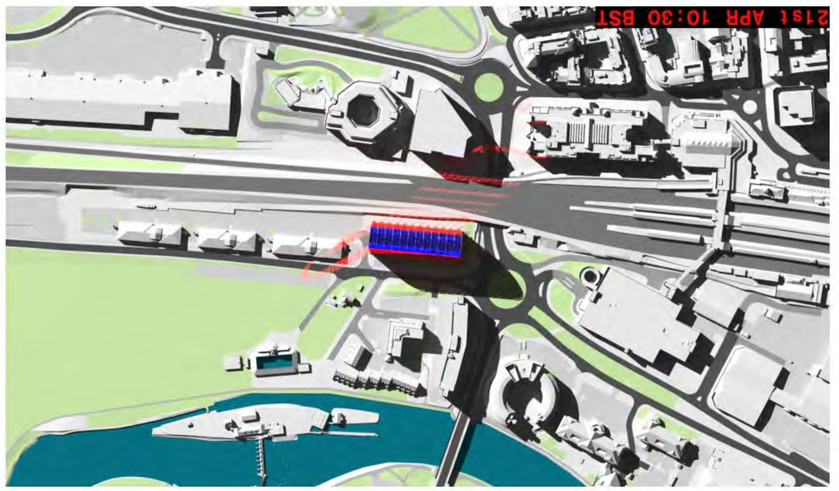

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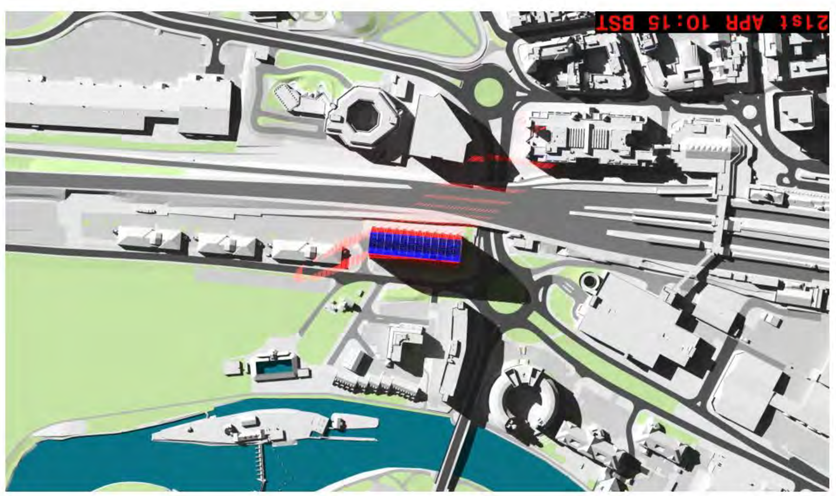

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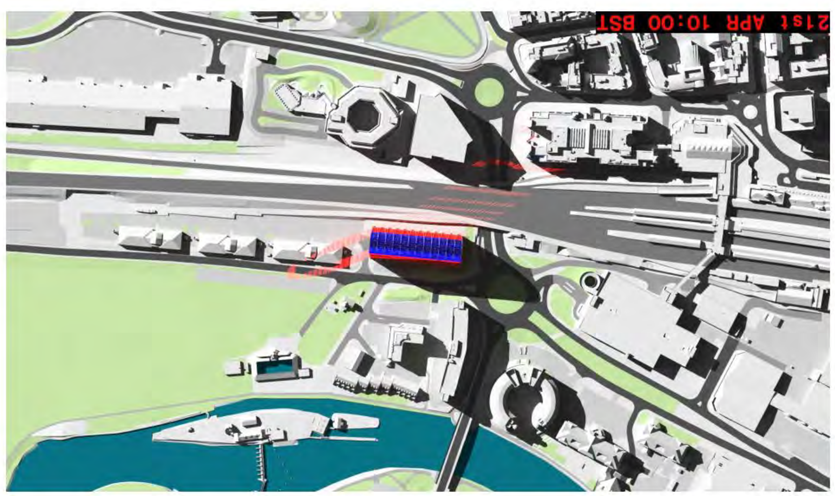

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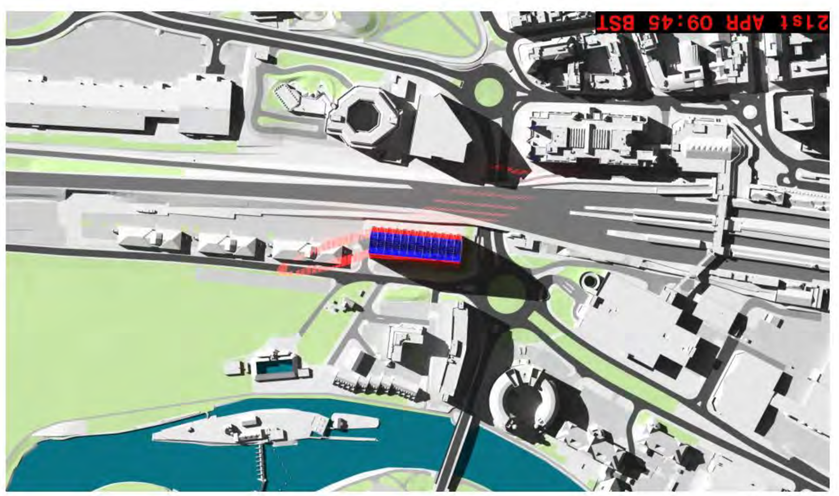

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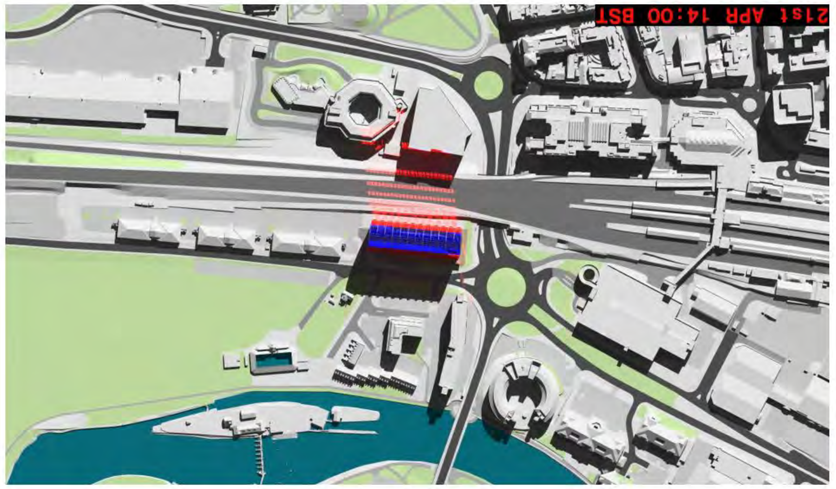

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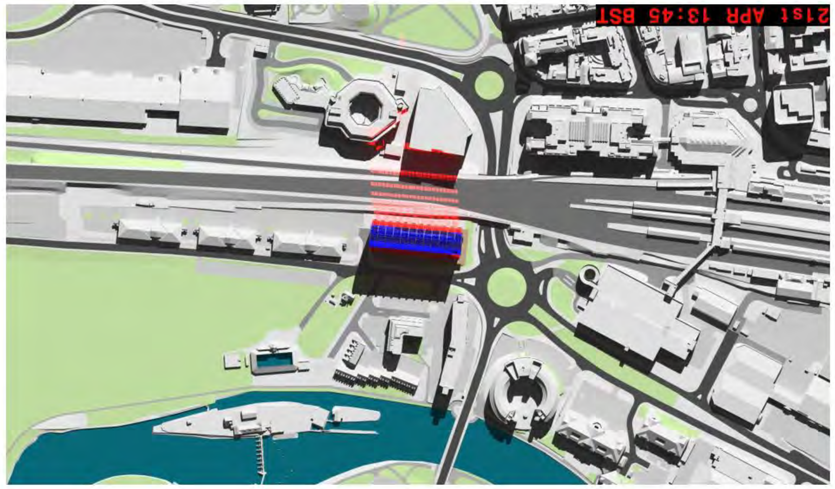

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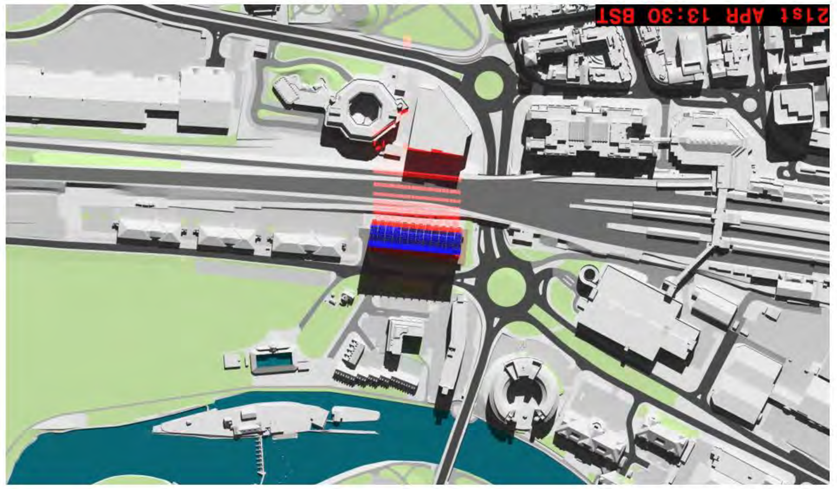

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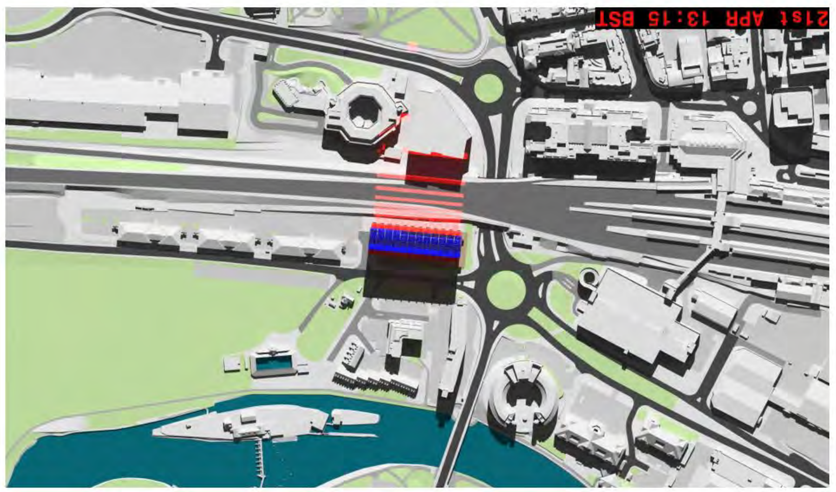

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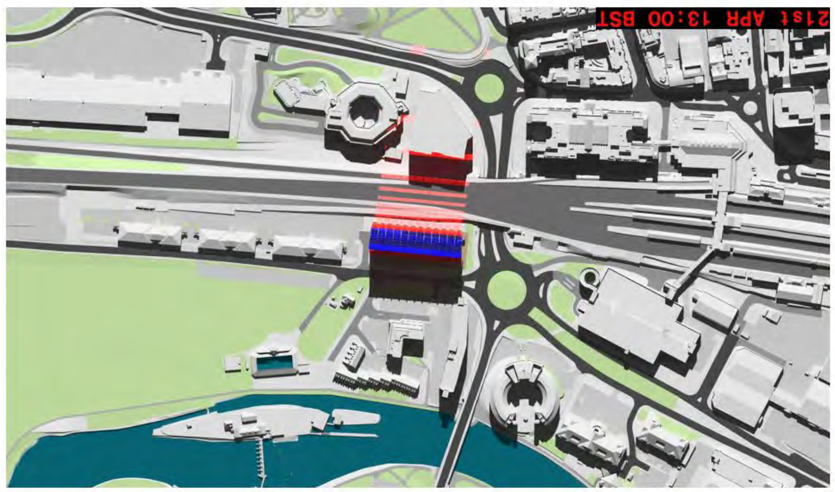

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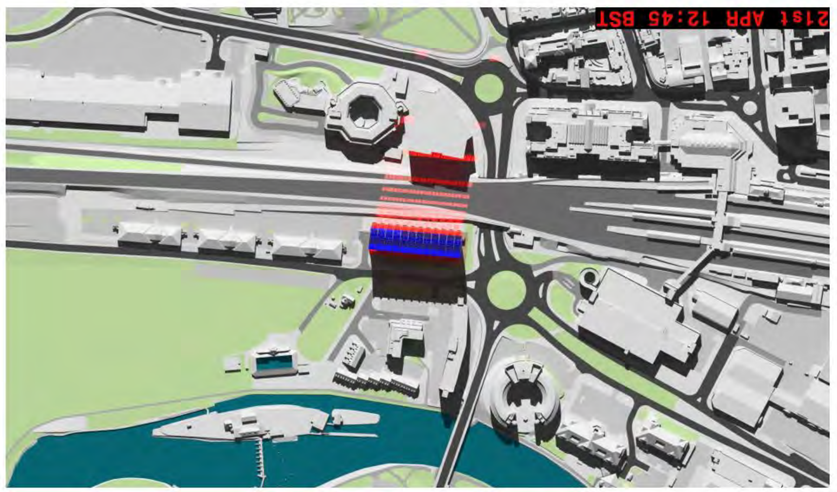

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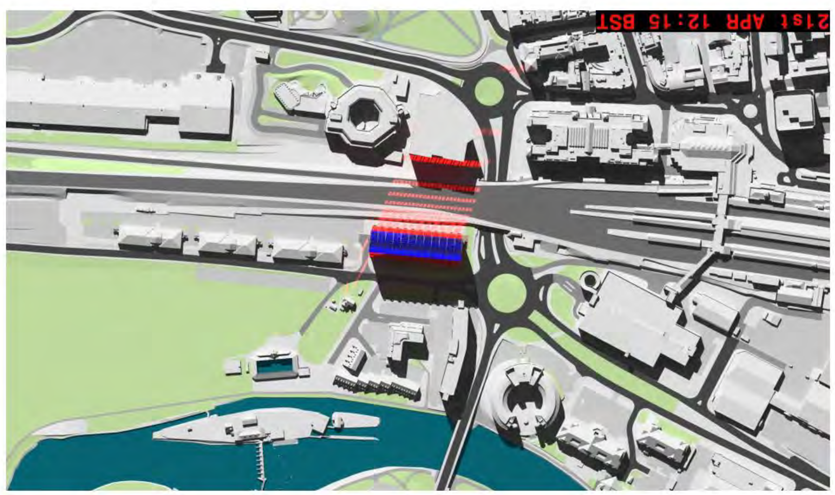

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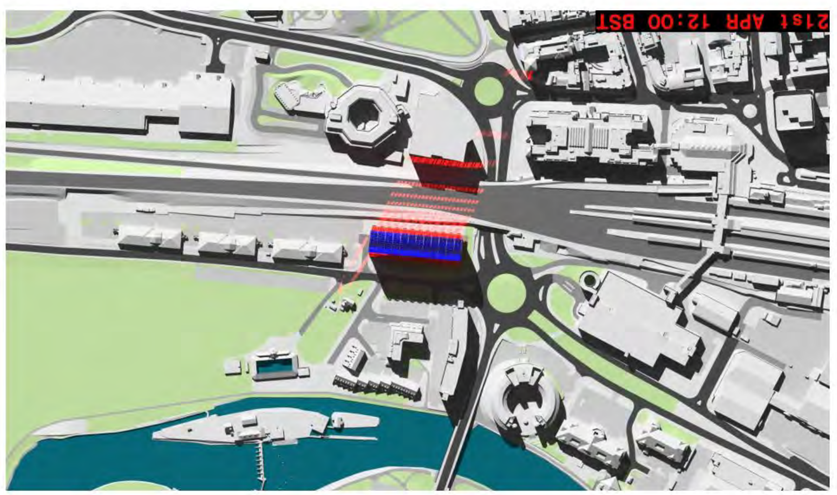

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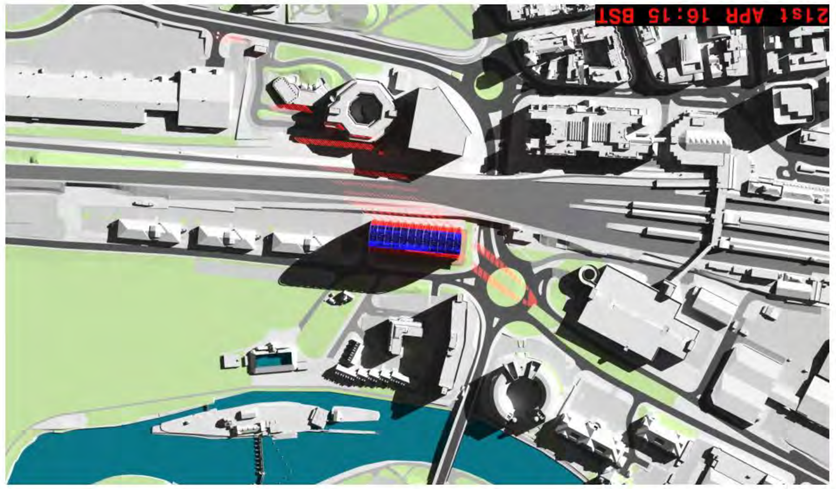

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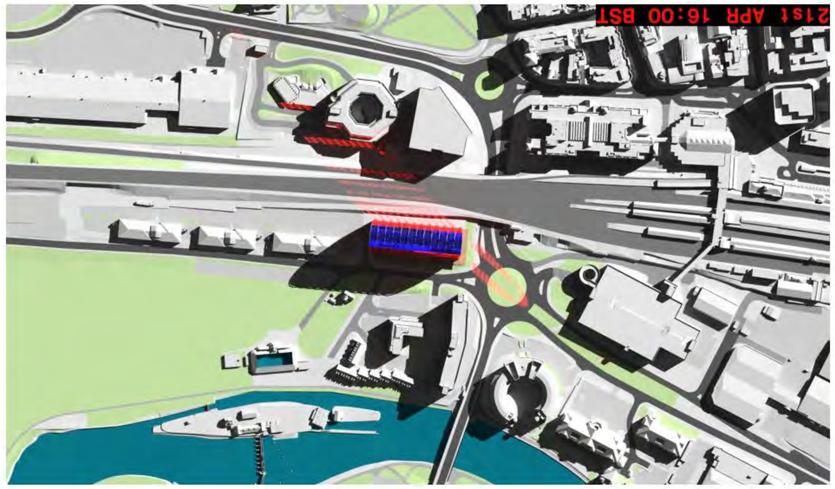

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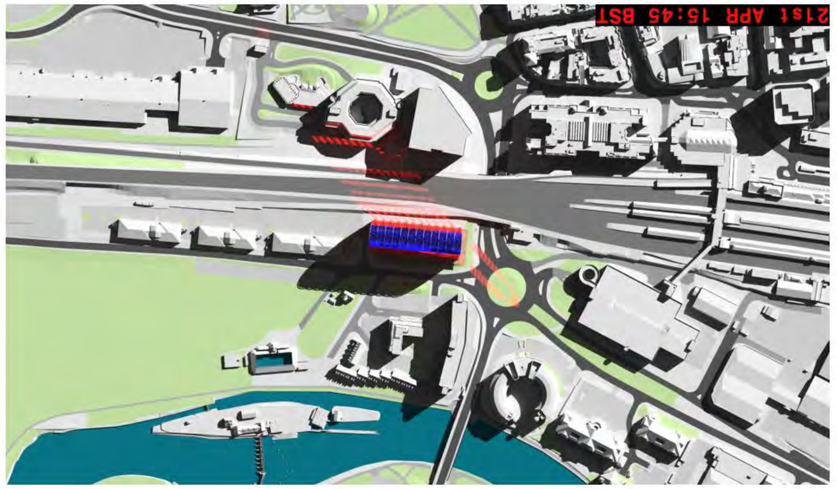

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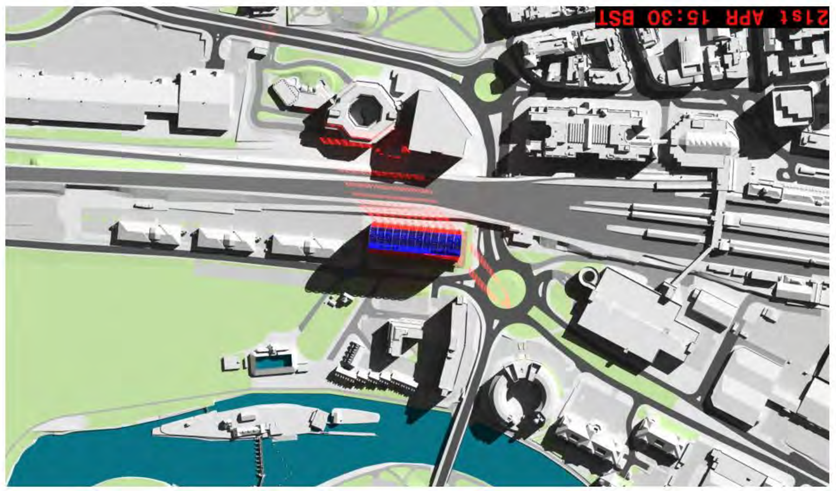

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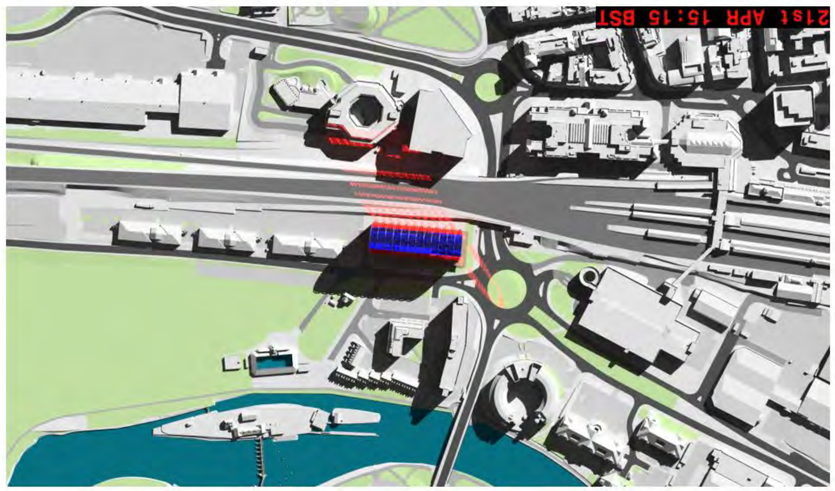

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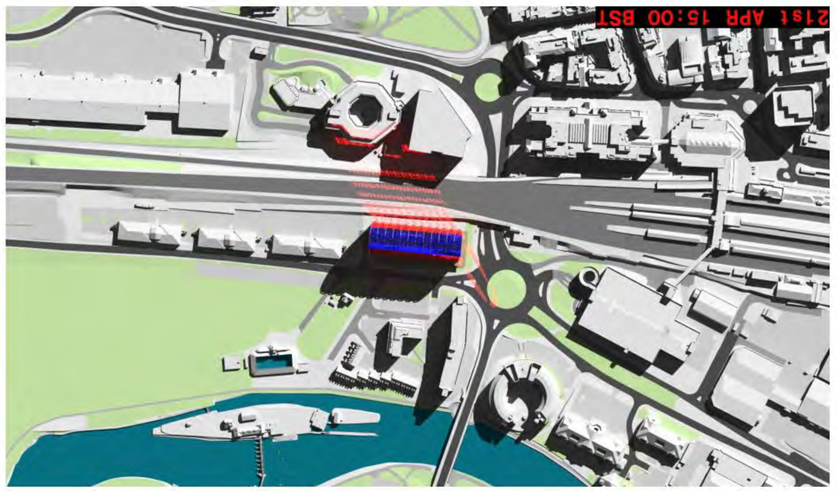

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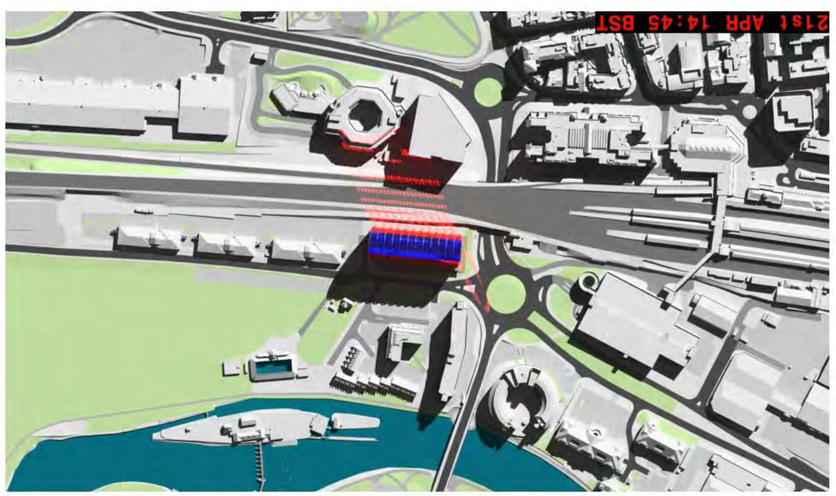

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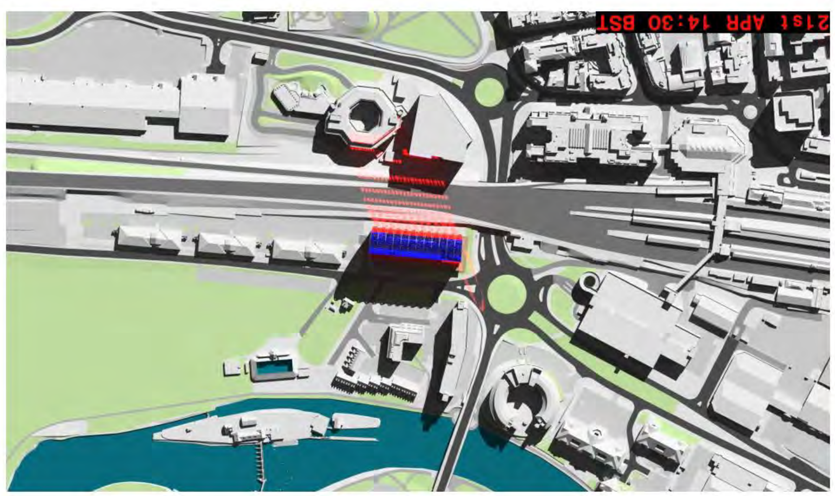

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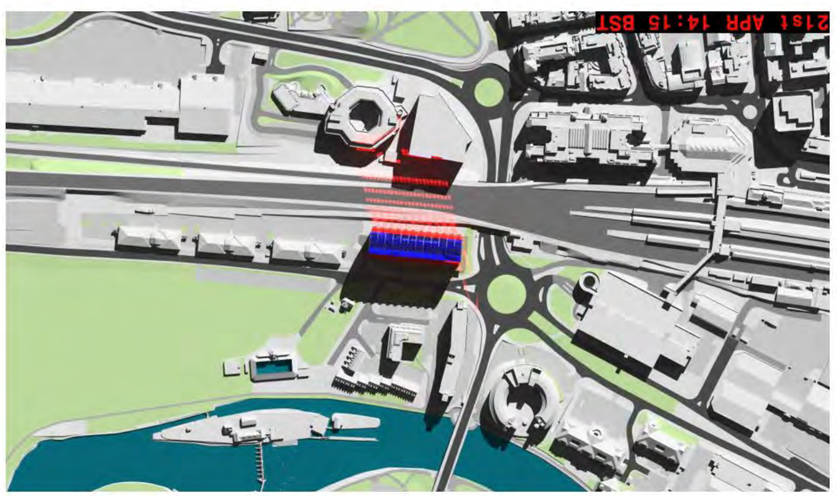

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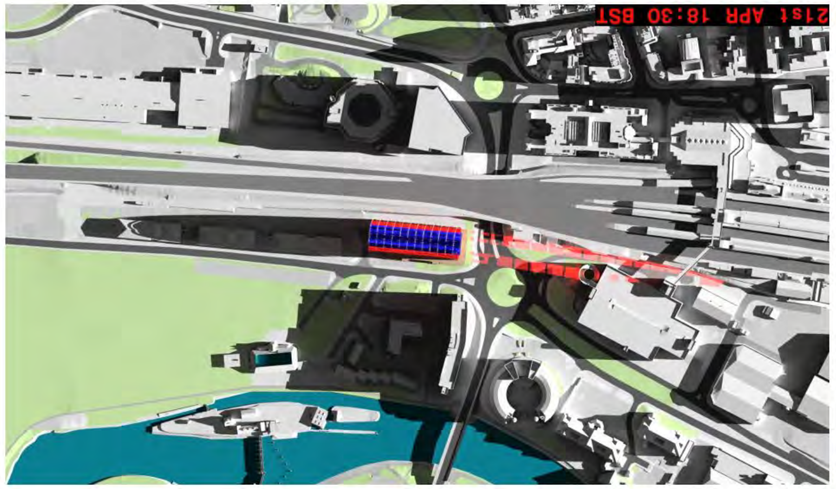

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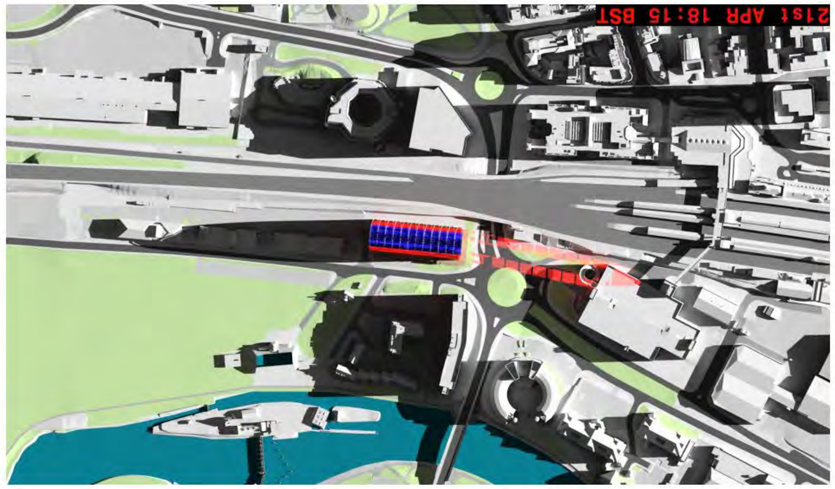

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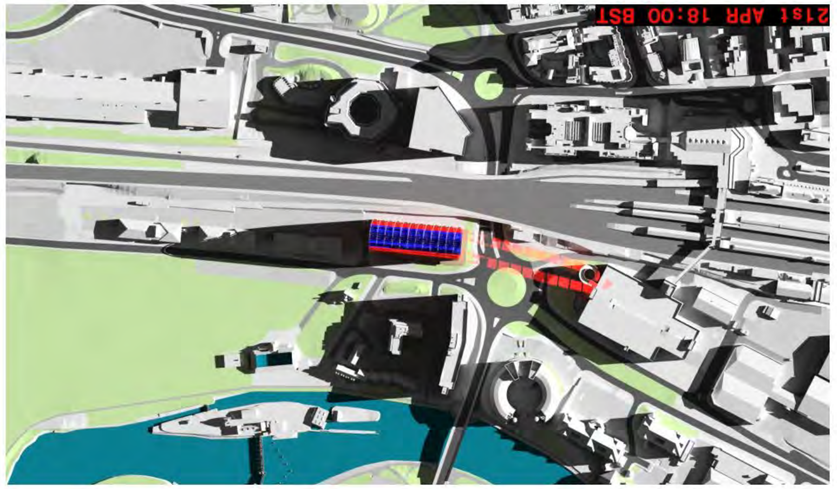

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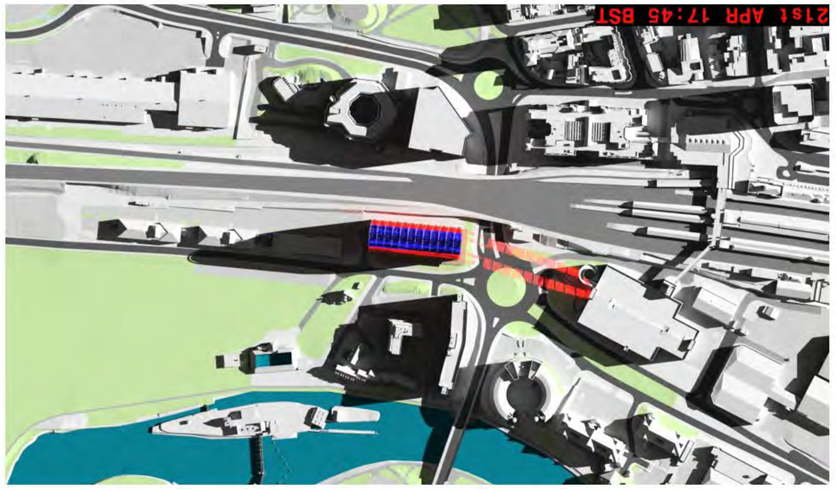

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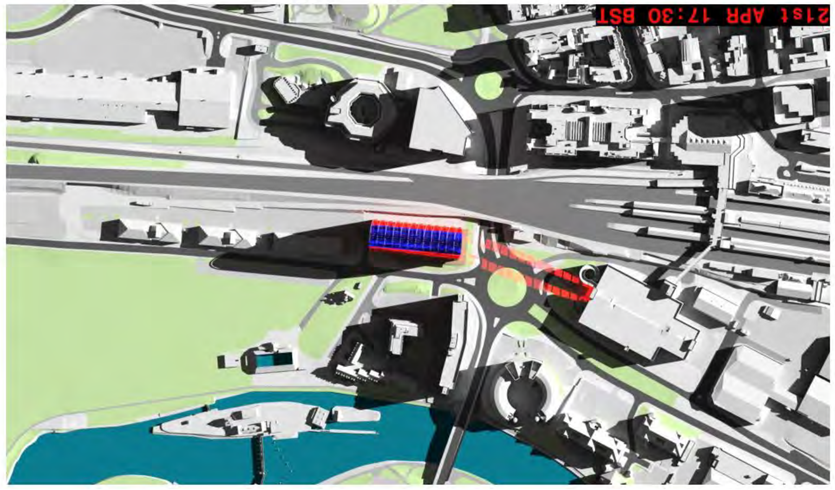

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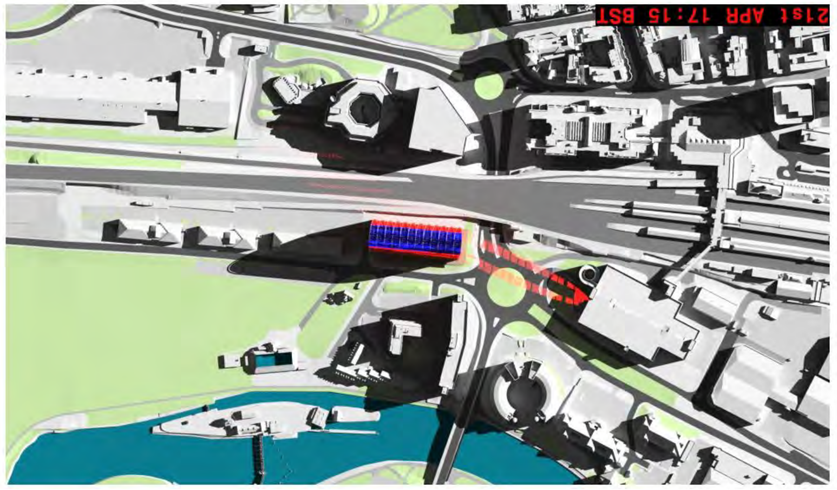

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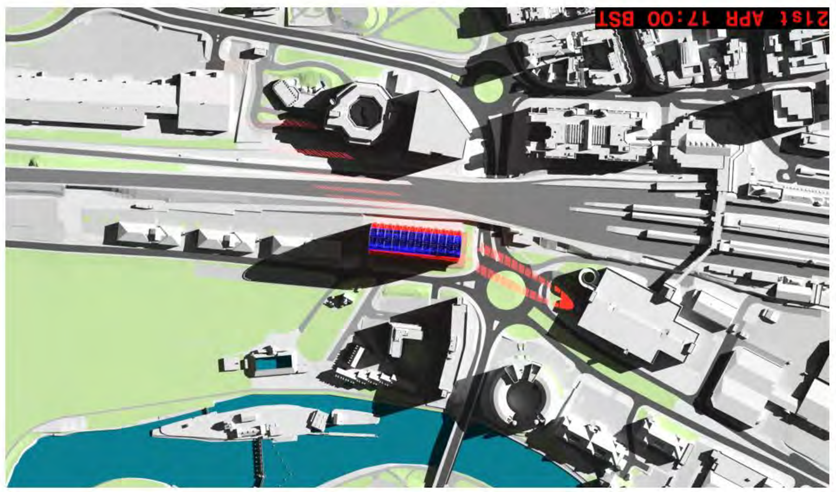

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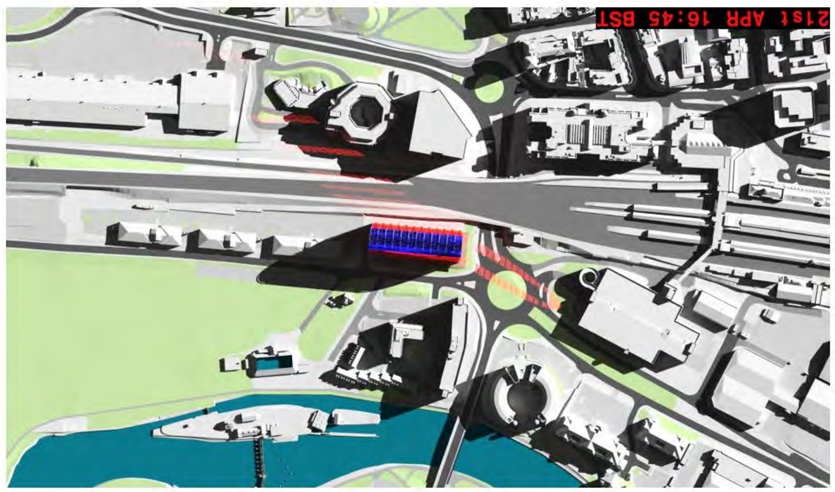

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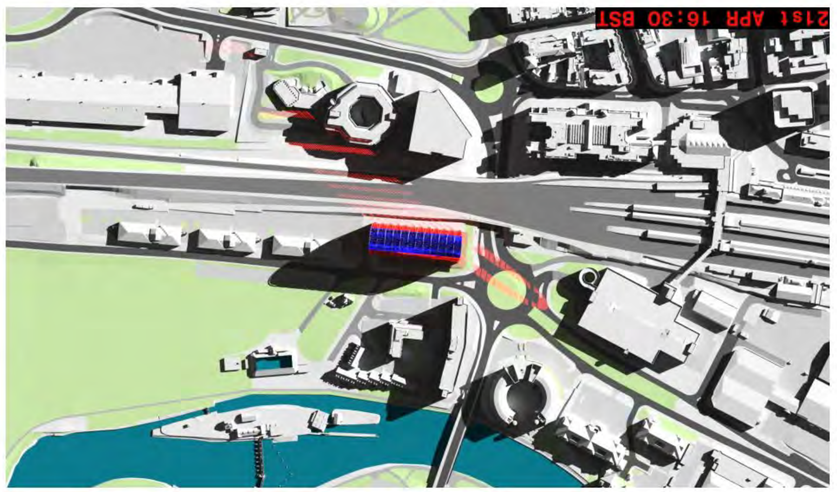

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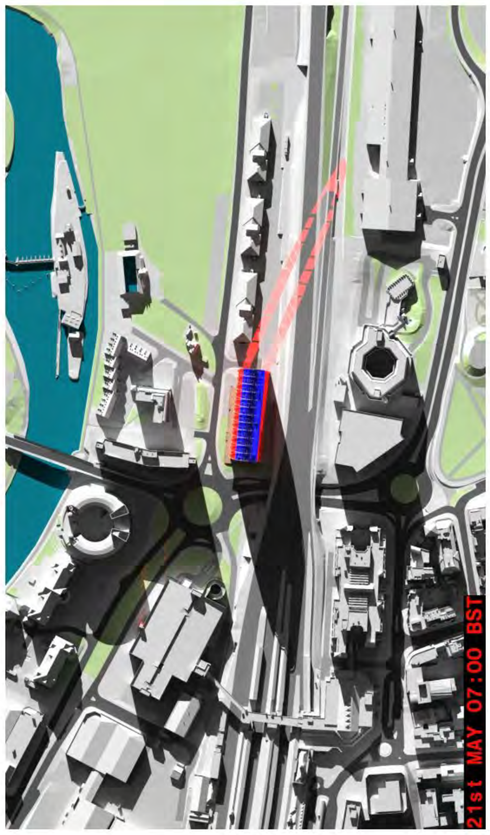

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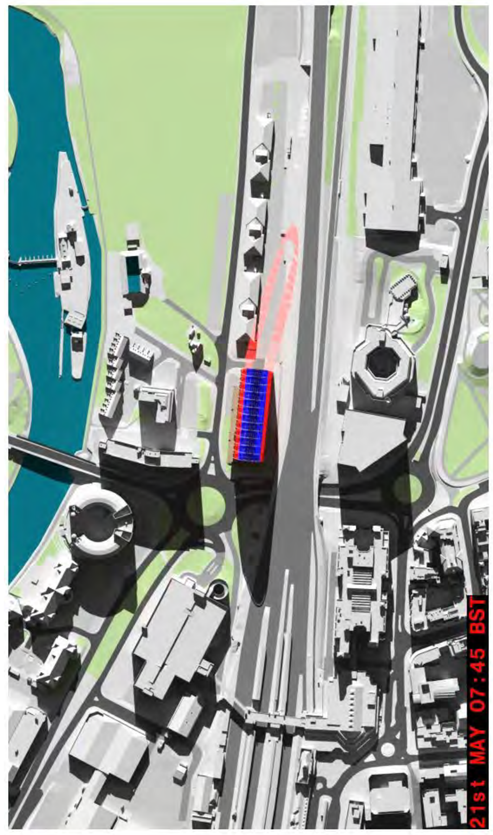

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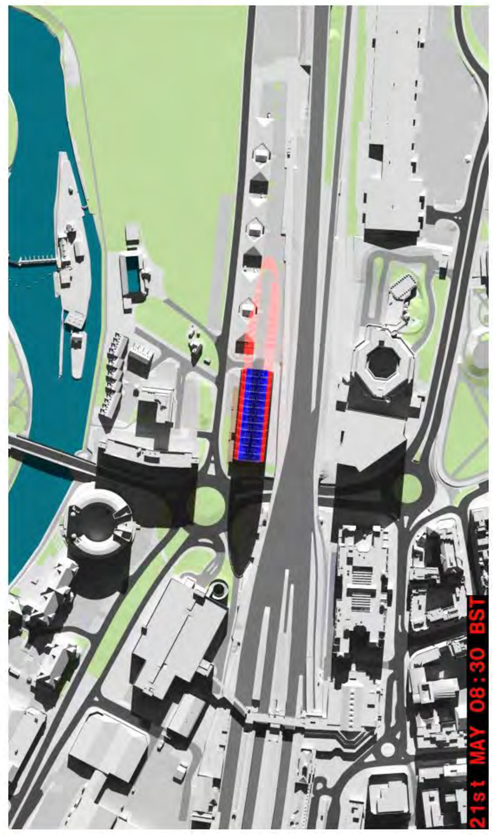

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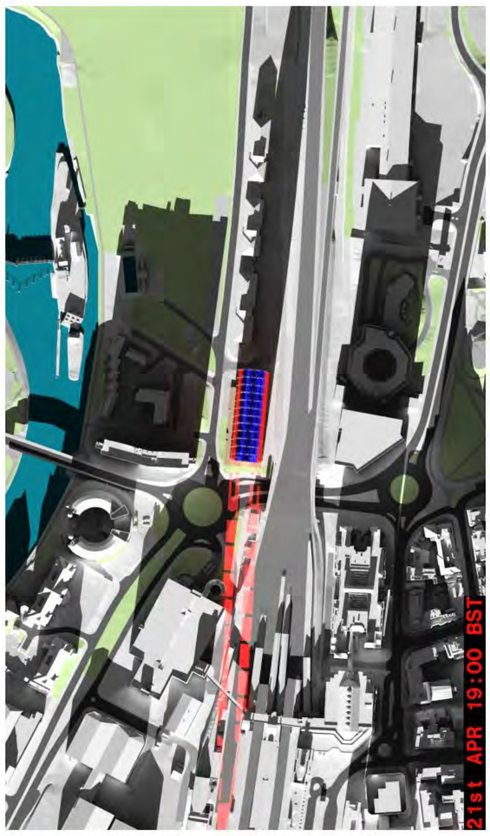

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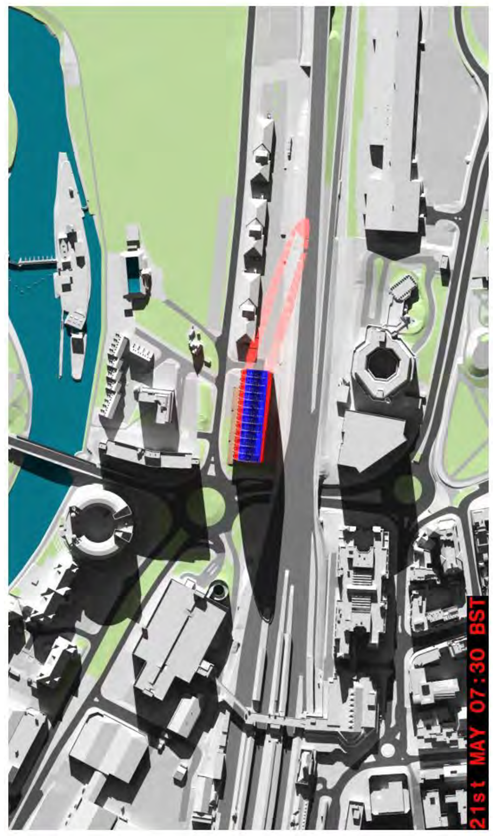

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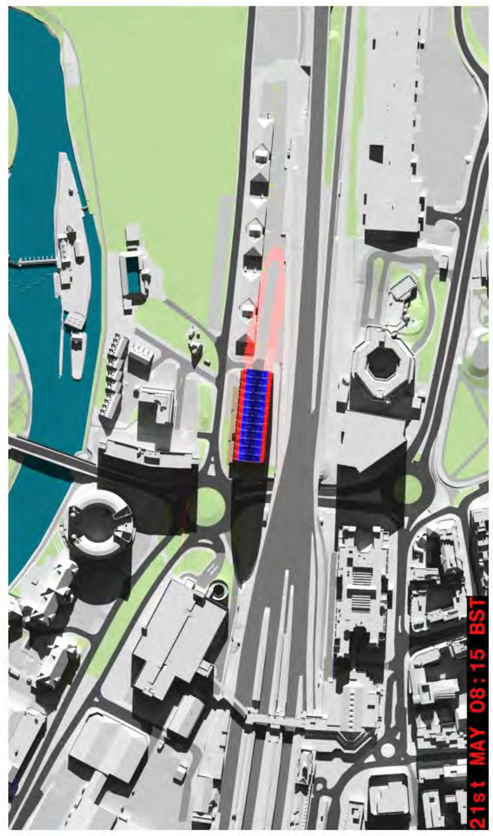

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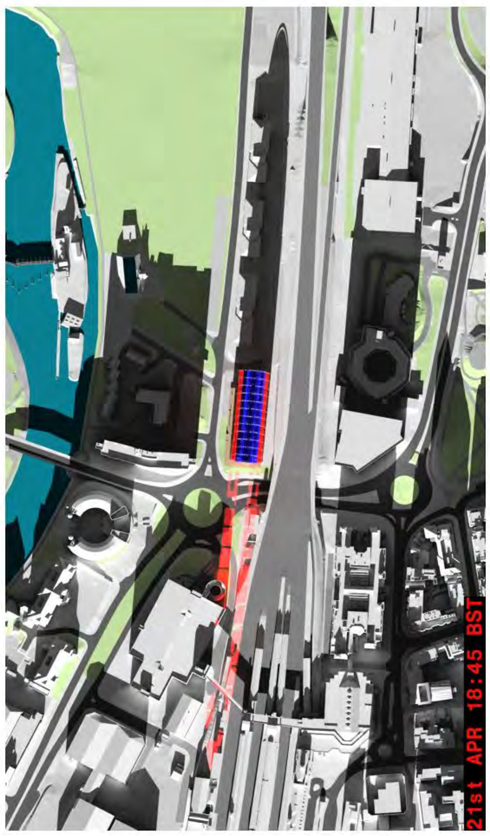

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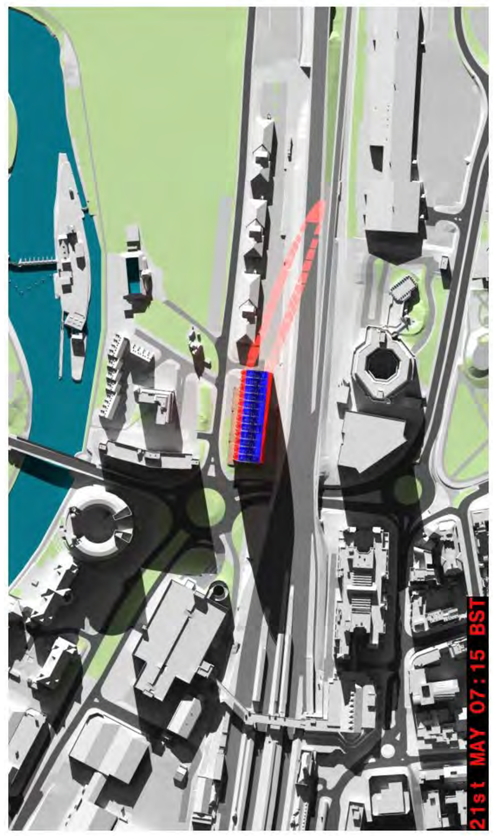

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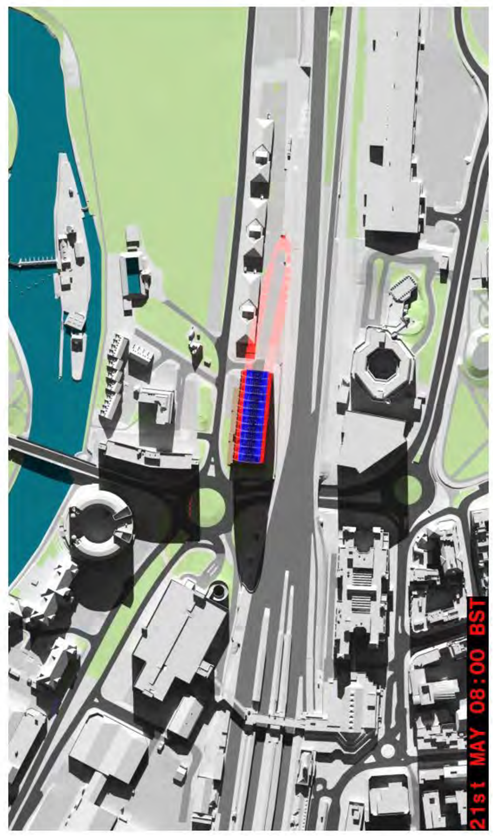

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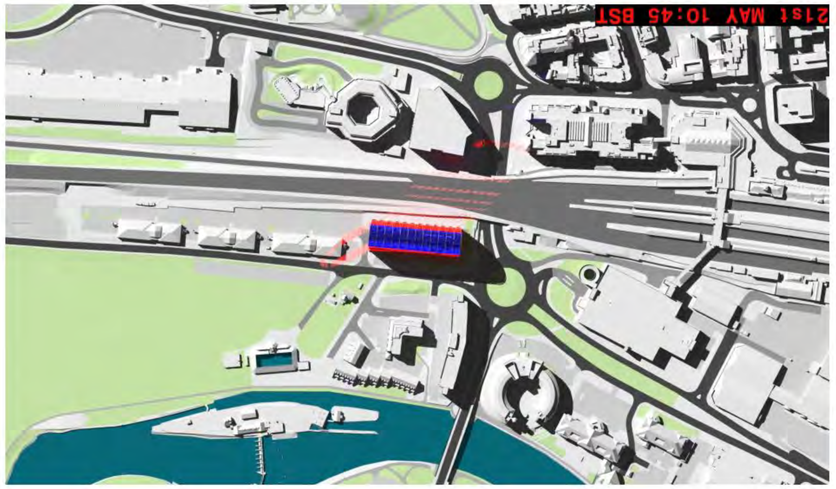

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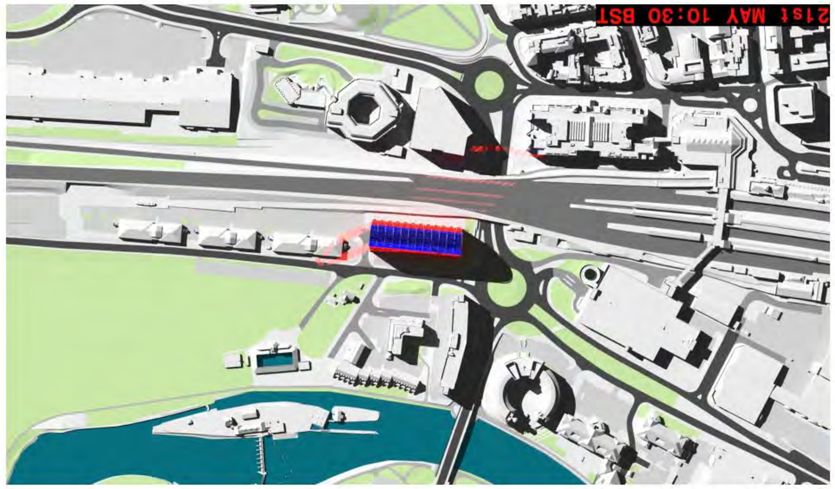

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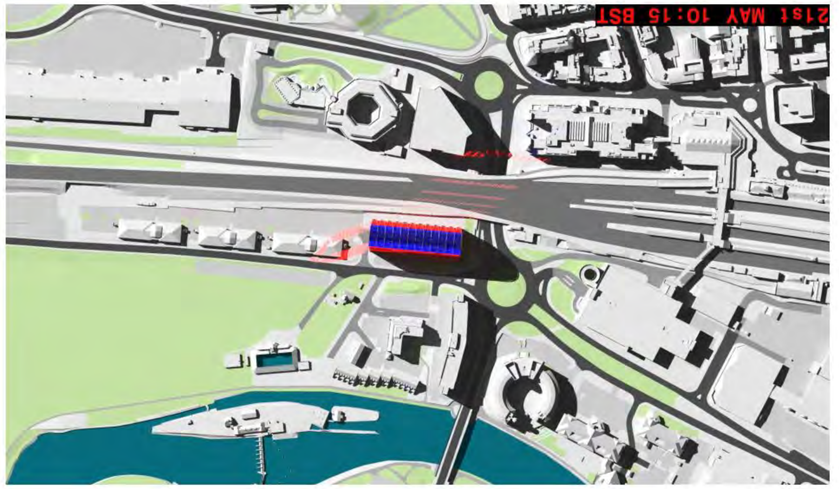

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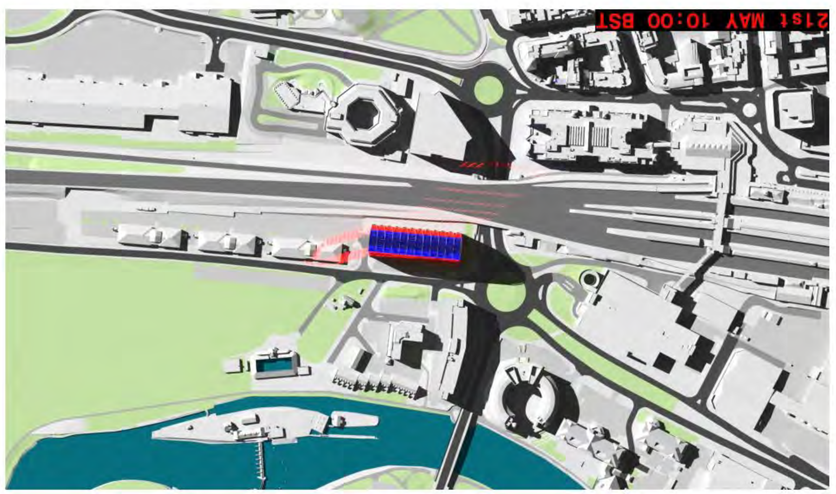

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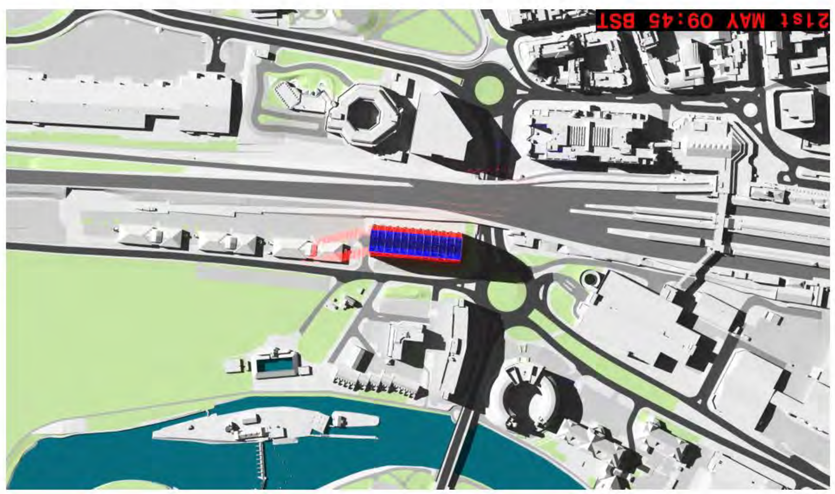

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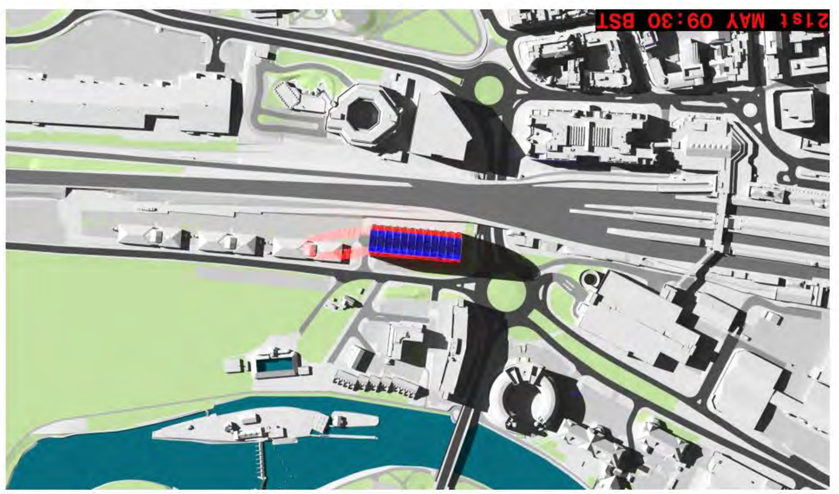

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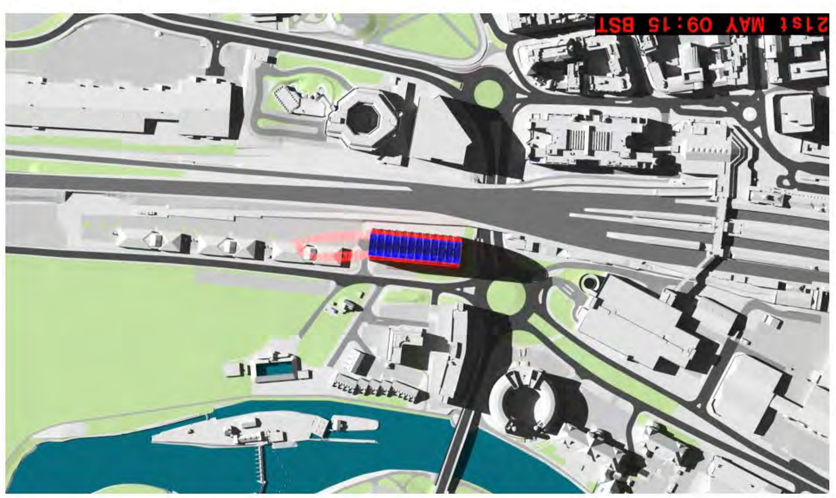

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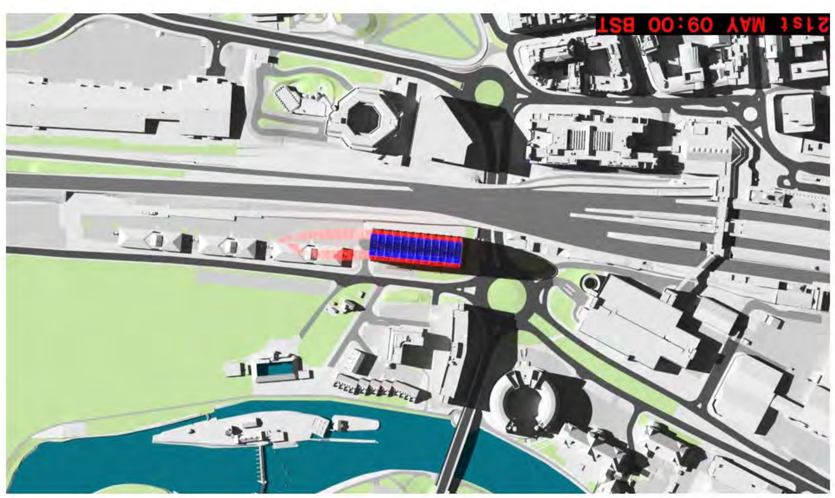

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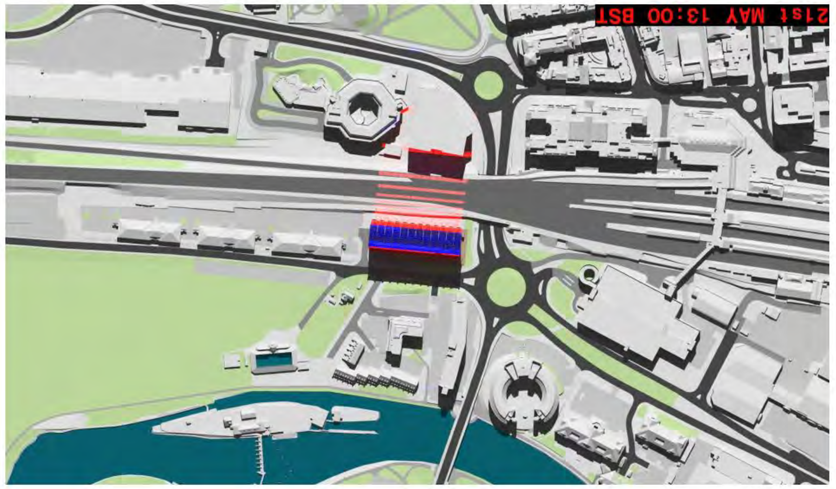

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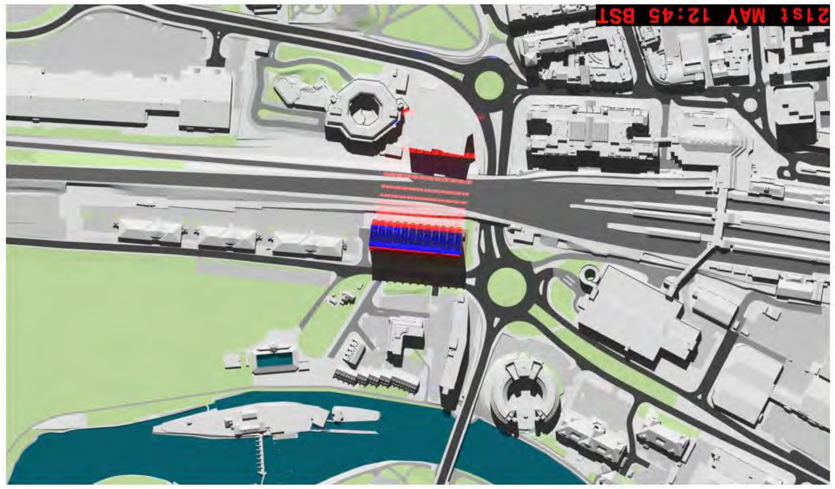

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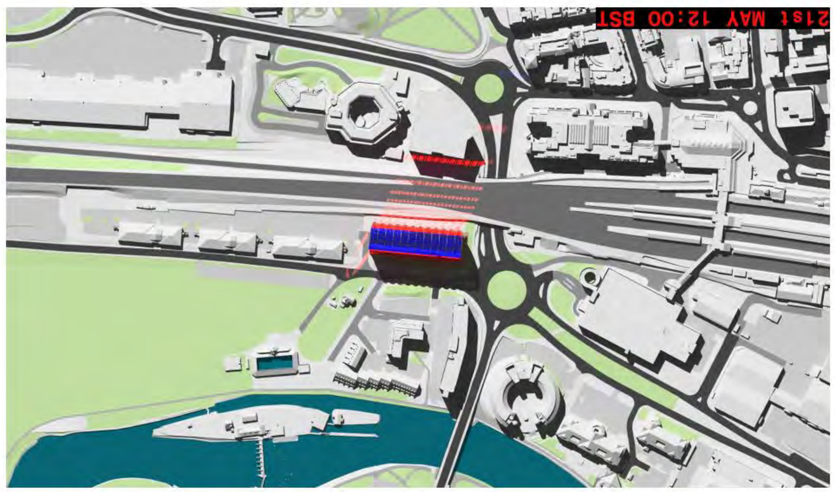

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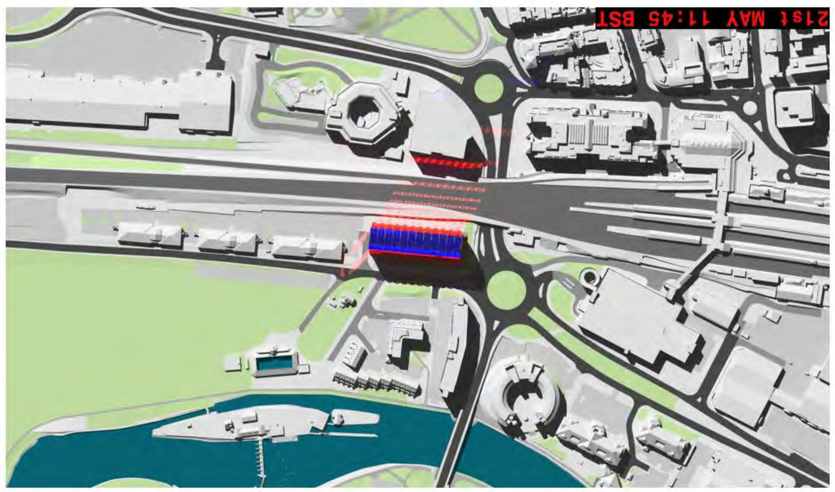

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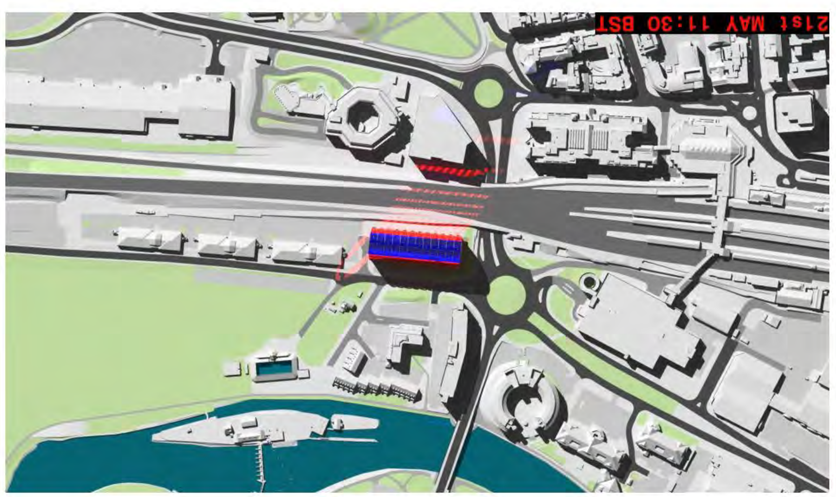

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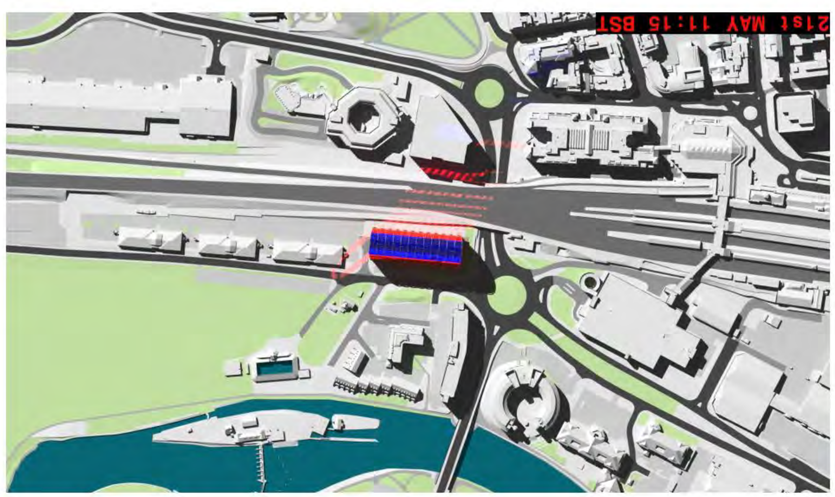

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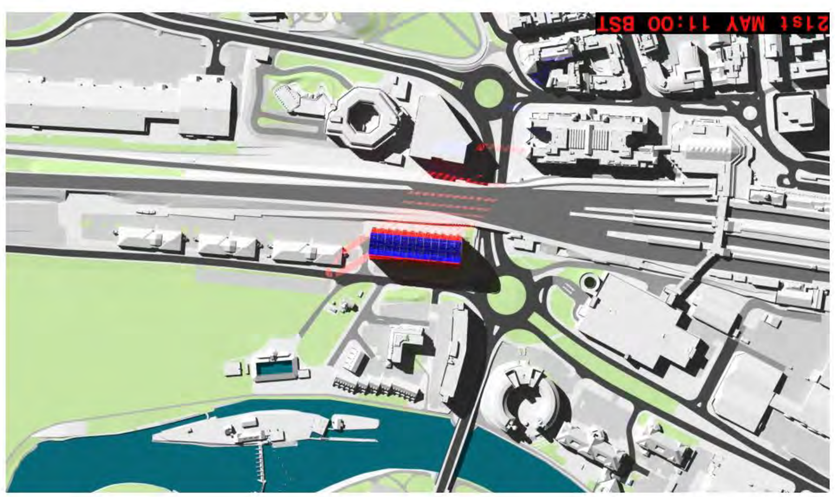

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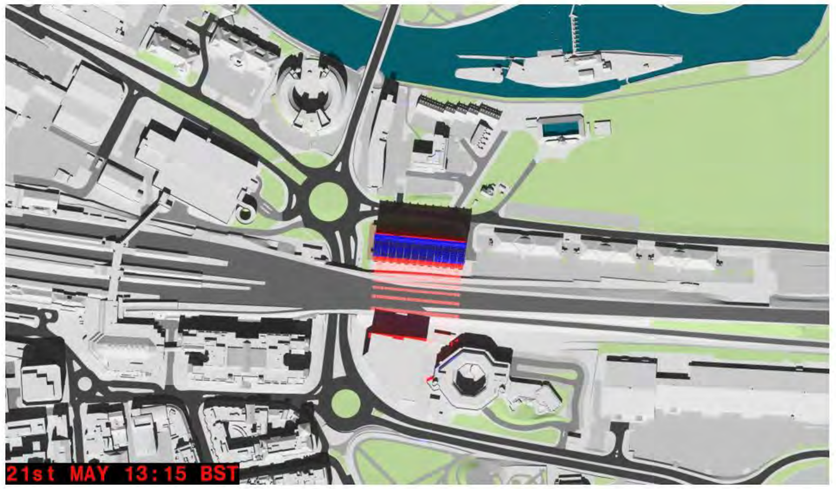

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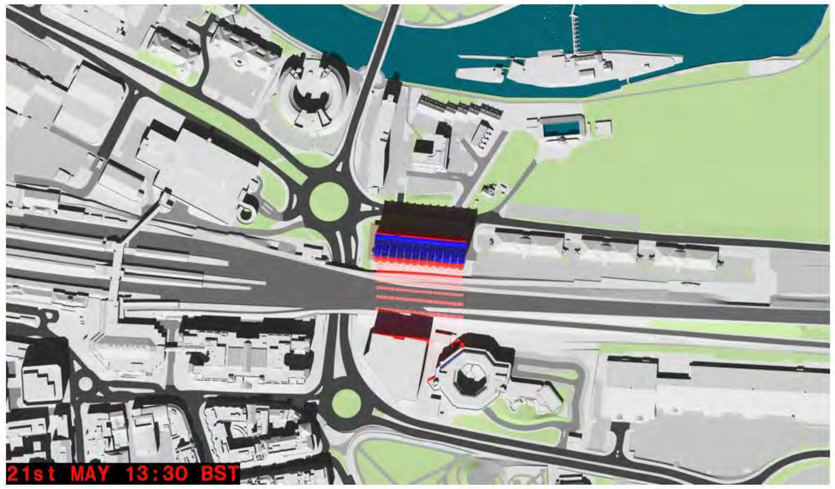

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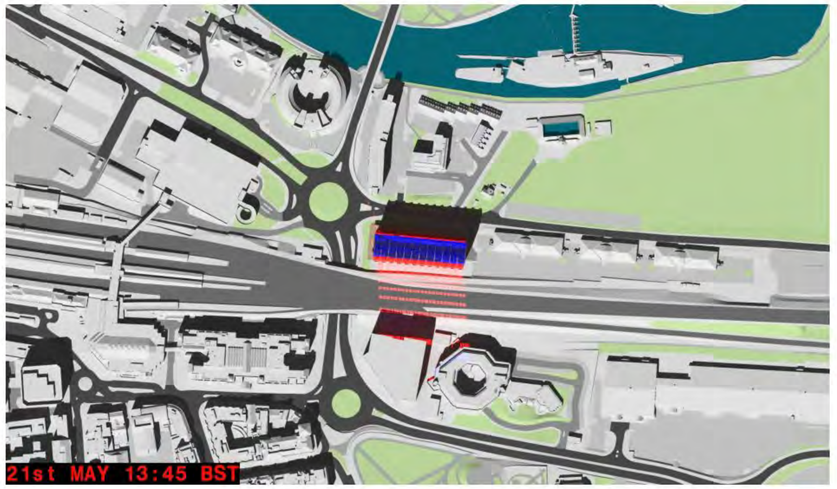

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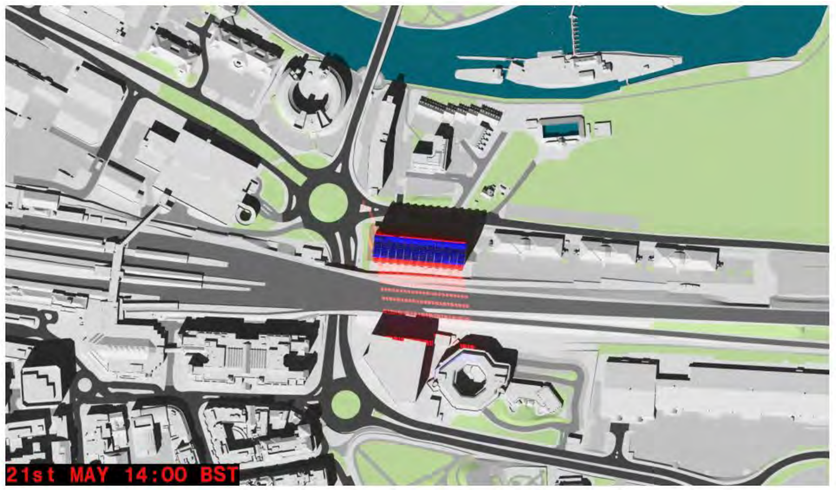

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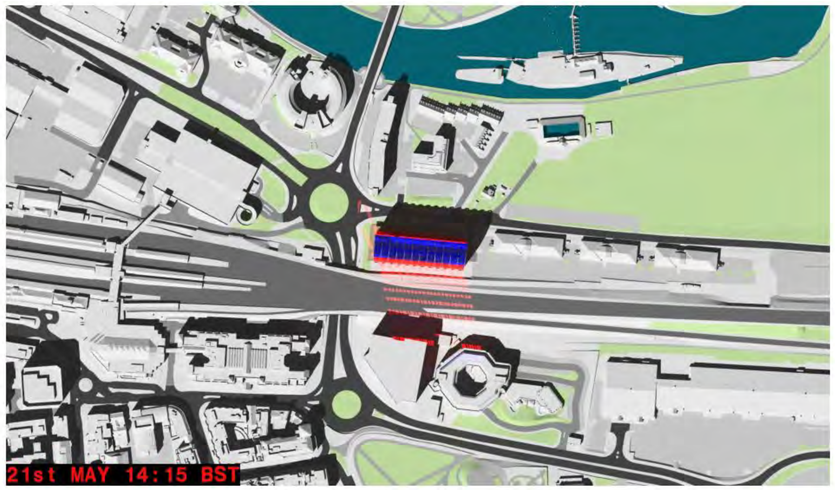

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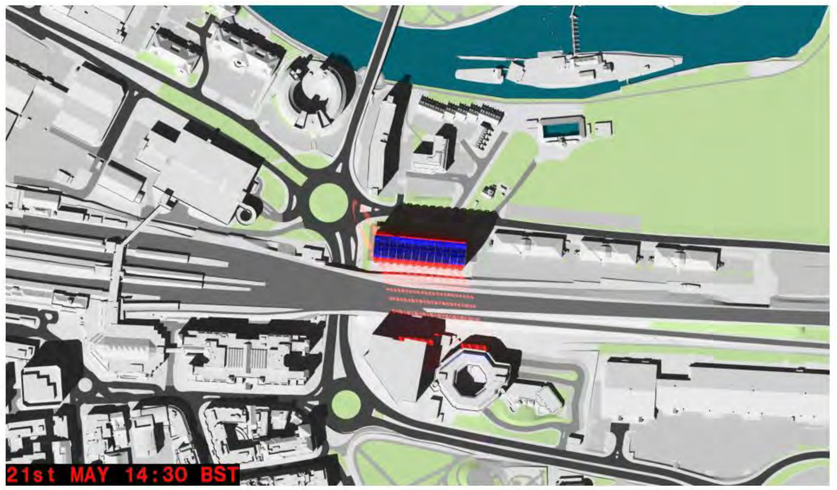

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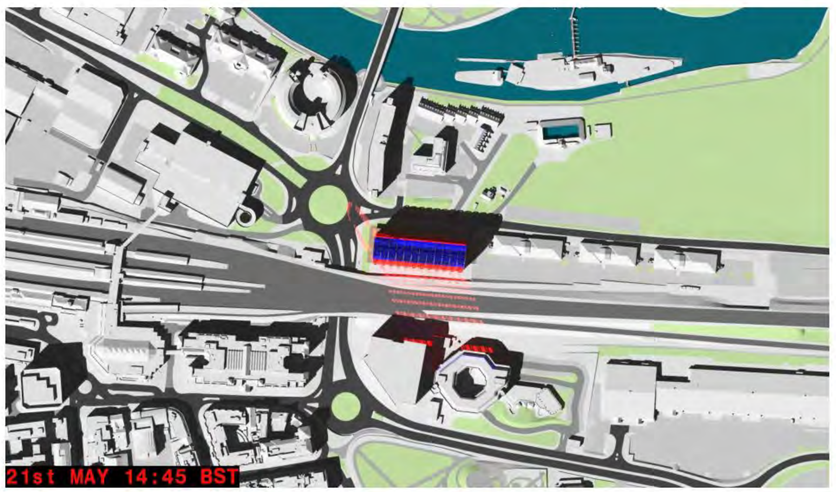

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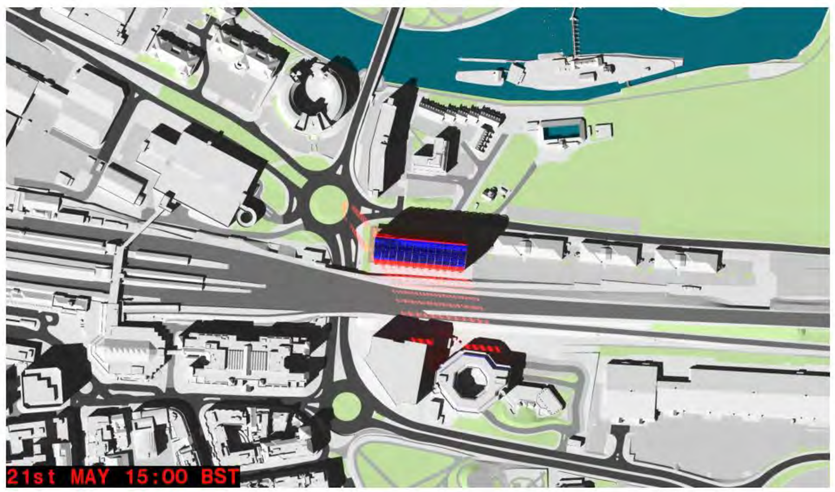

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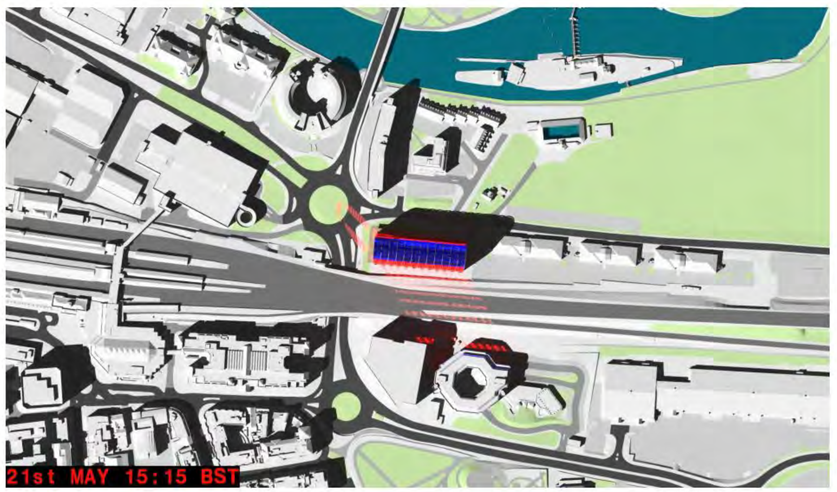

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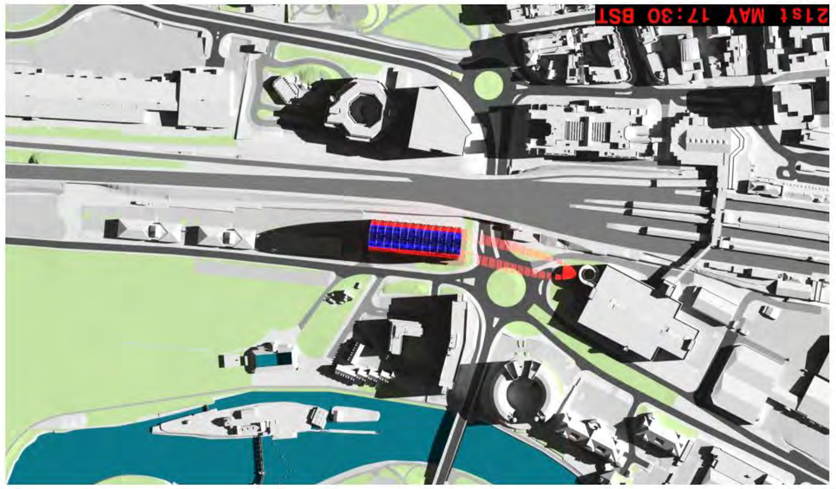

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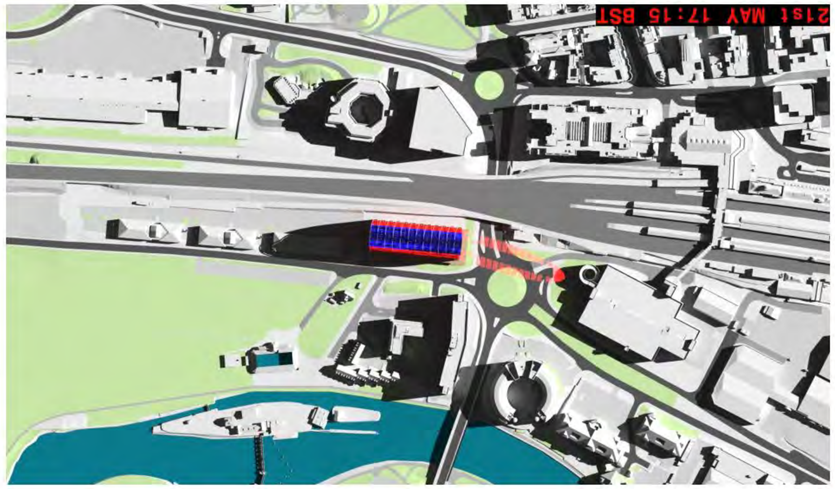

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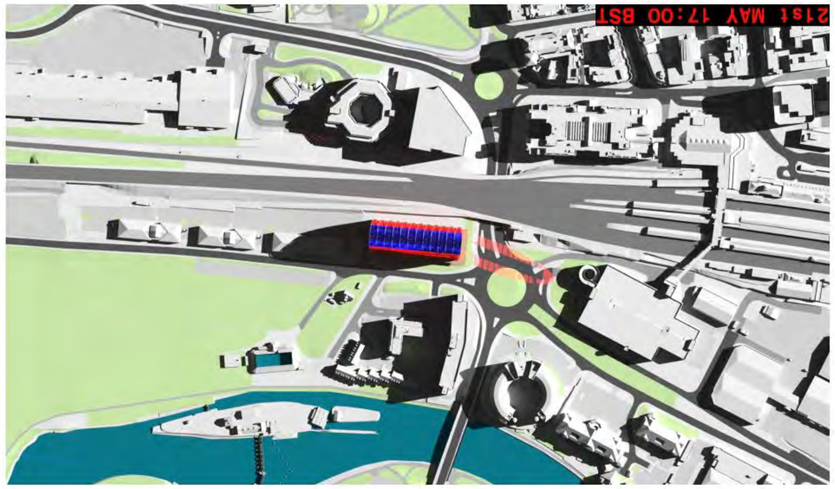

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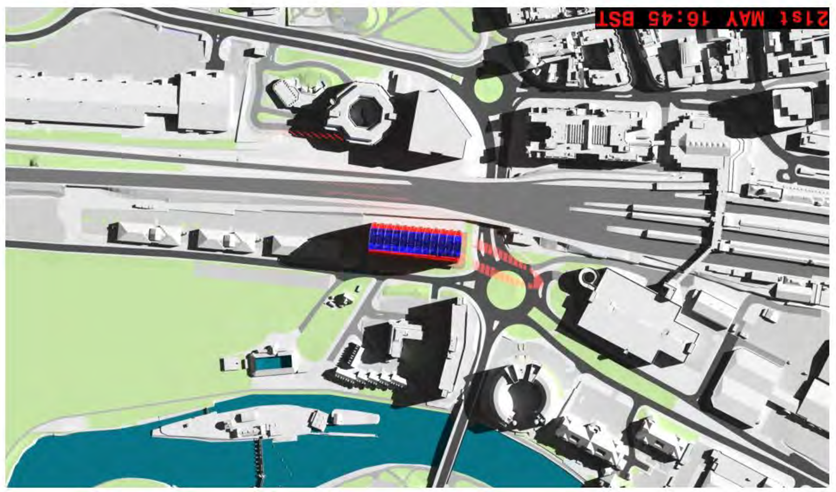

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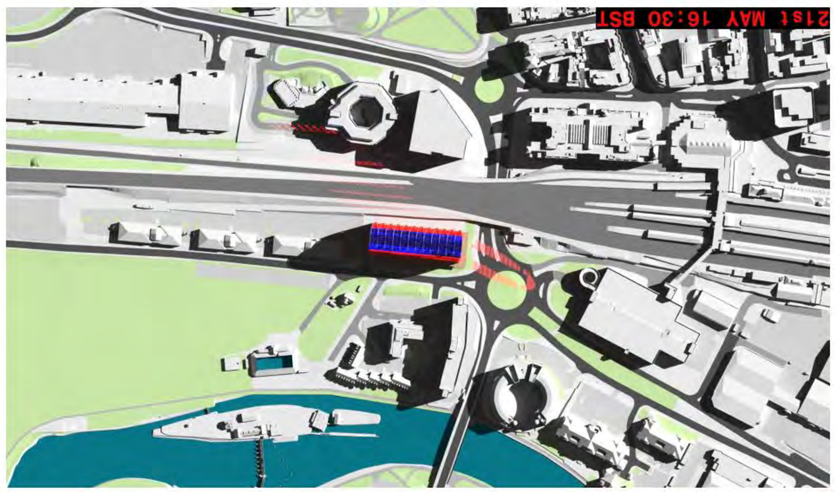

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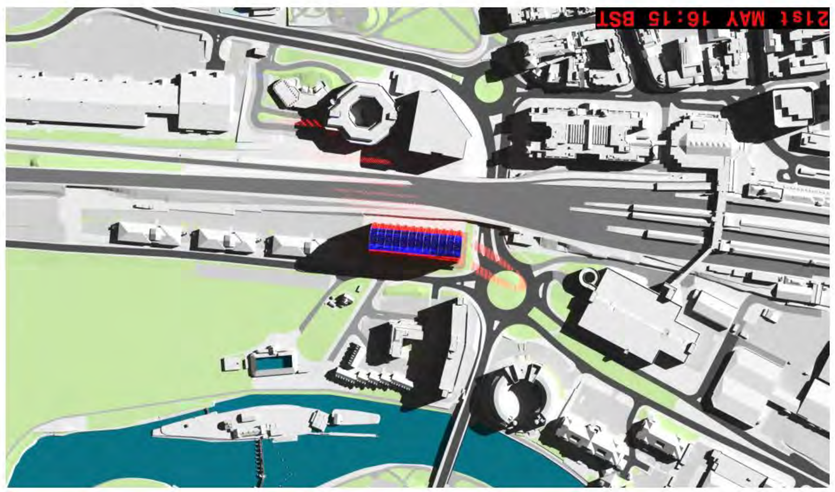

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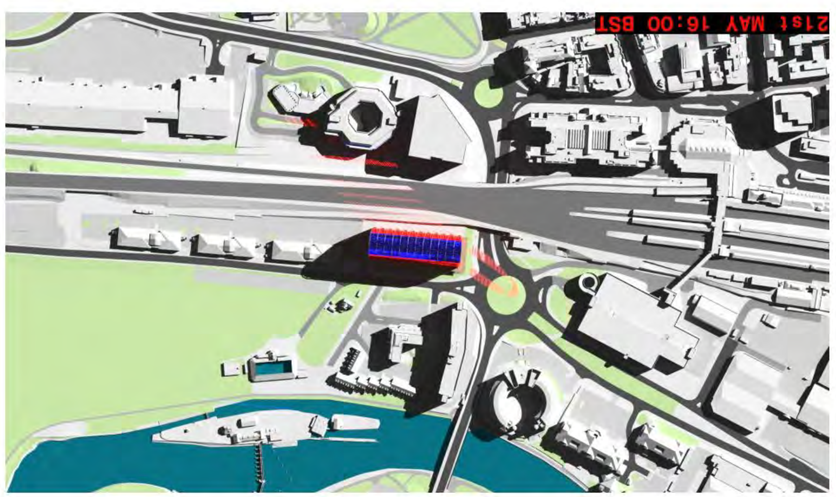

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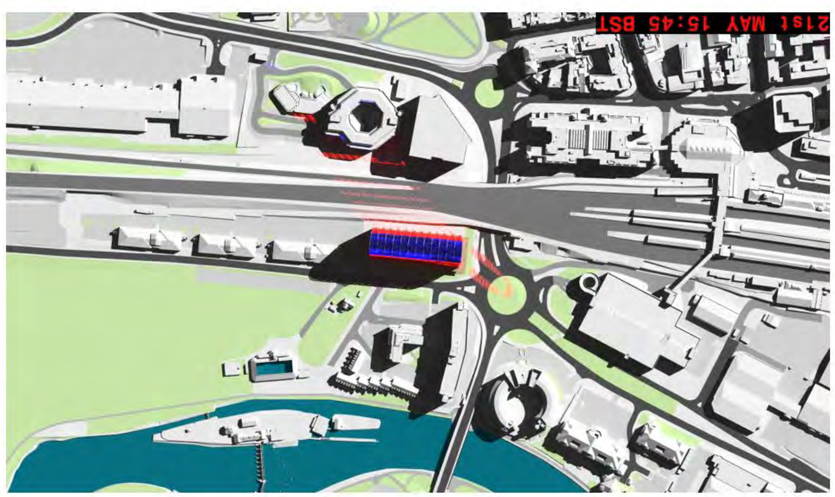

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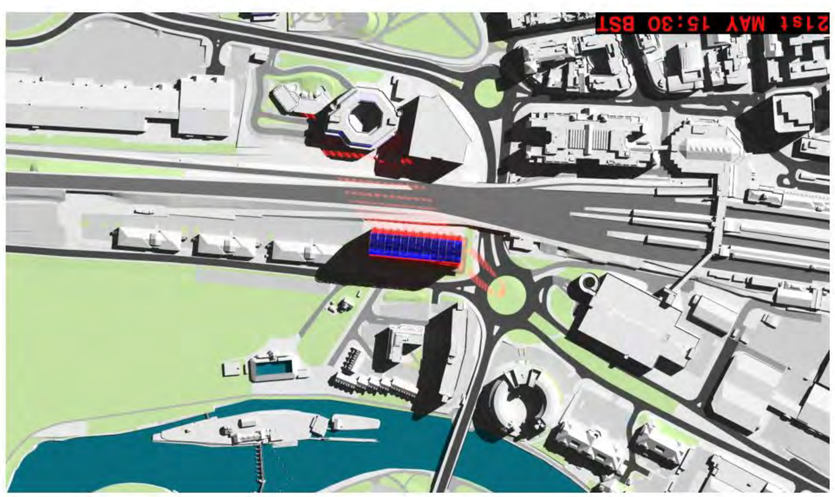

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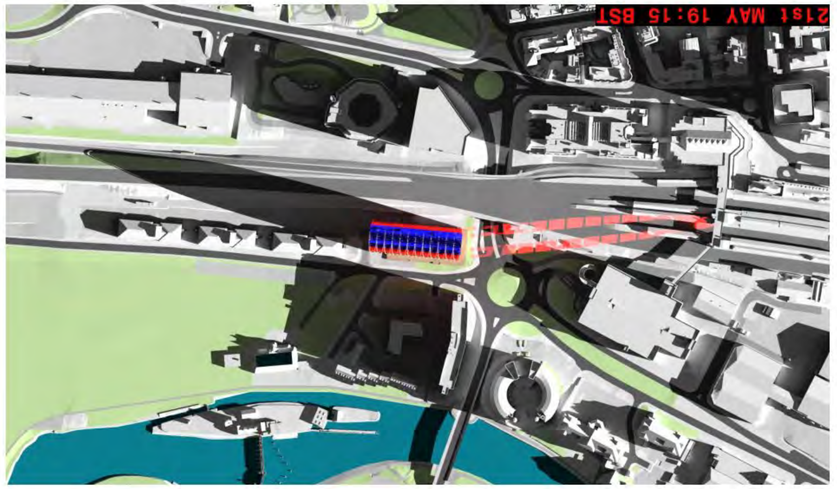

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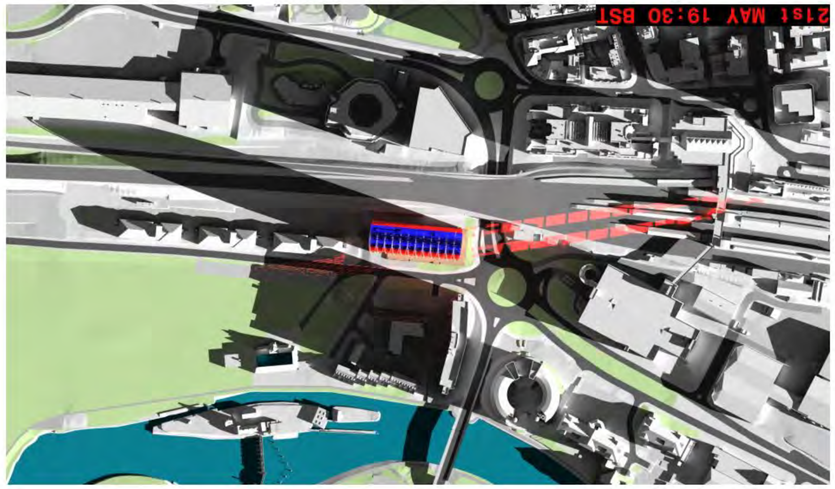

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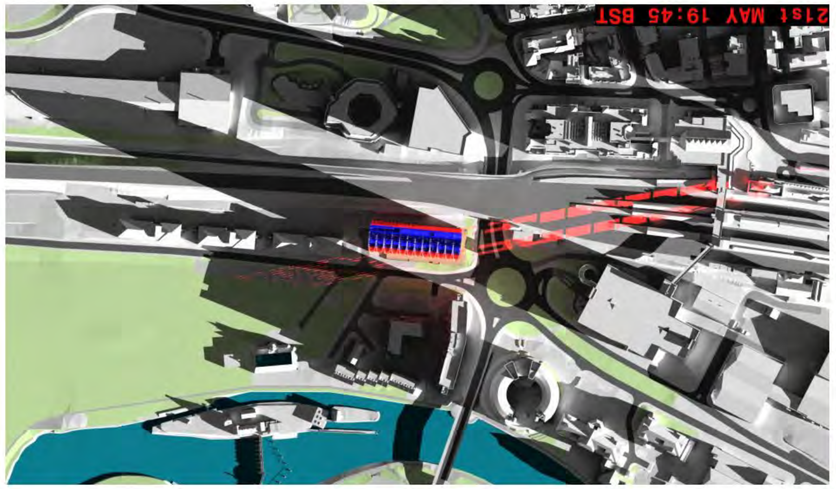

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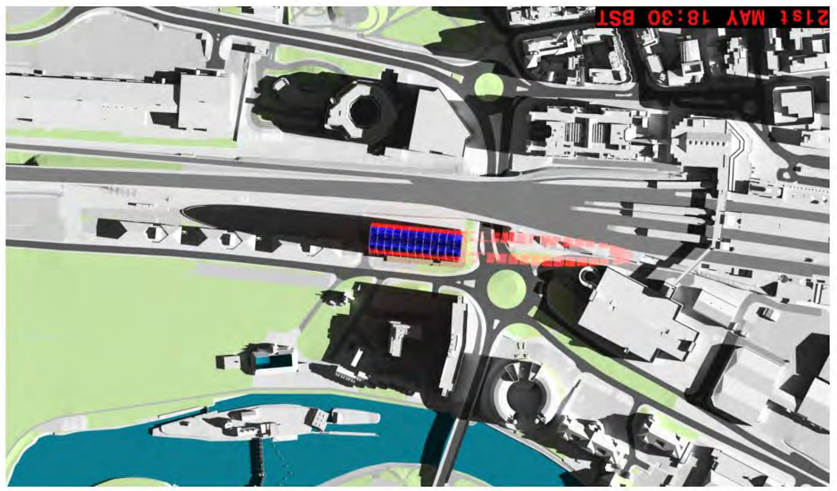

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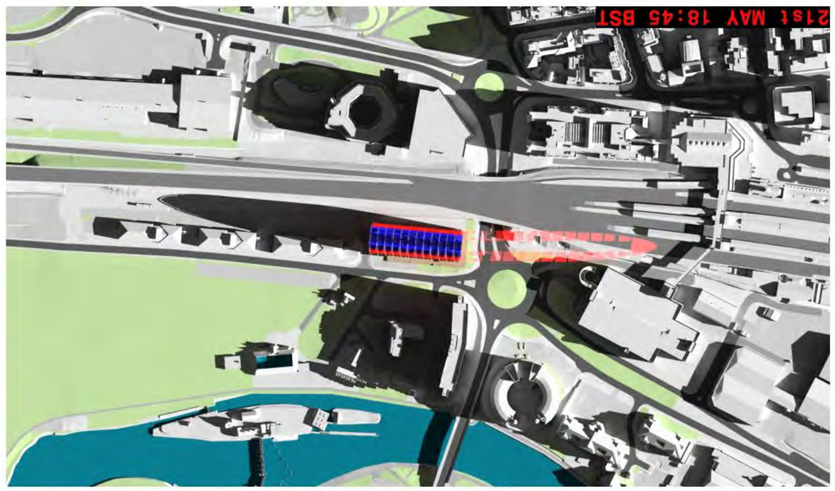

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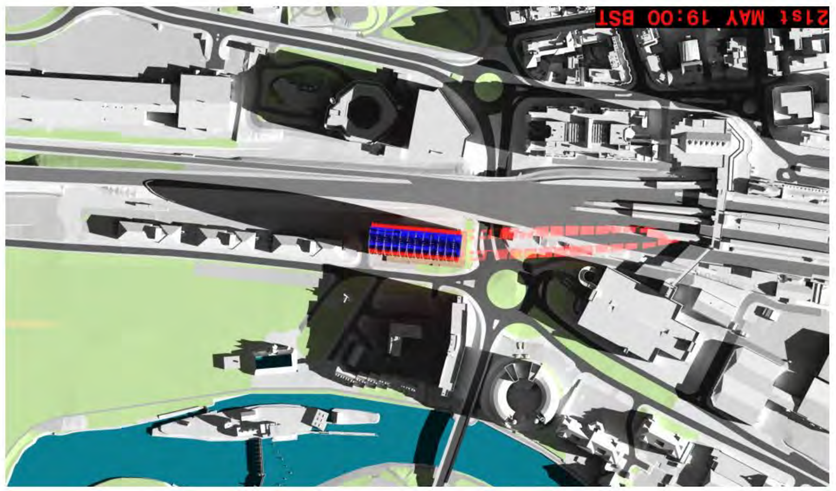

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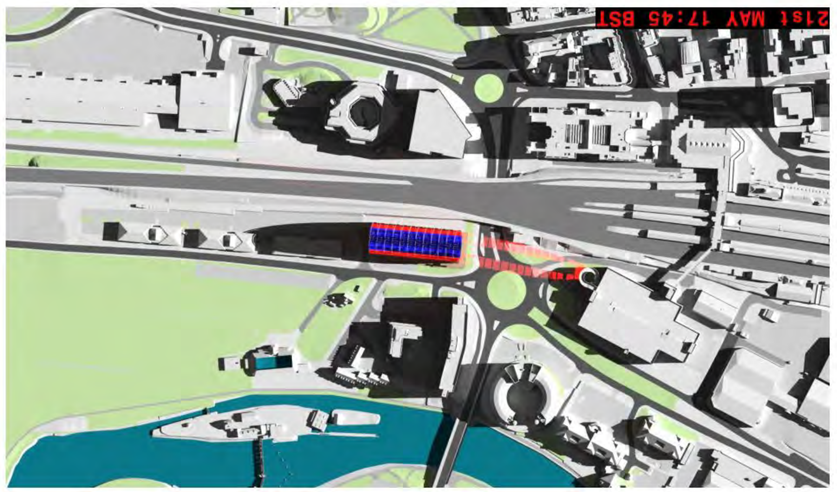

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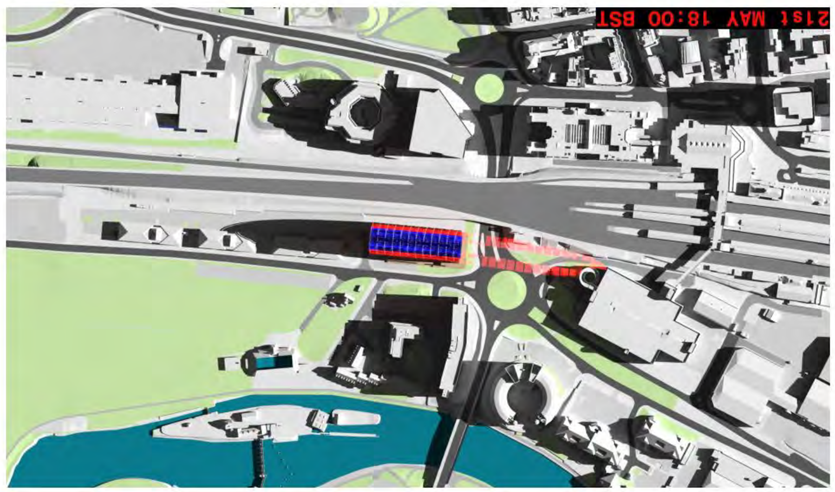

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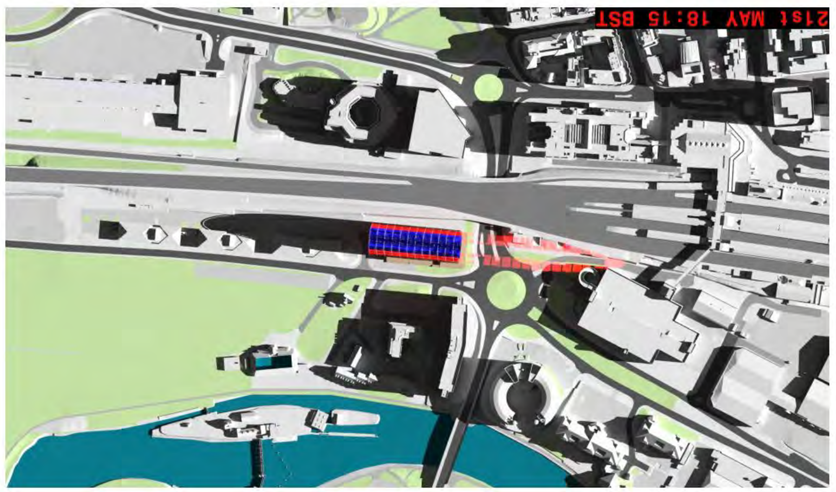

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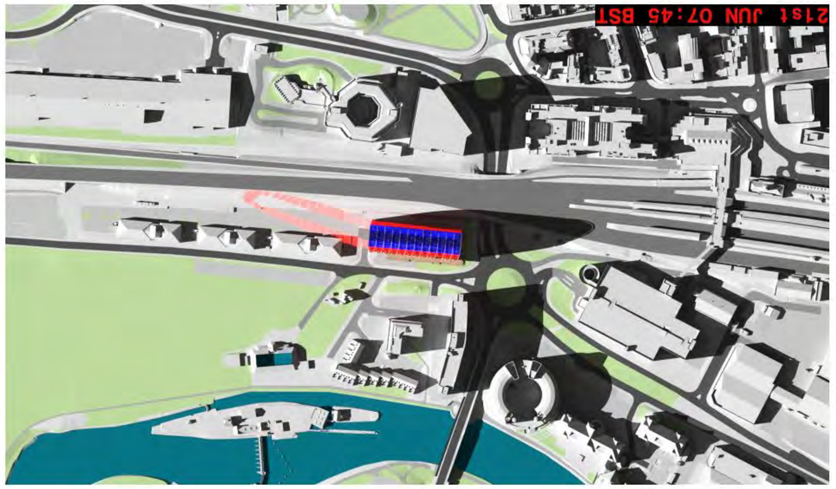

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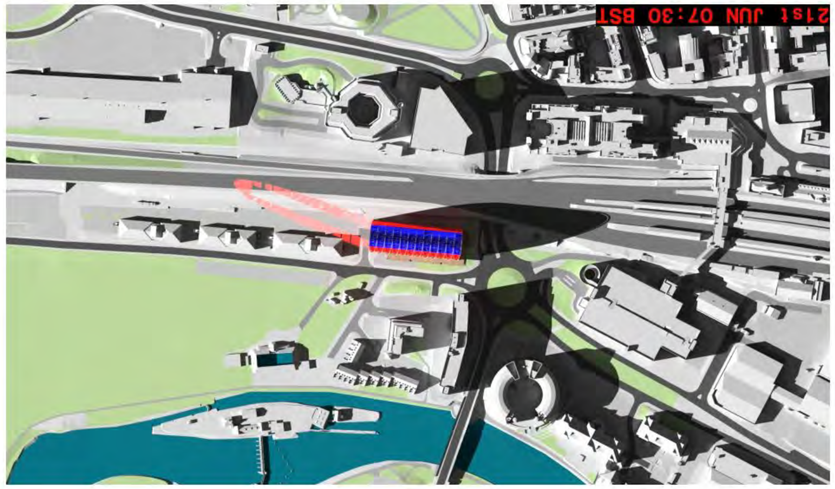

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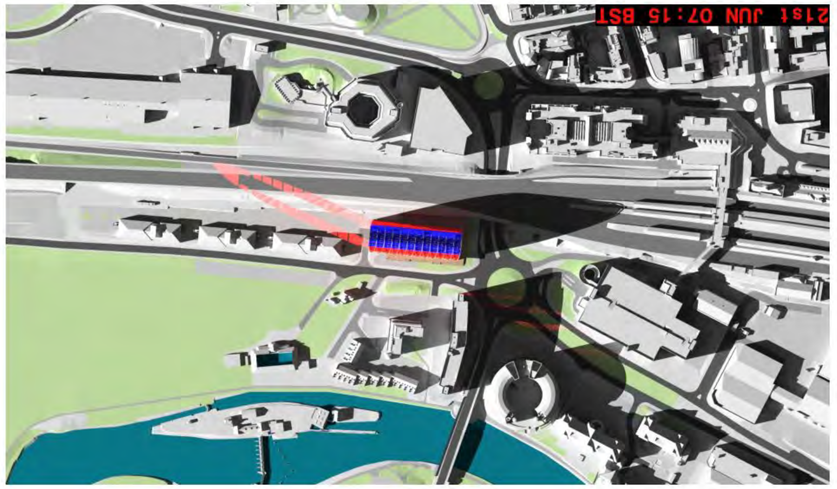

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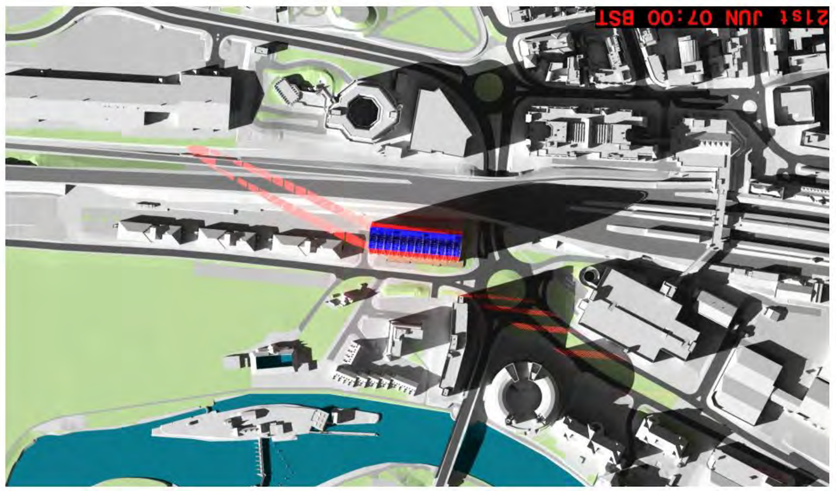

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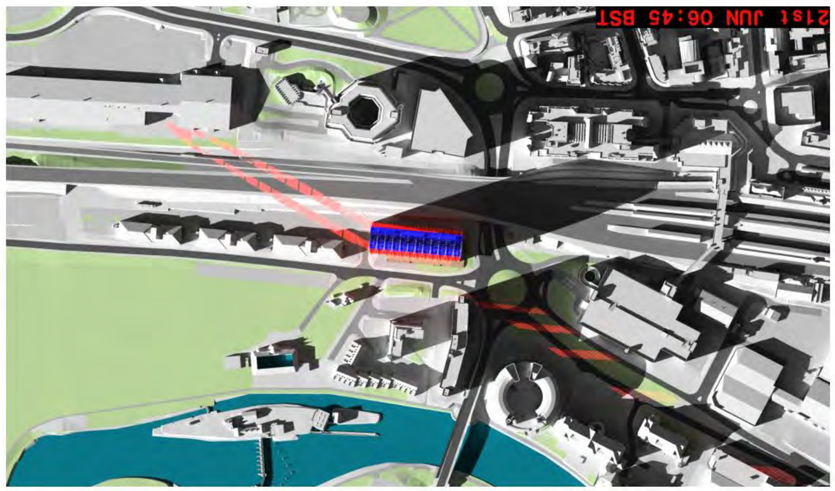

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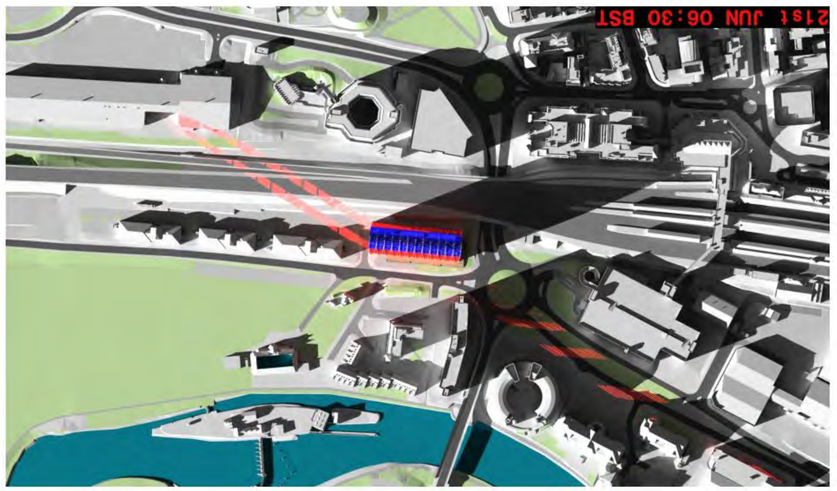

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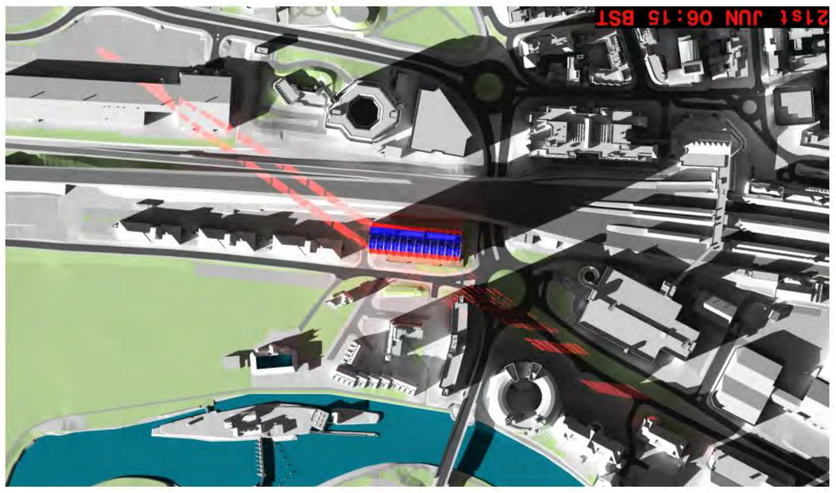

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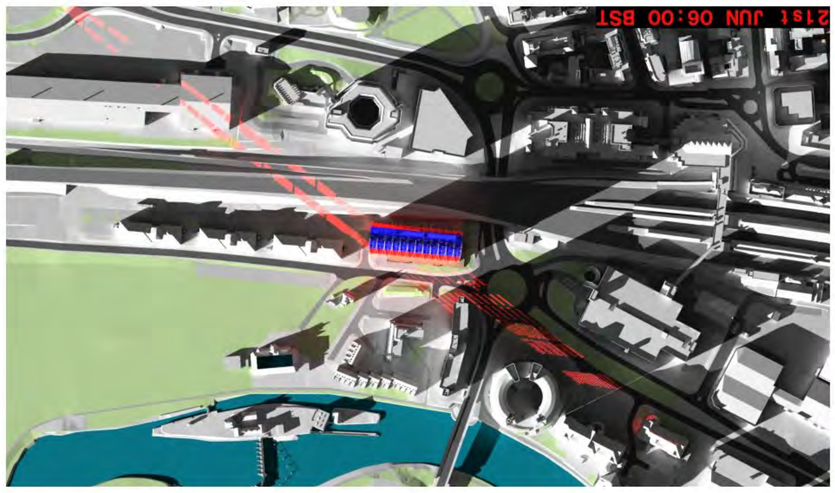

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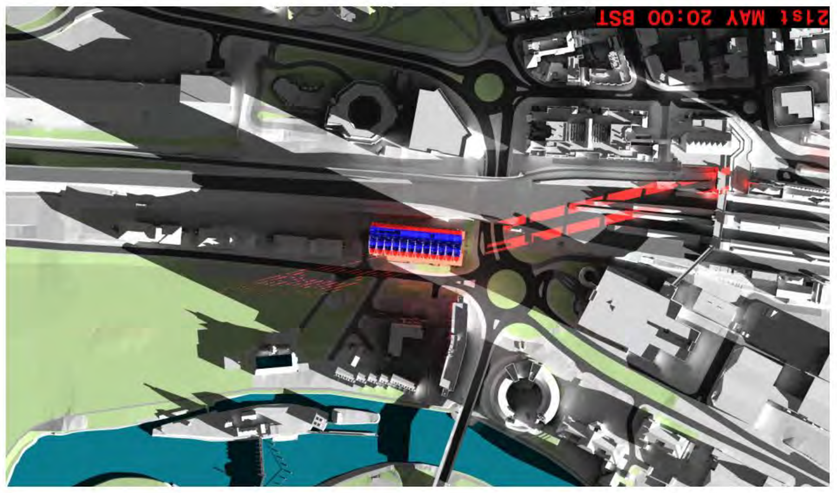

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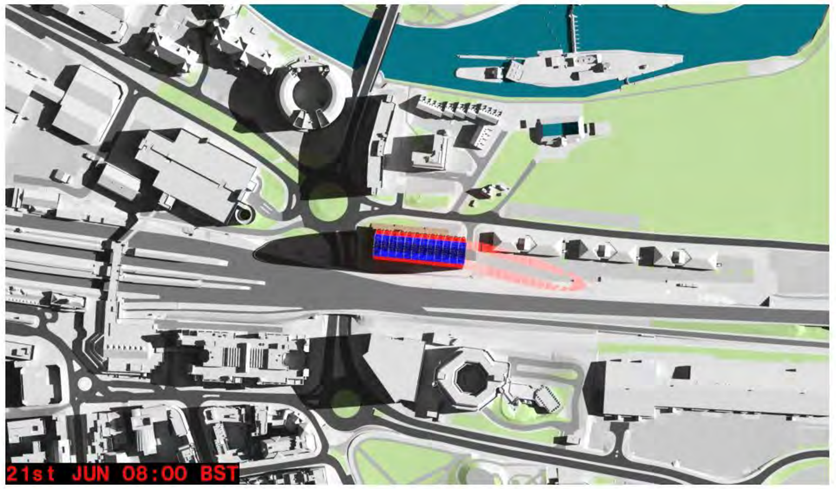

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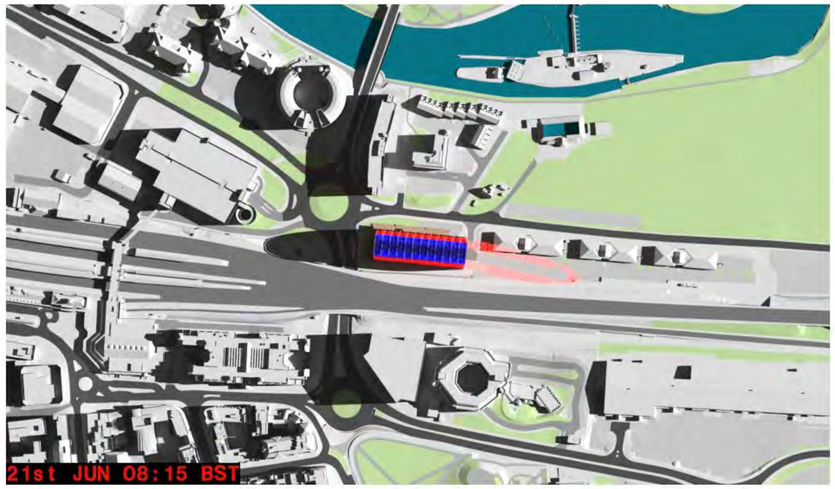

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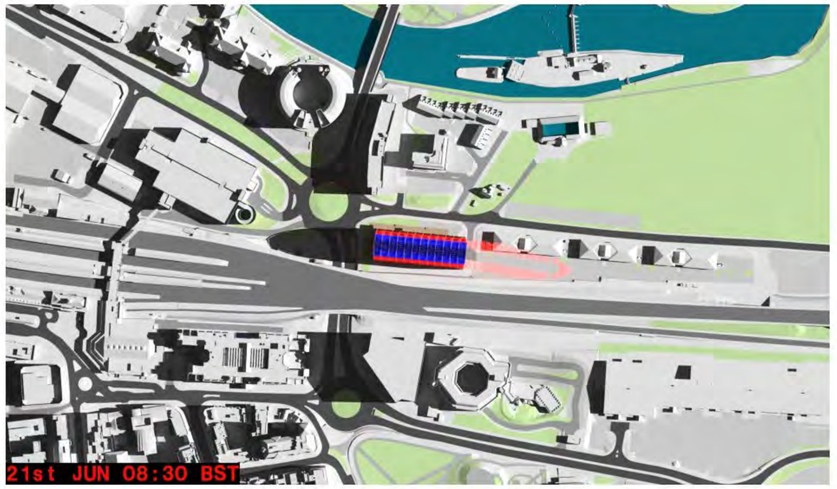

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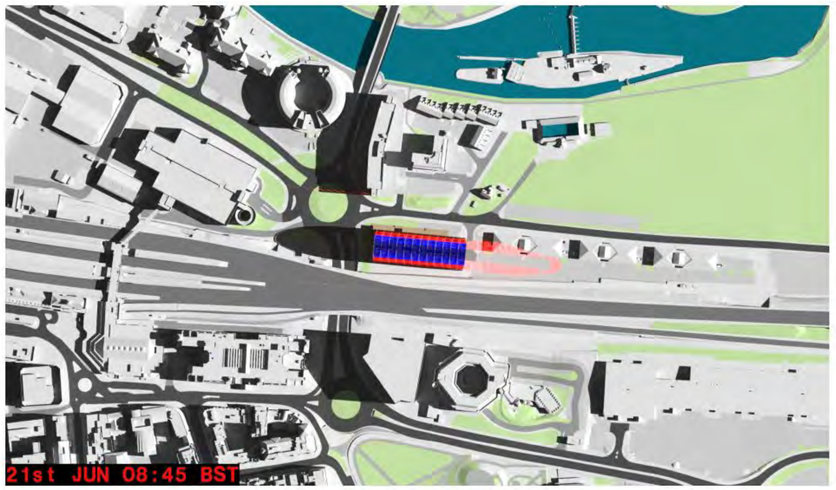

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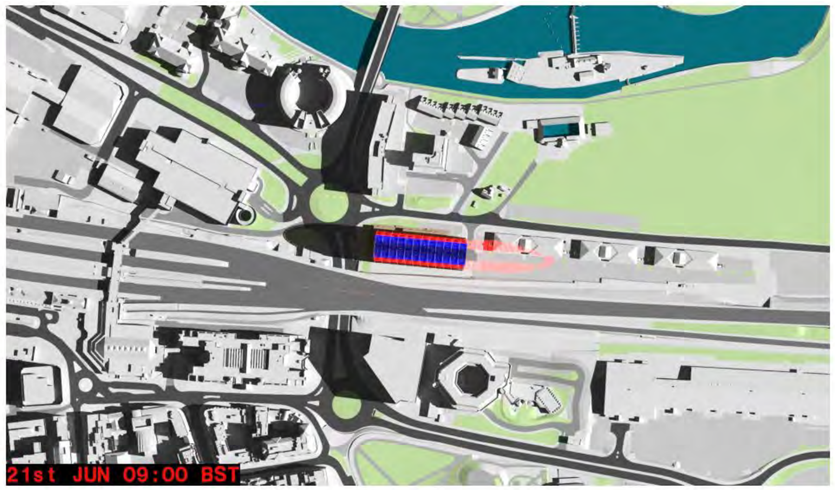

21st MAY 20:00 BST


21st JUN 08:00 BST

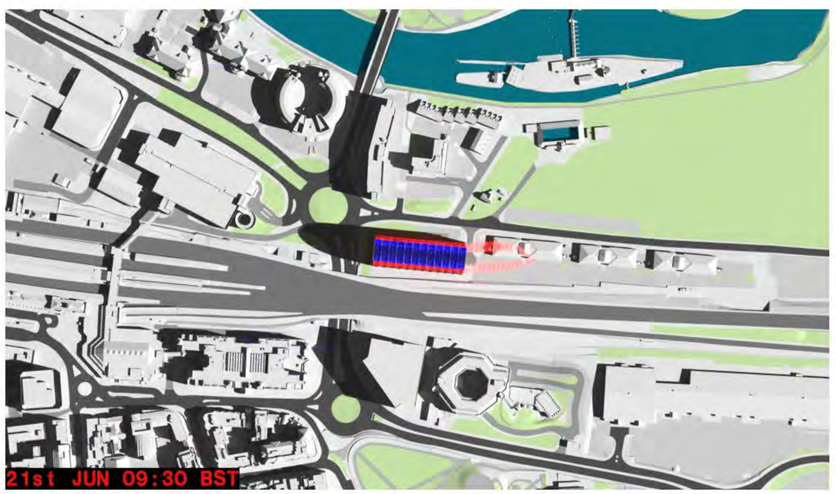

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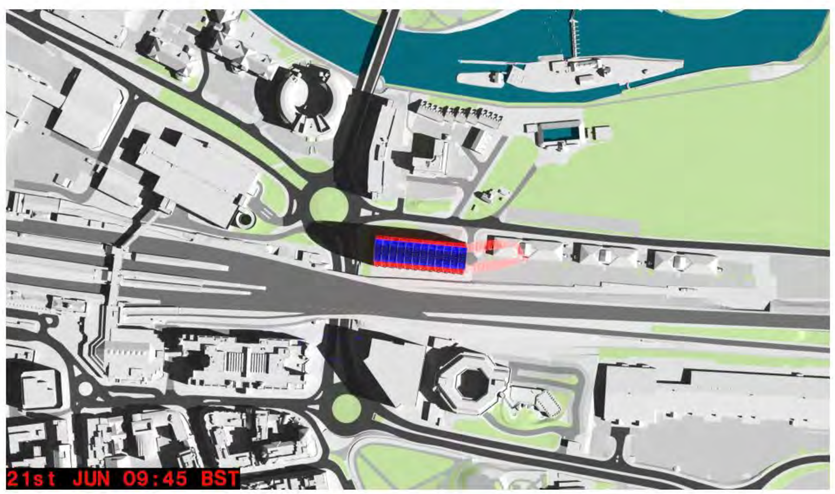

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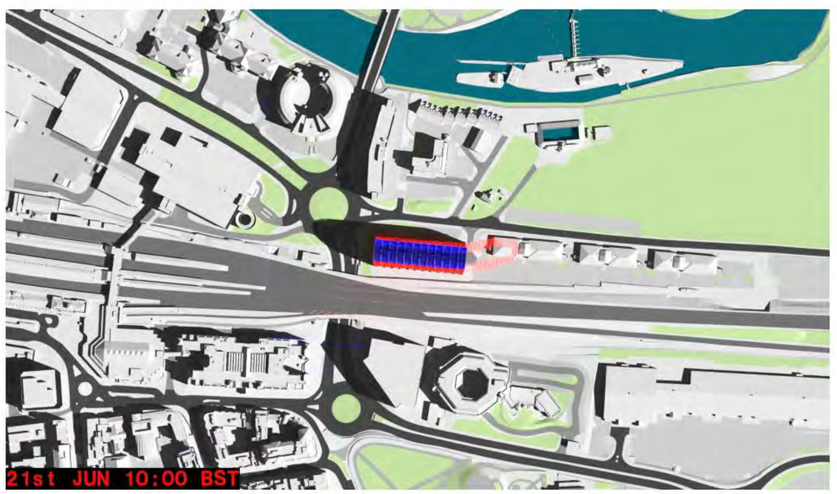

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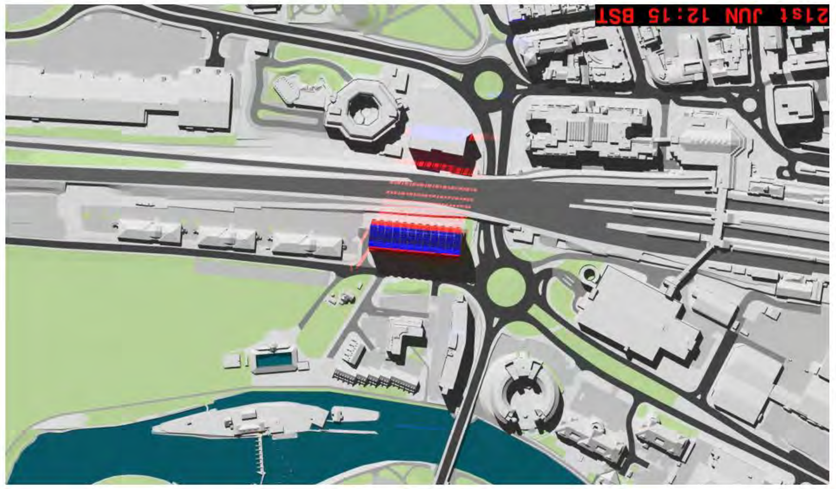

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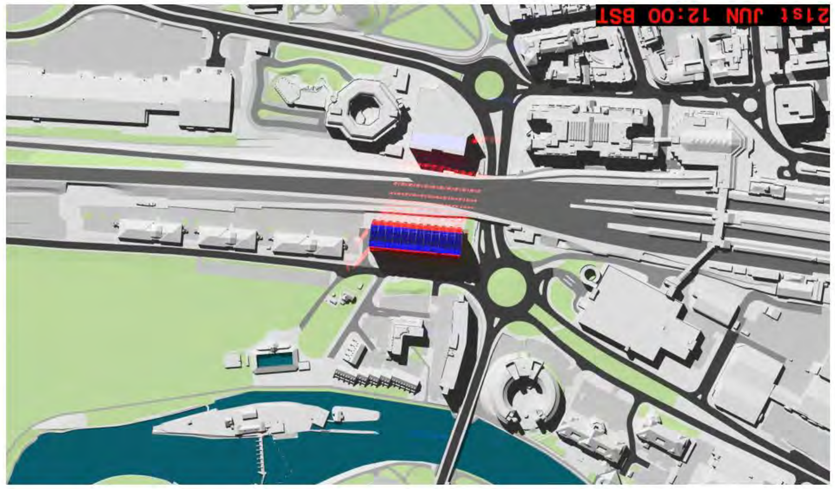

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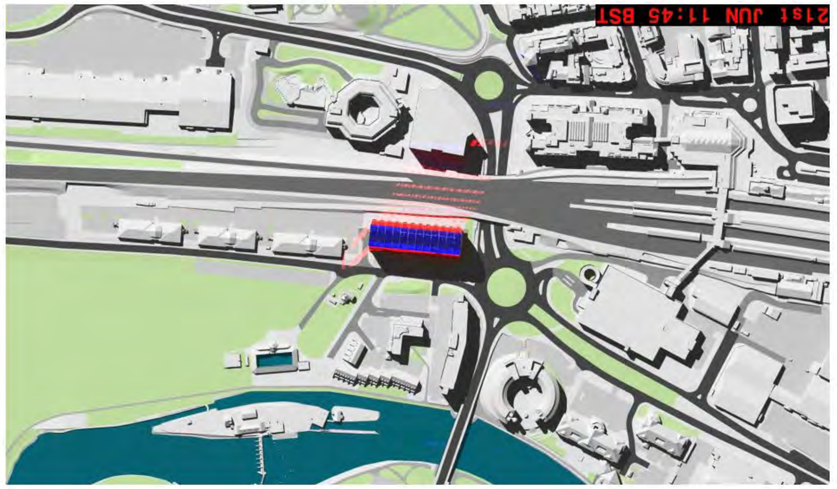

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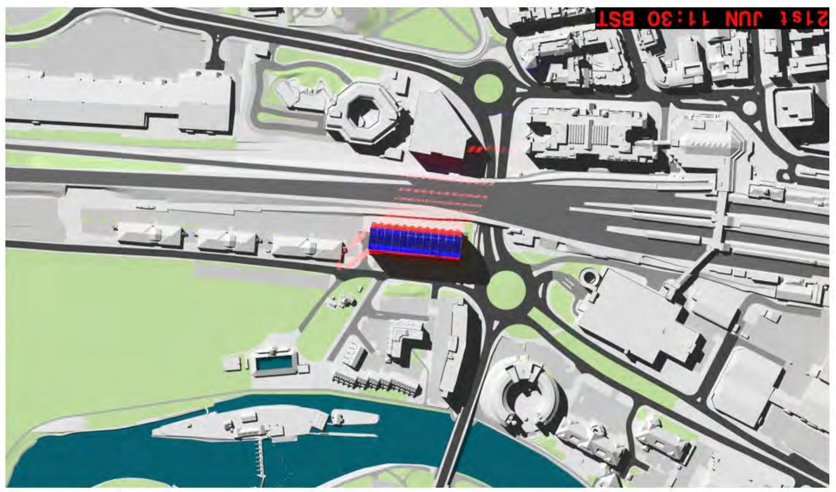

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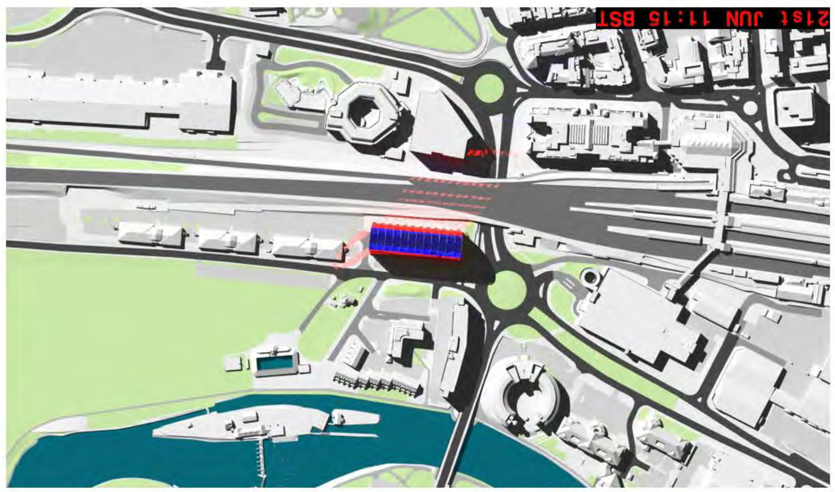

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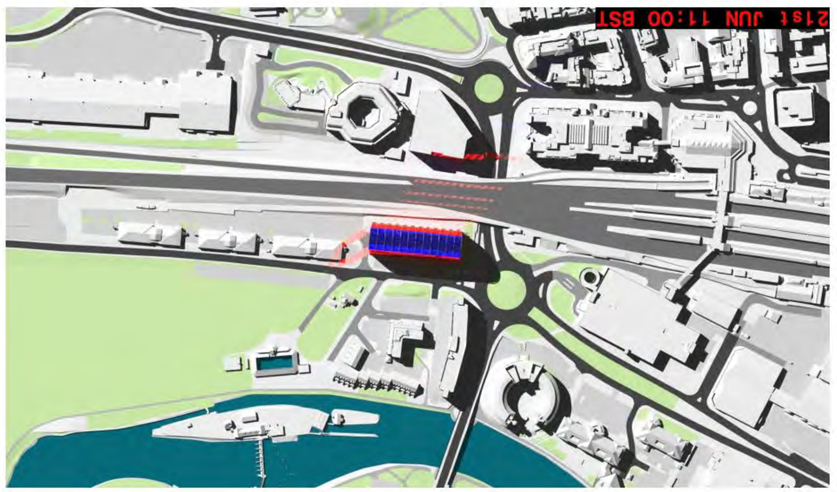

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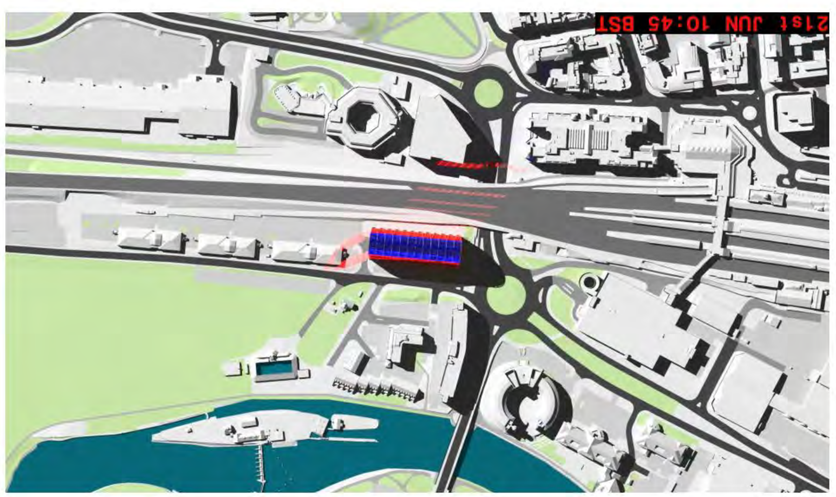

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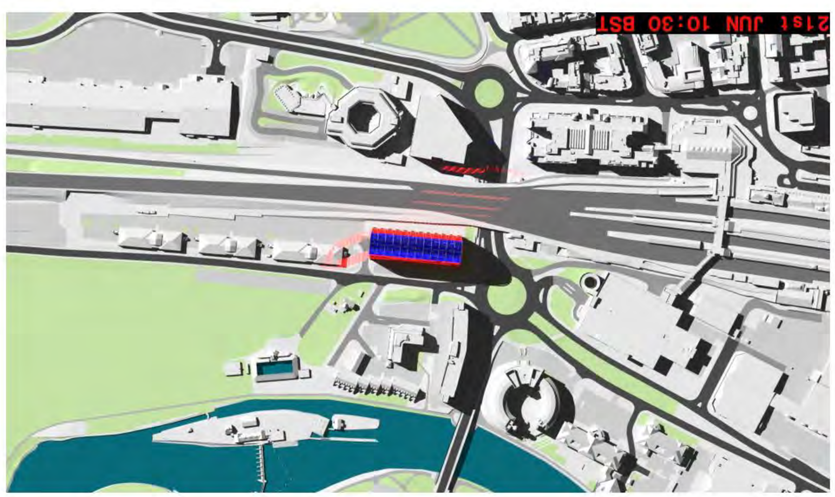

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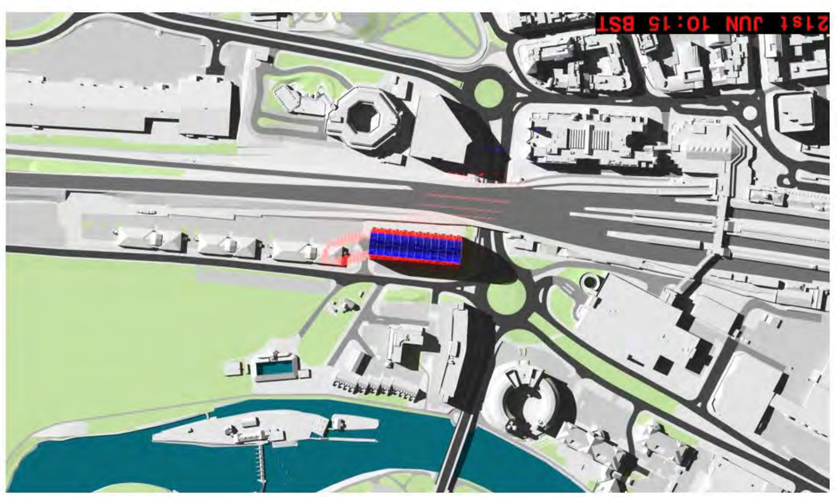

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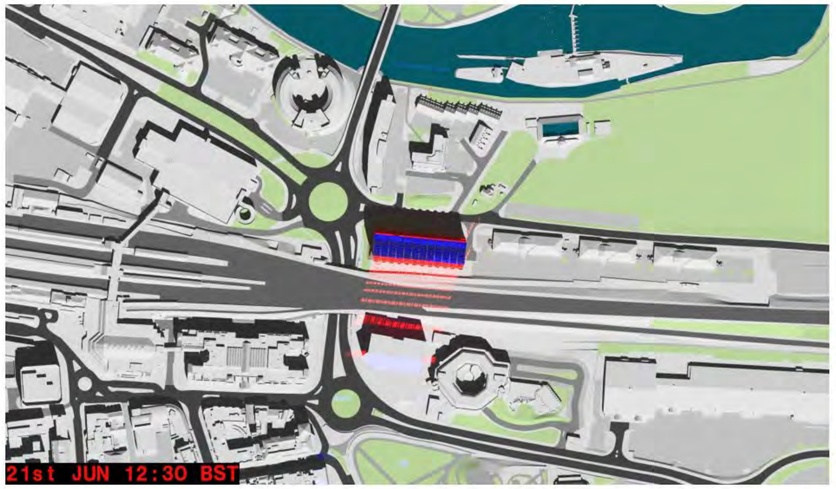

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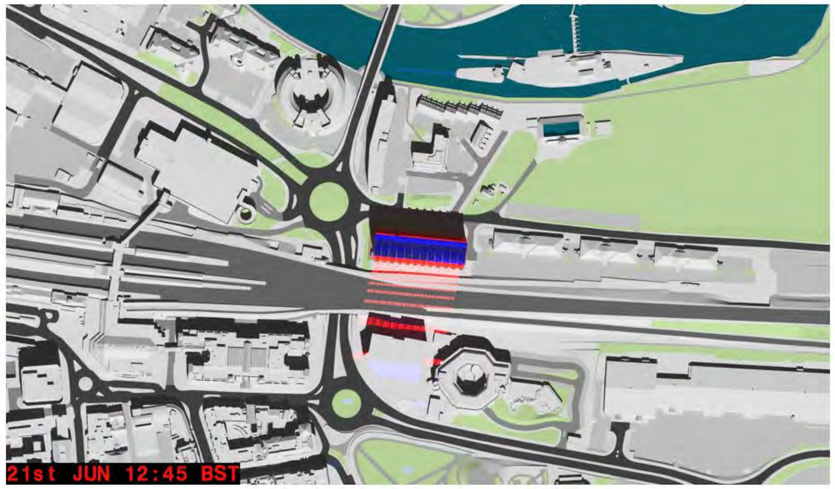

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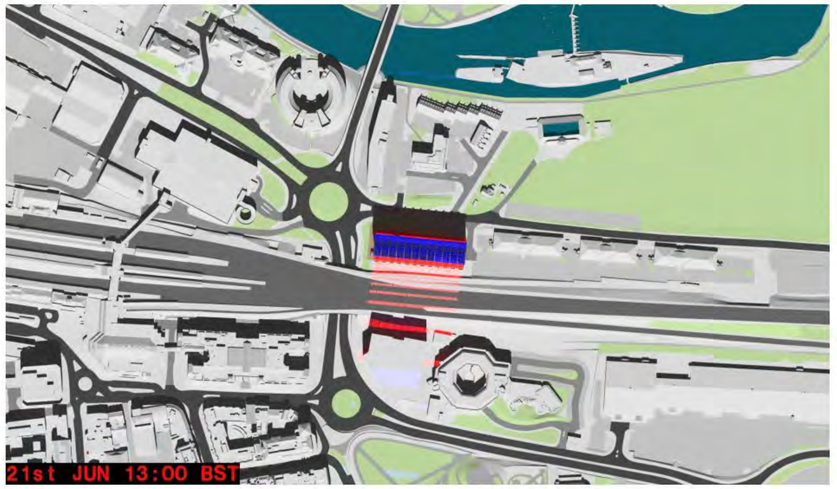

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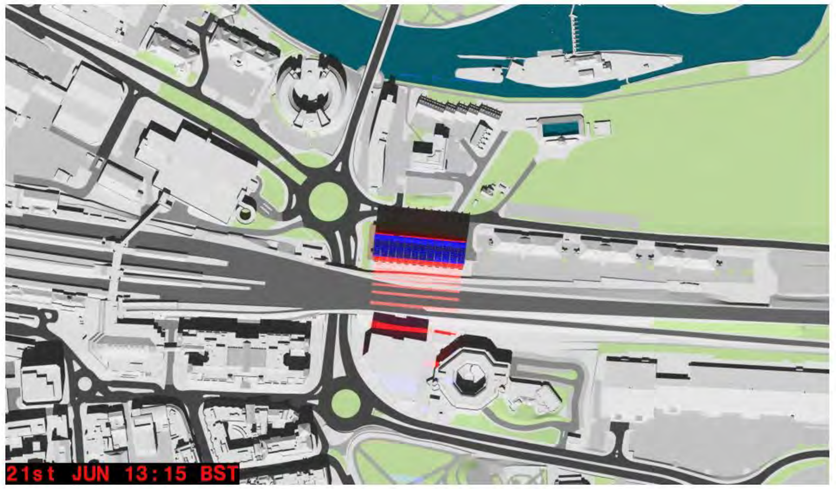

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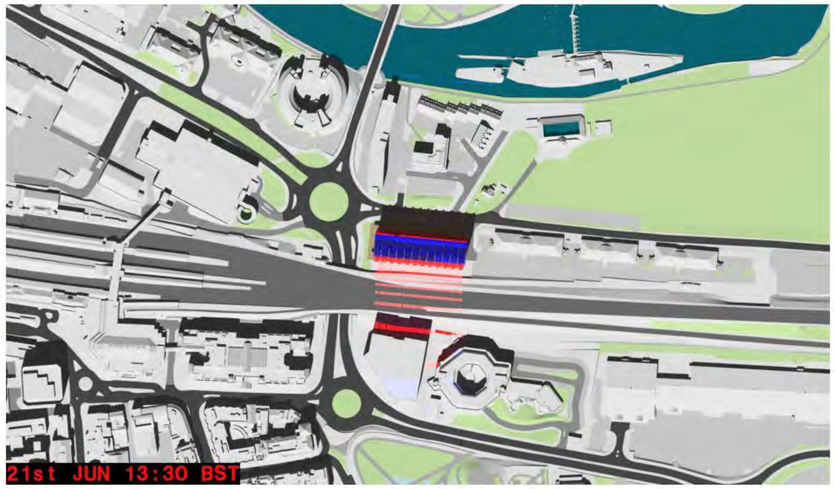

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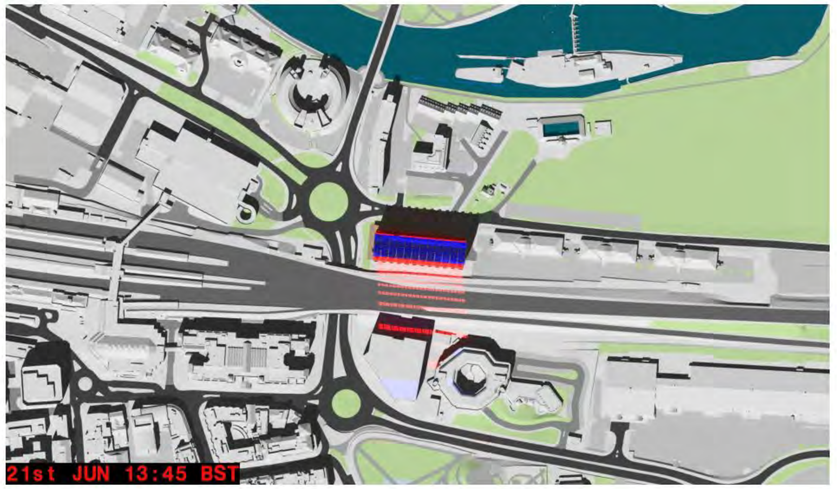

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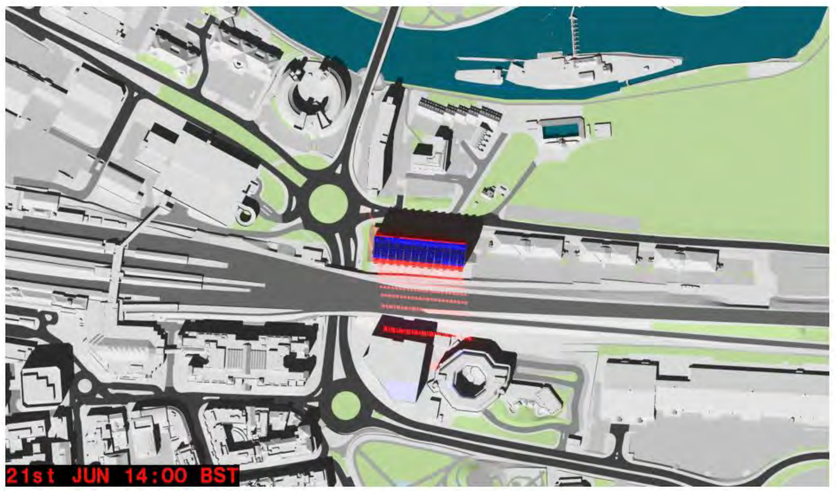

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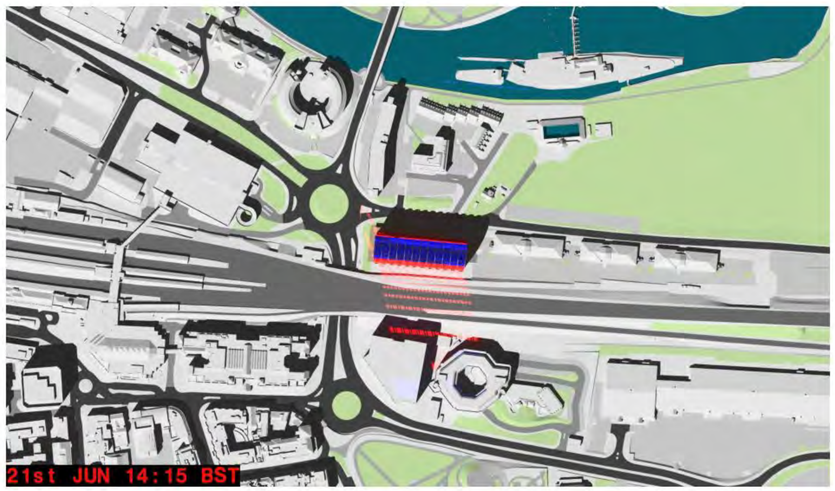

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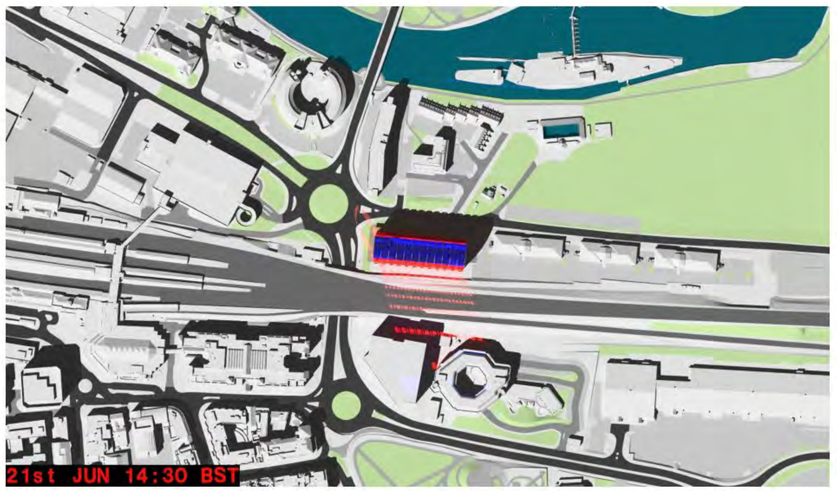

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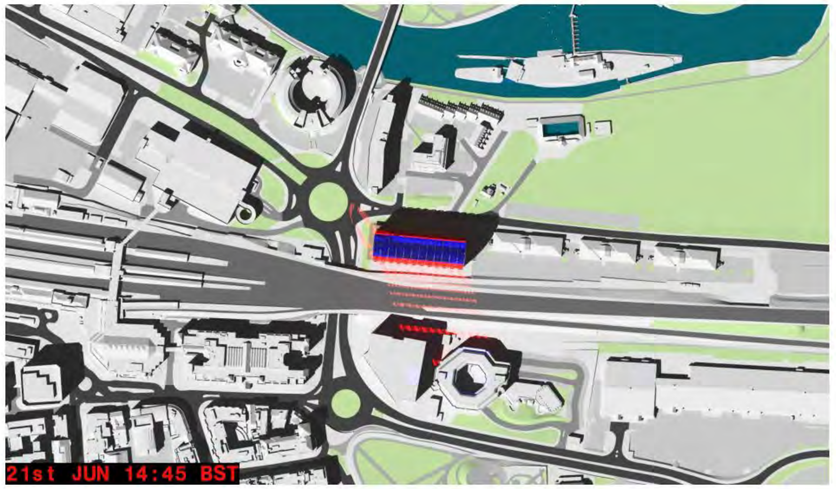

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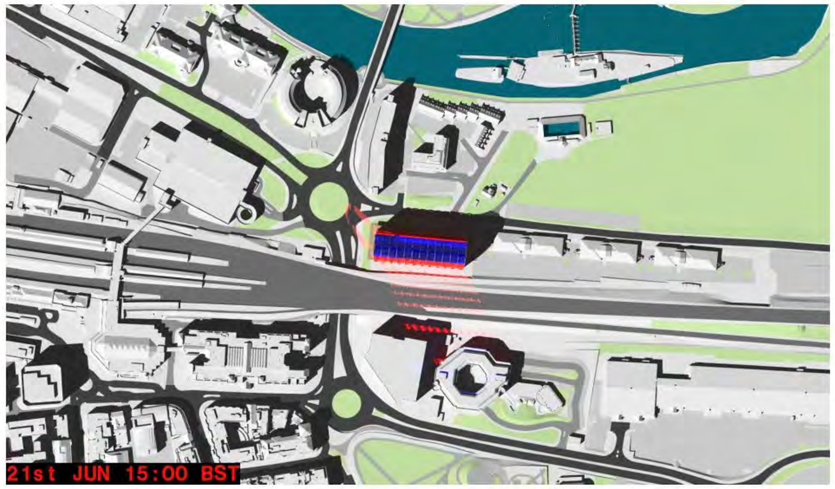

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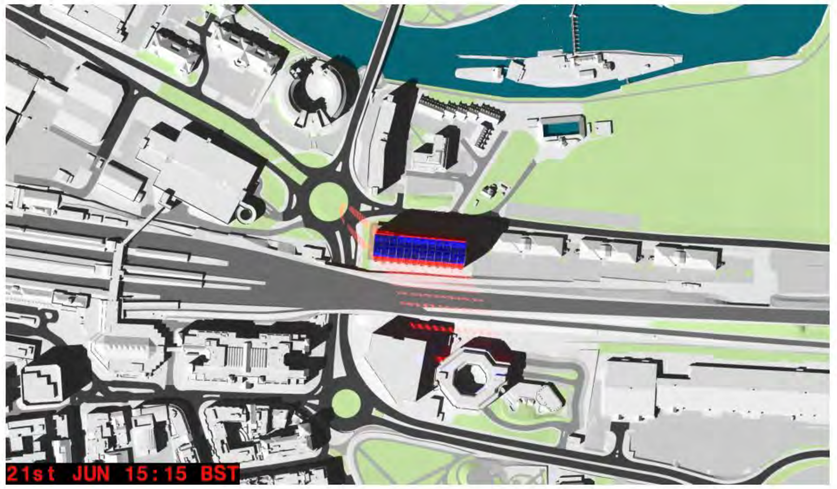

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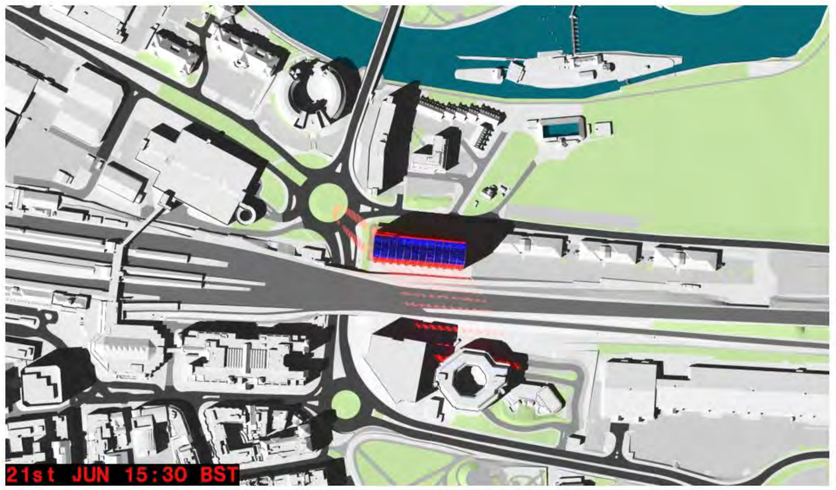

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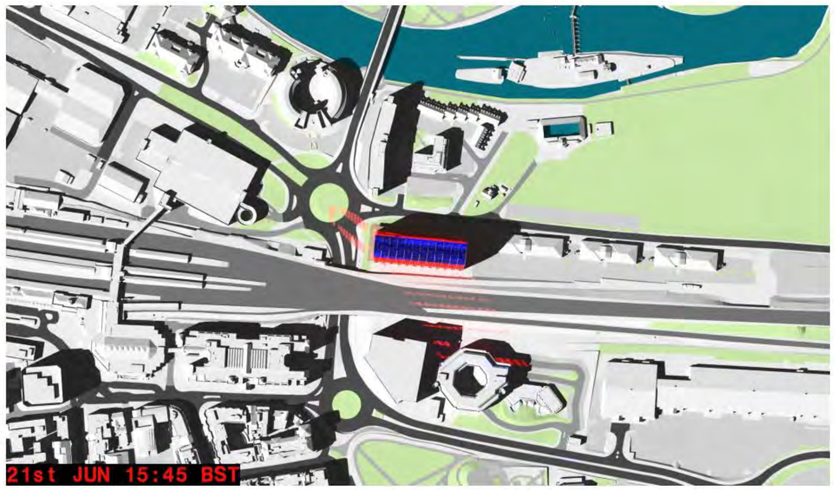

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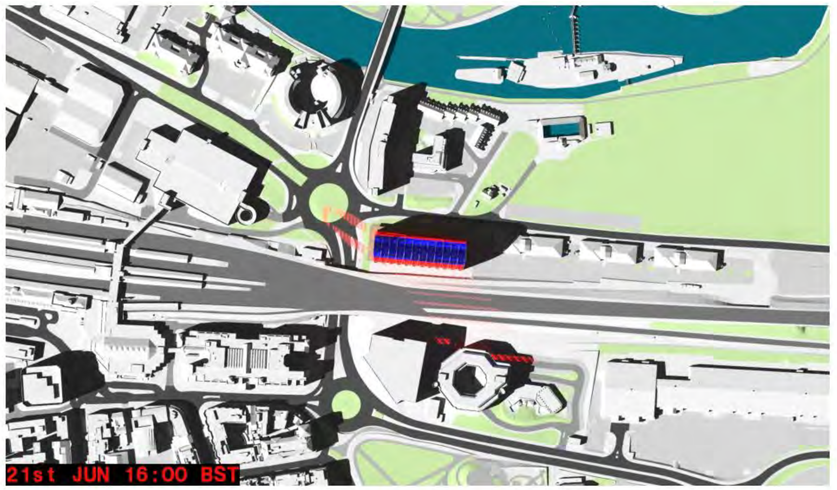

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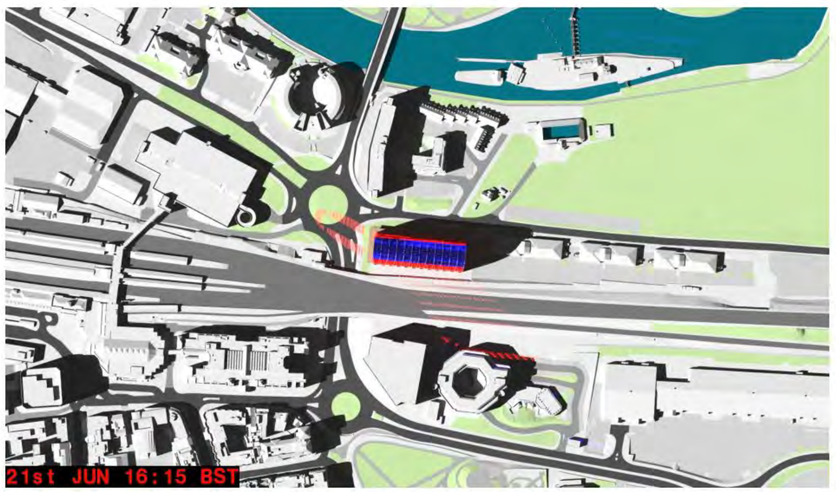

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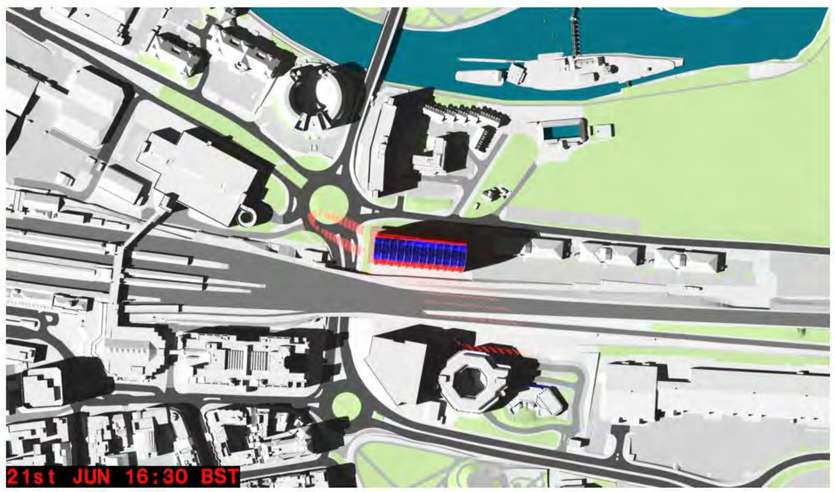

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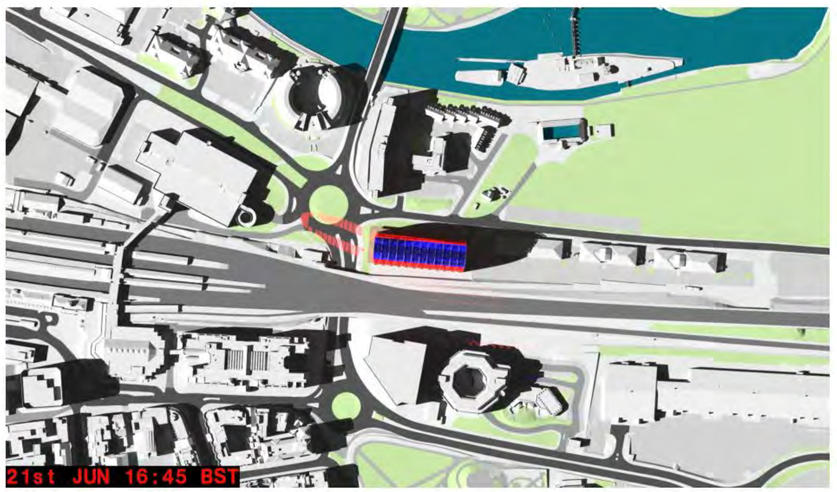

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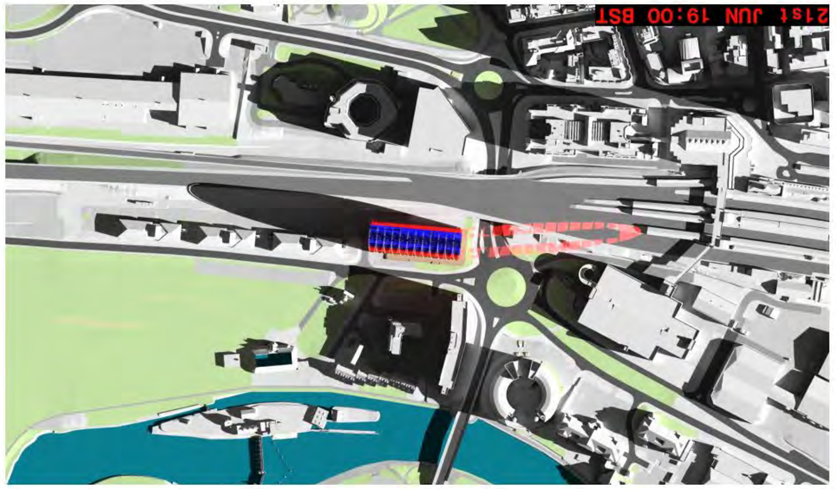

21st JUN 15:45 BST

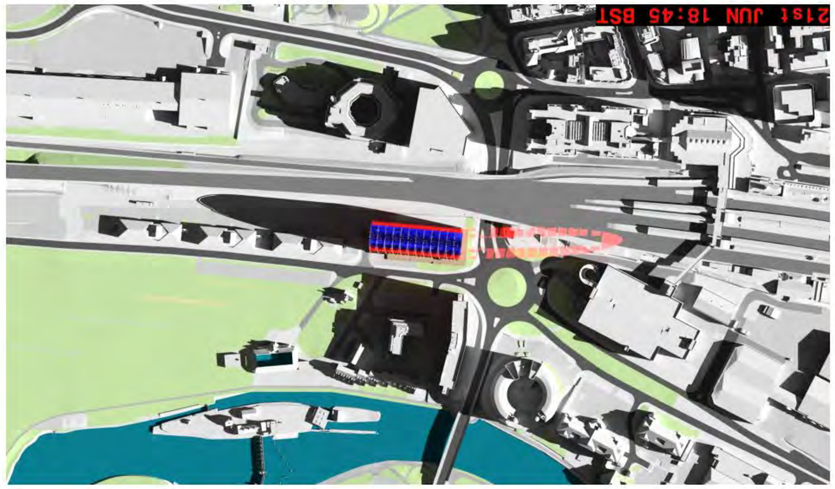

21st JUN 16:00 BST

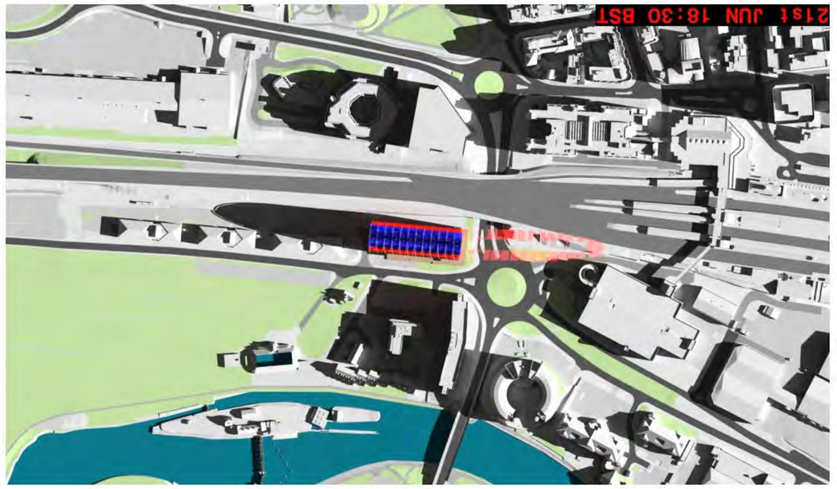

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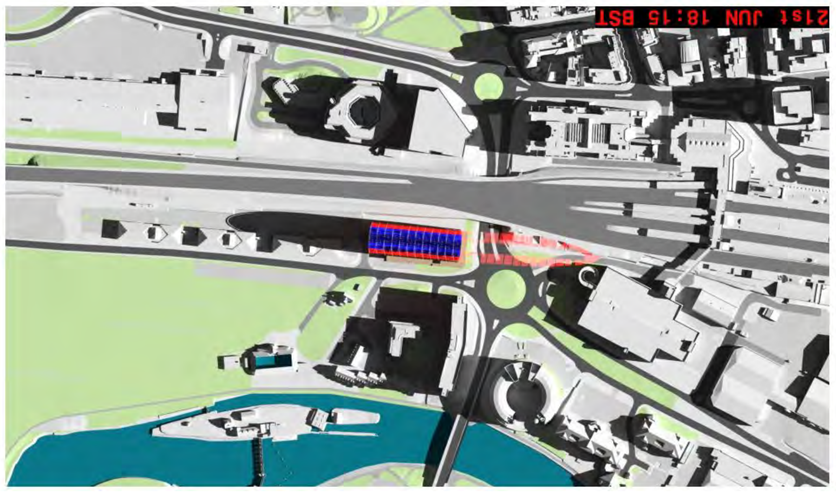

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21st JUN 16:45 BST


21st JUN 19:00 BST


21st JUN 18:45 BST

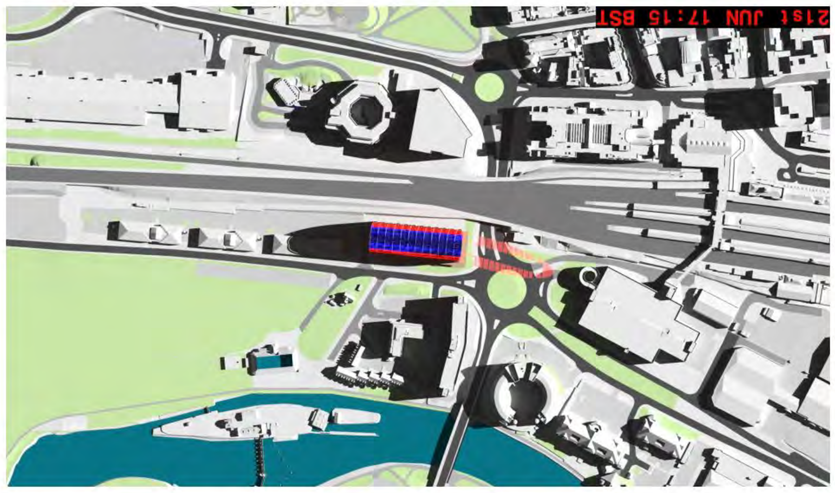

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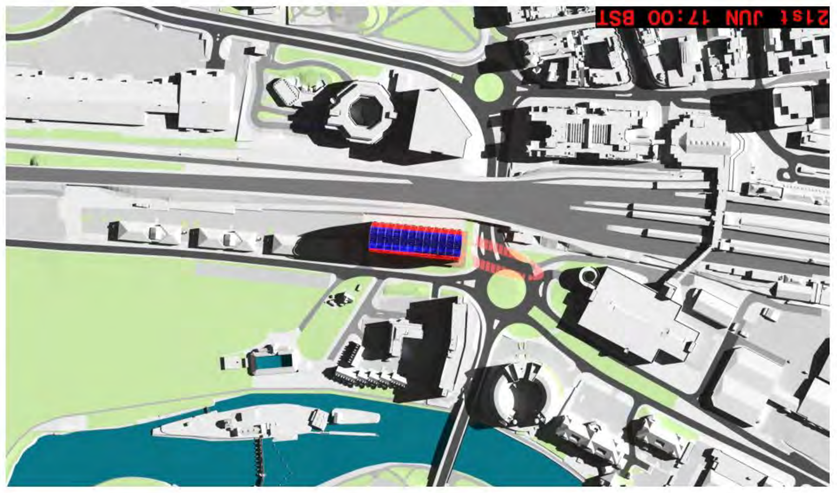

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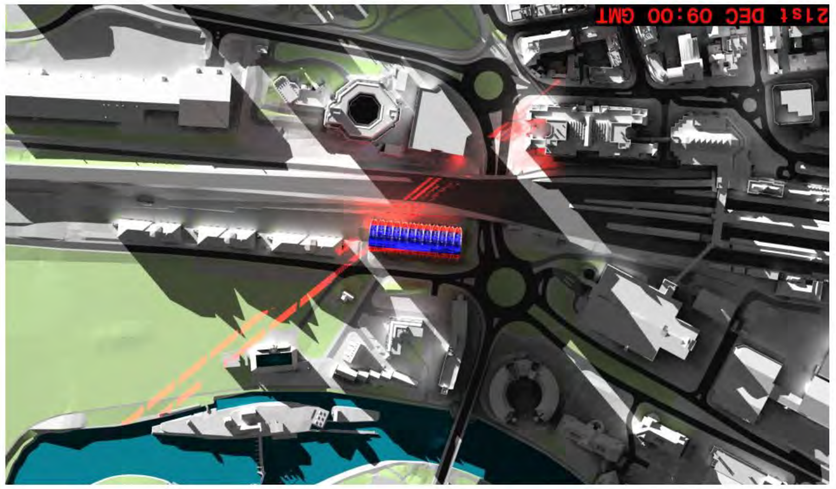

21st JUN 18:00 BST

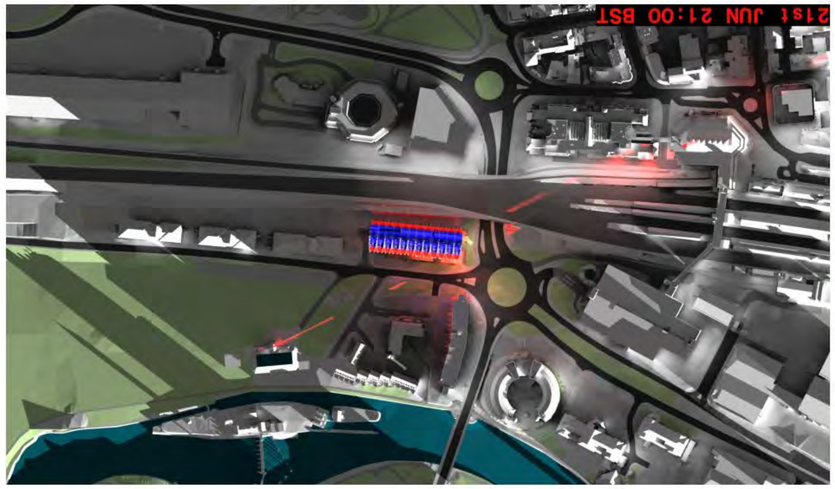

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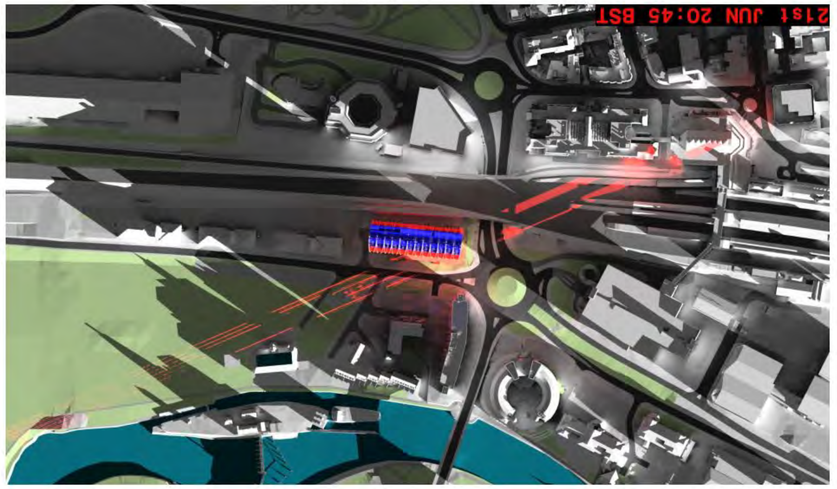

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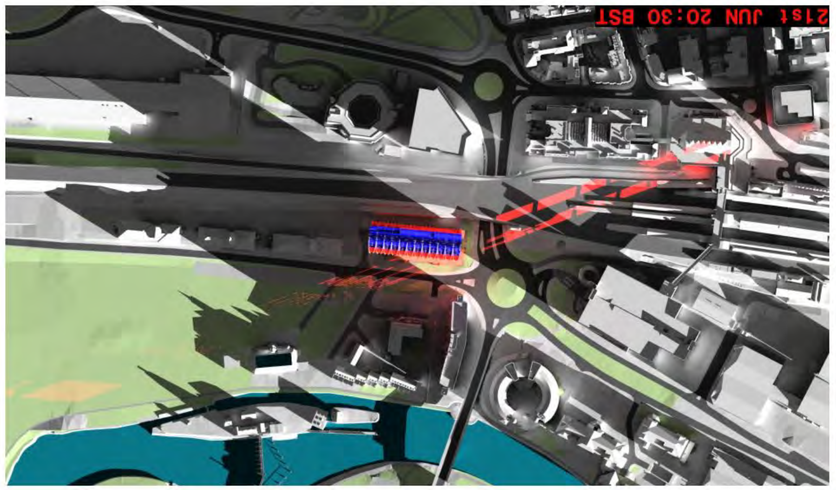

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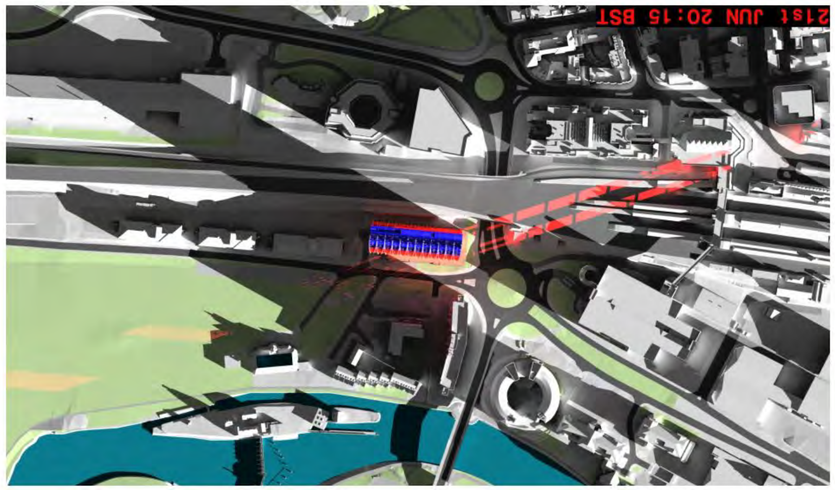

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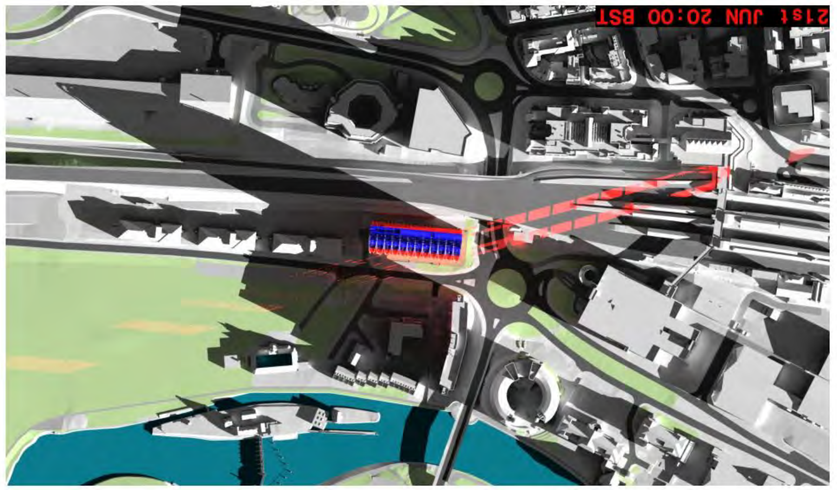

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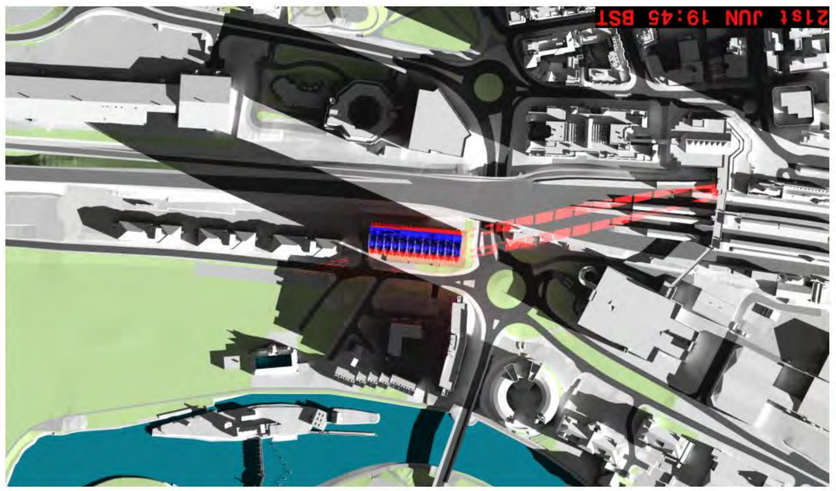

21st JUN 21:00 BST

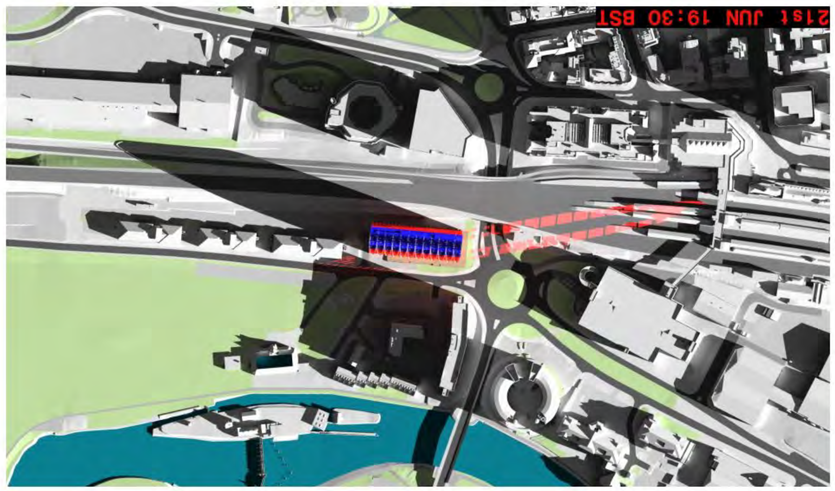

21st JUN 20:45 BST

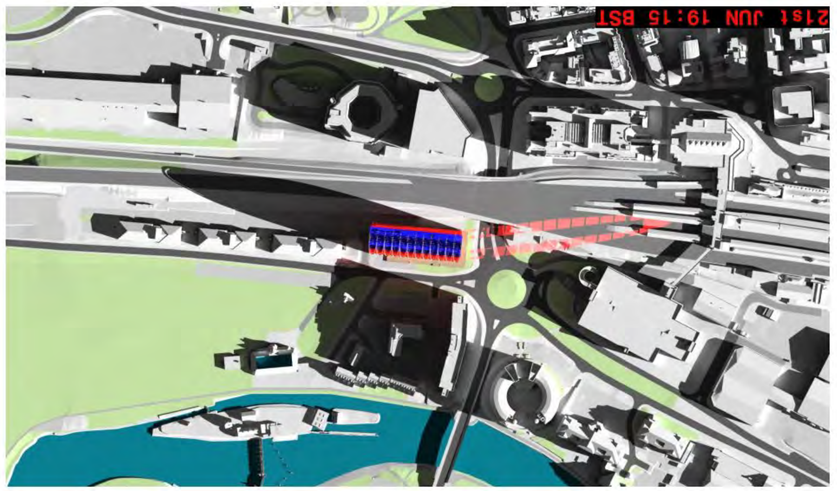

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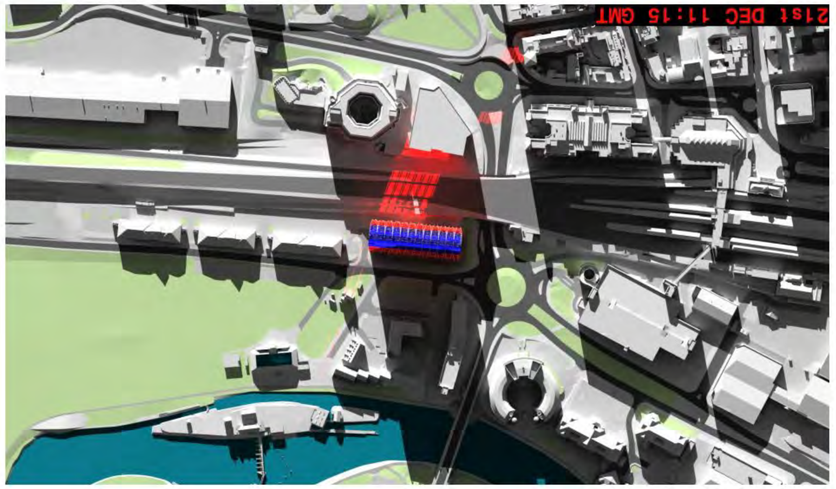

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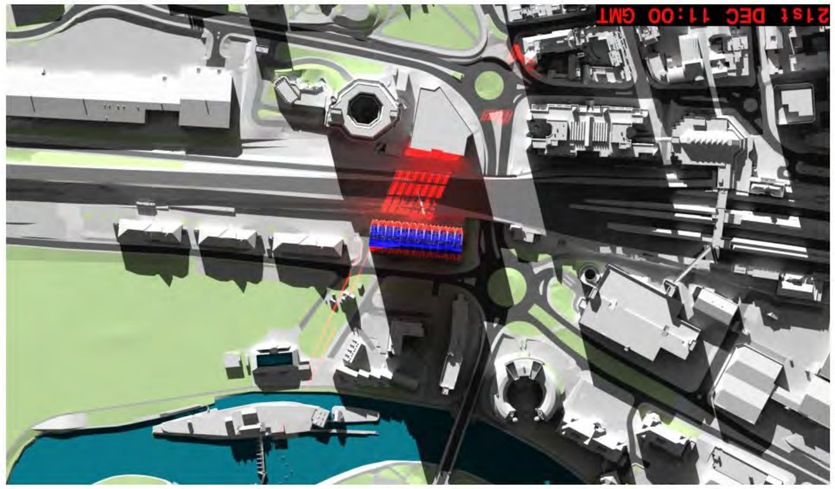

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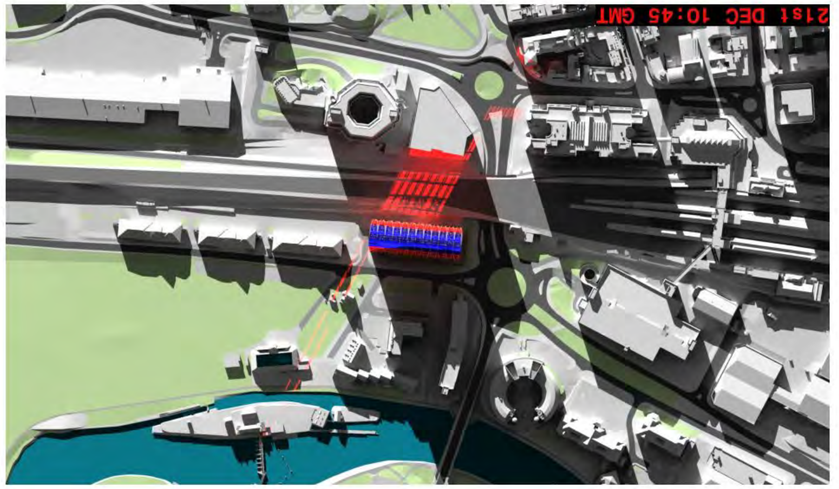

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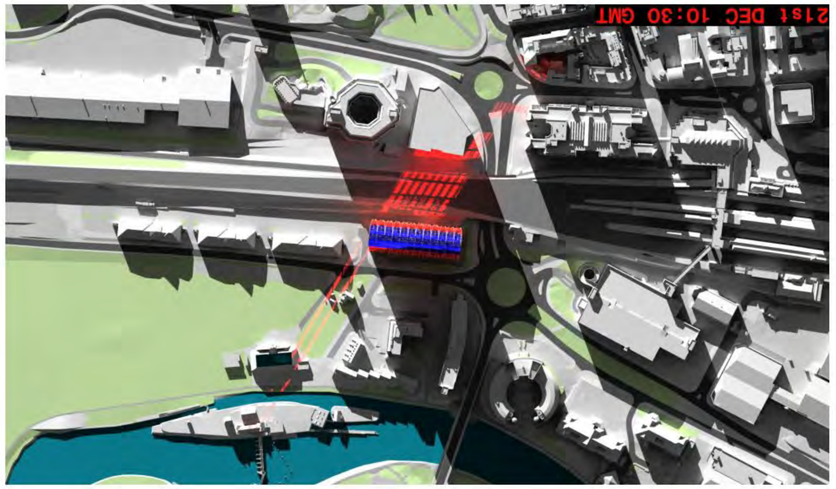

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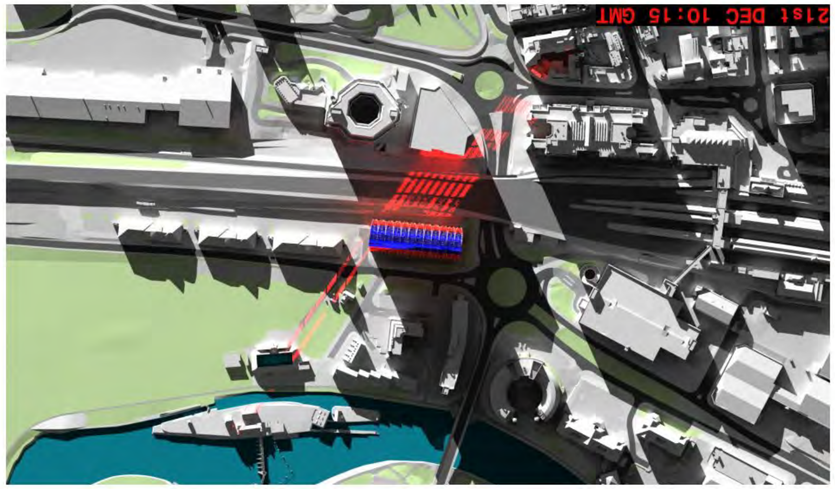

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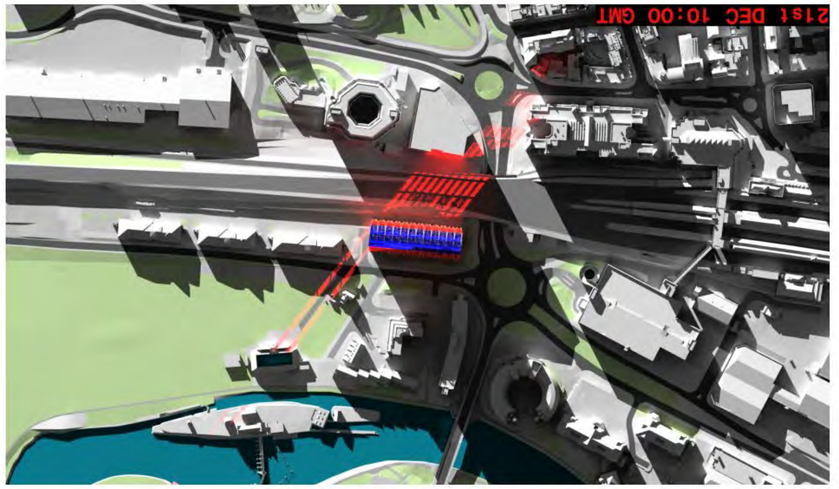

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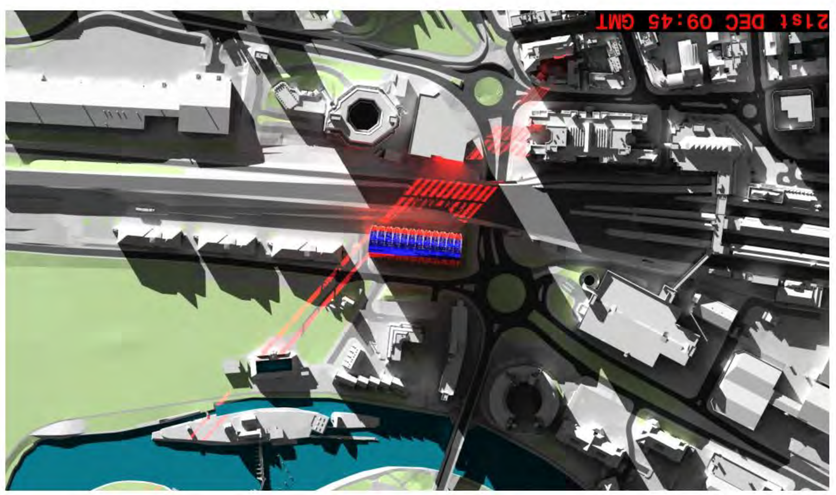

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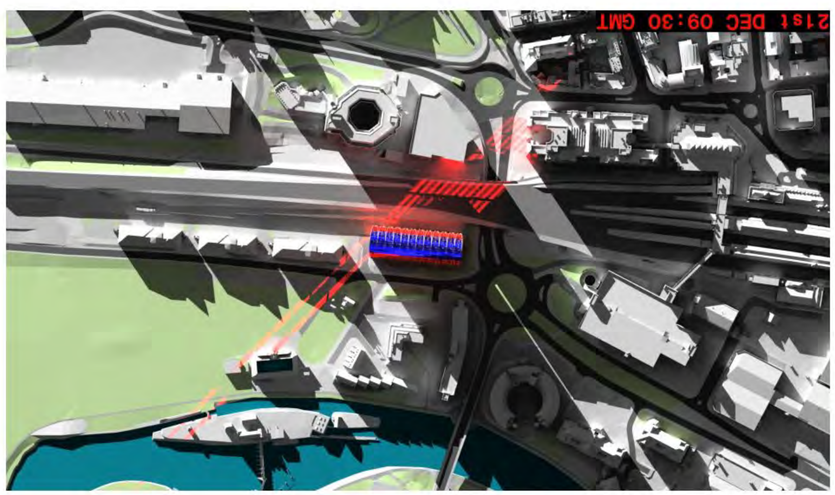

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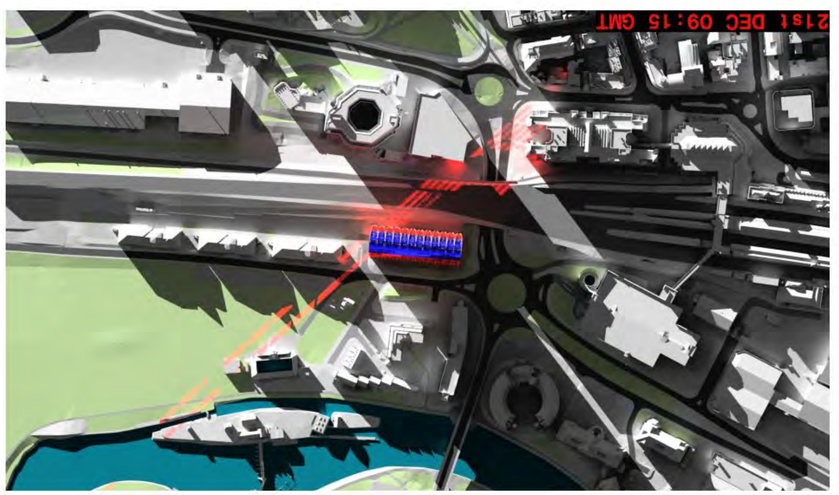

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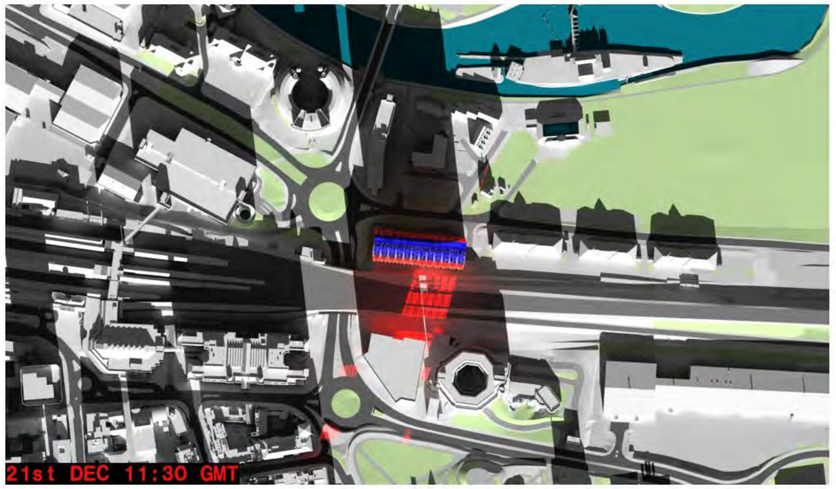

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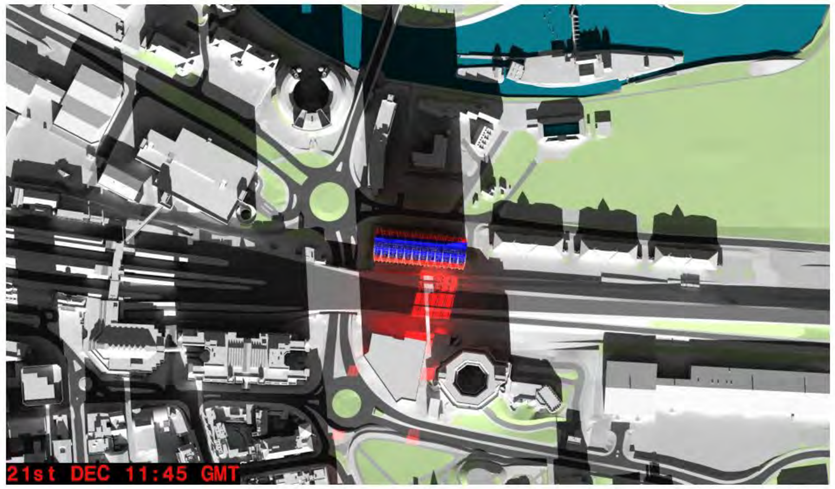

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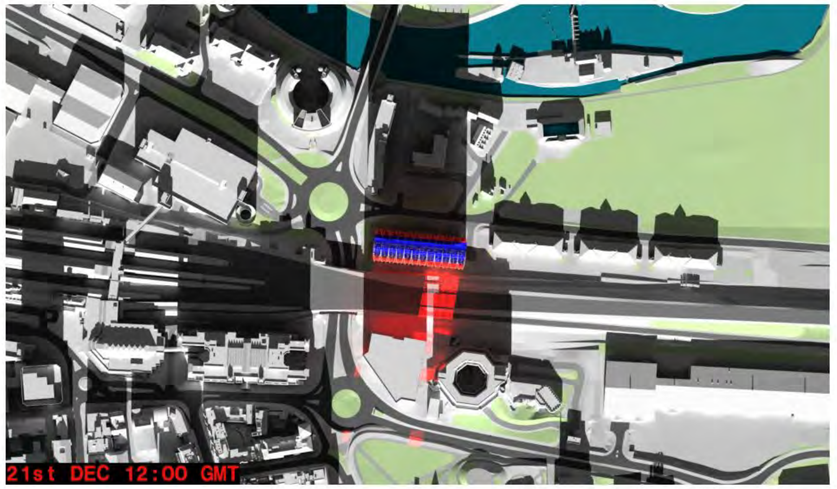

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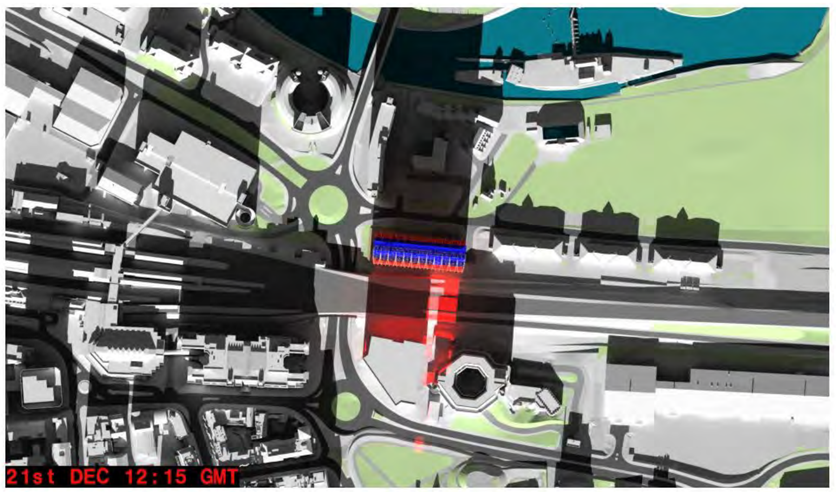

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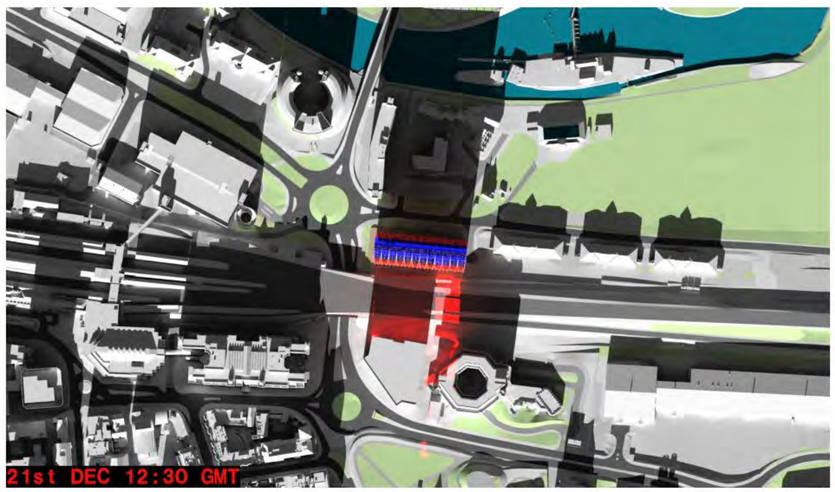

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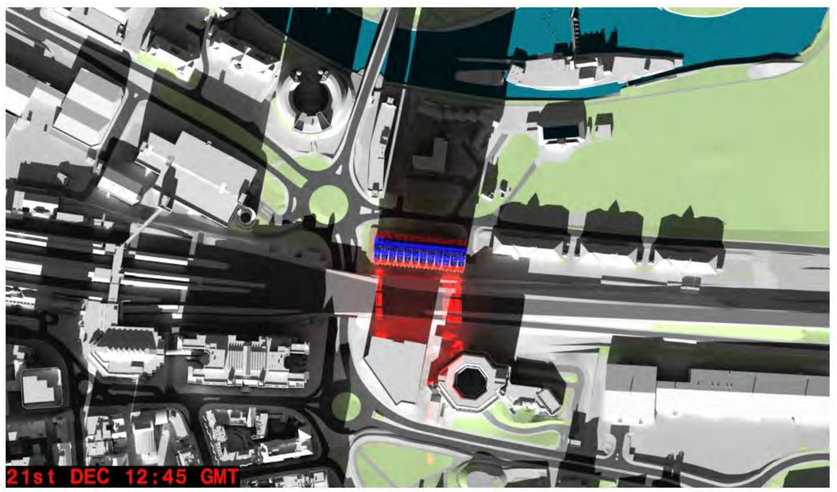

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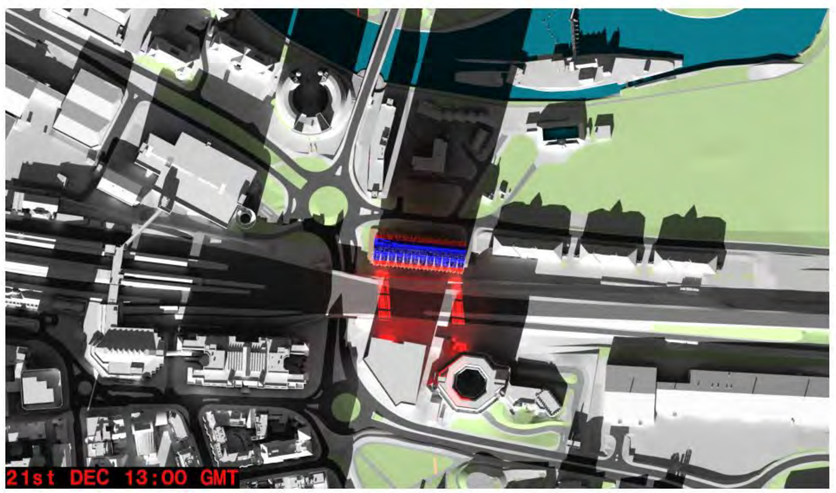

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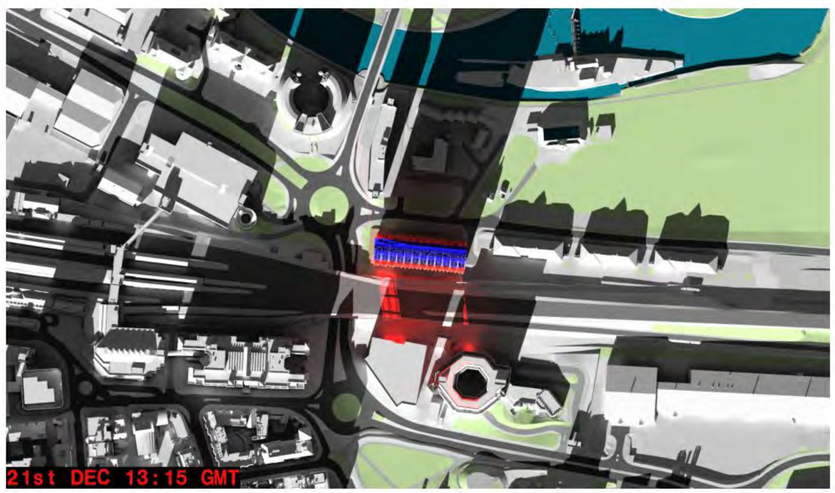

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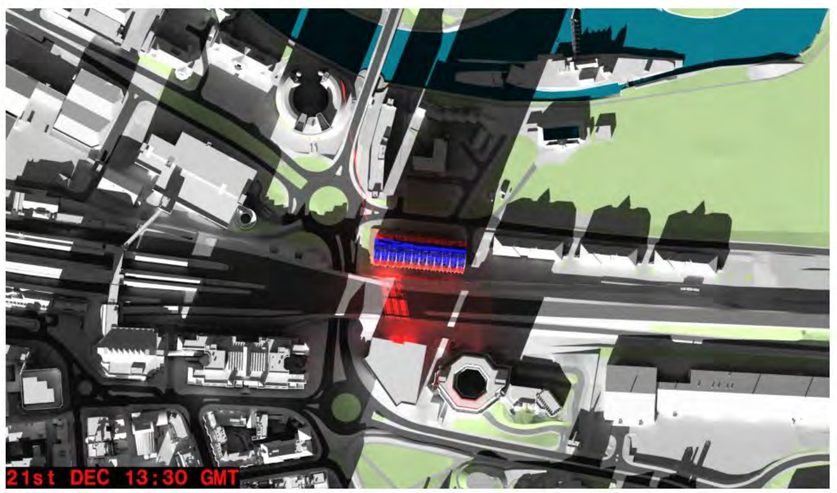

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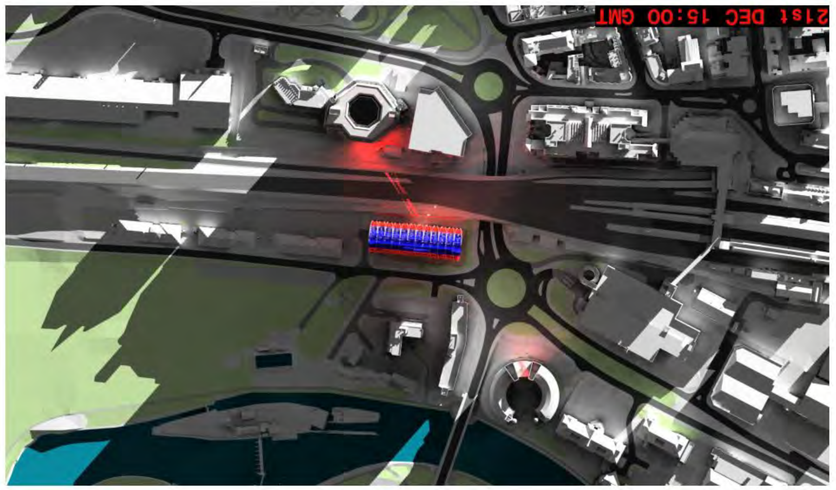

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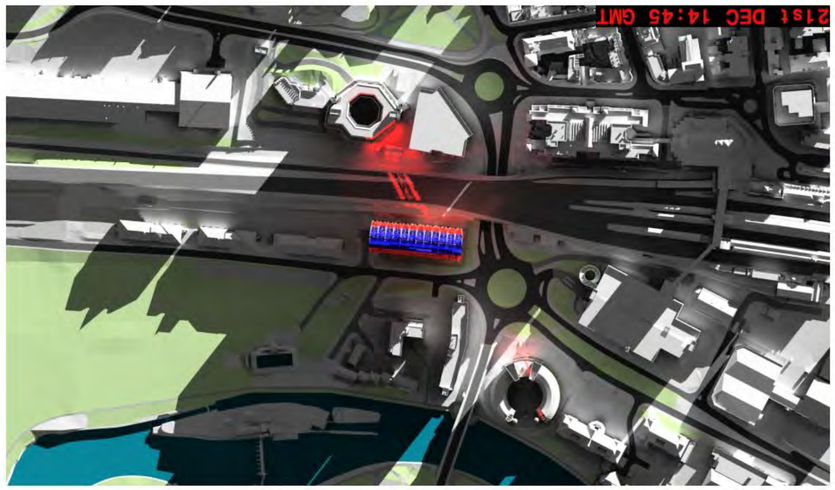

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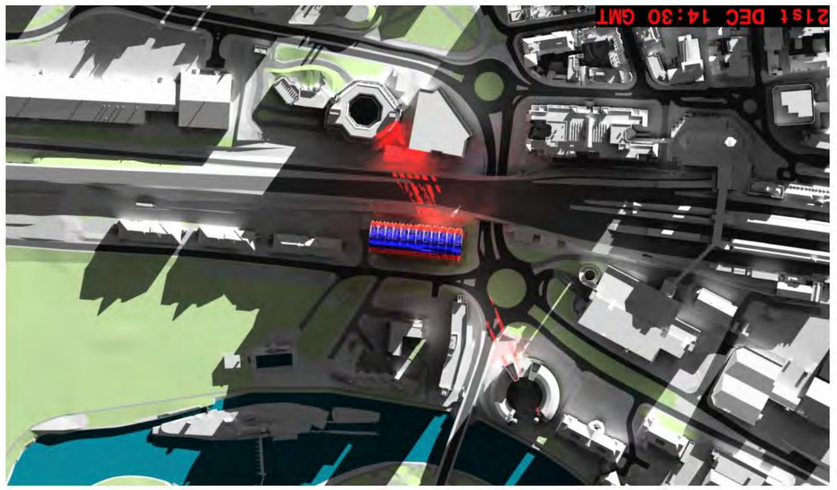

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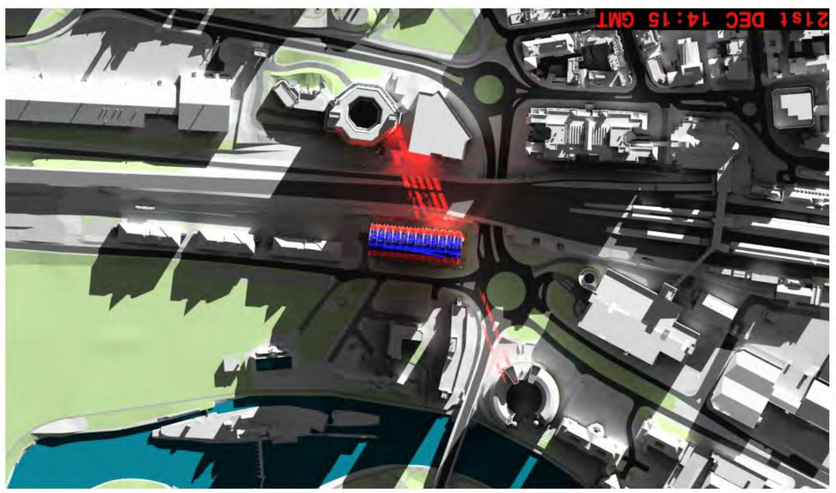

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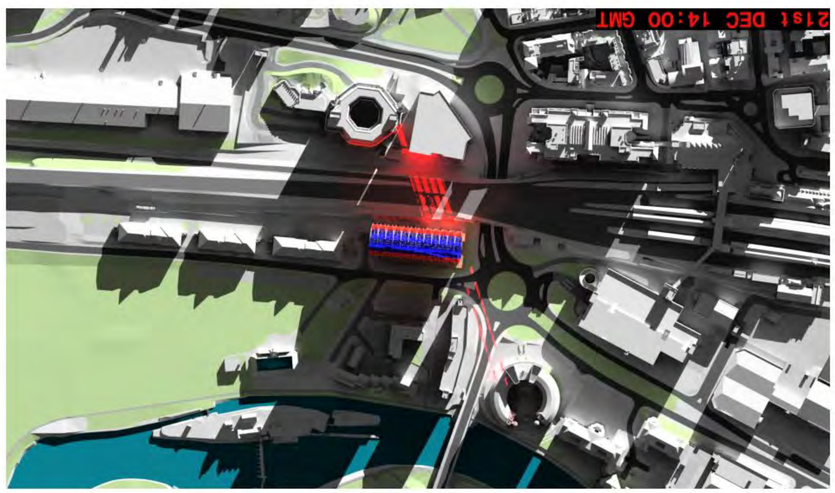

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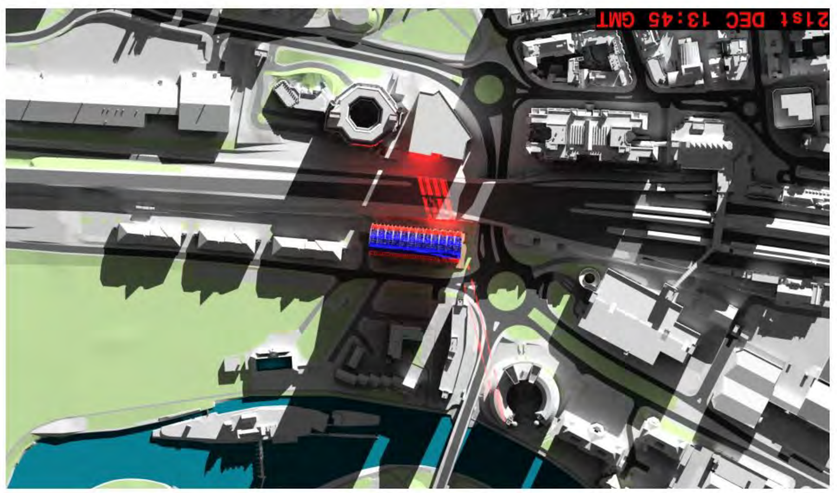

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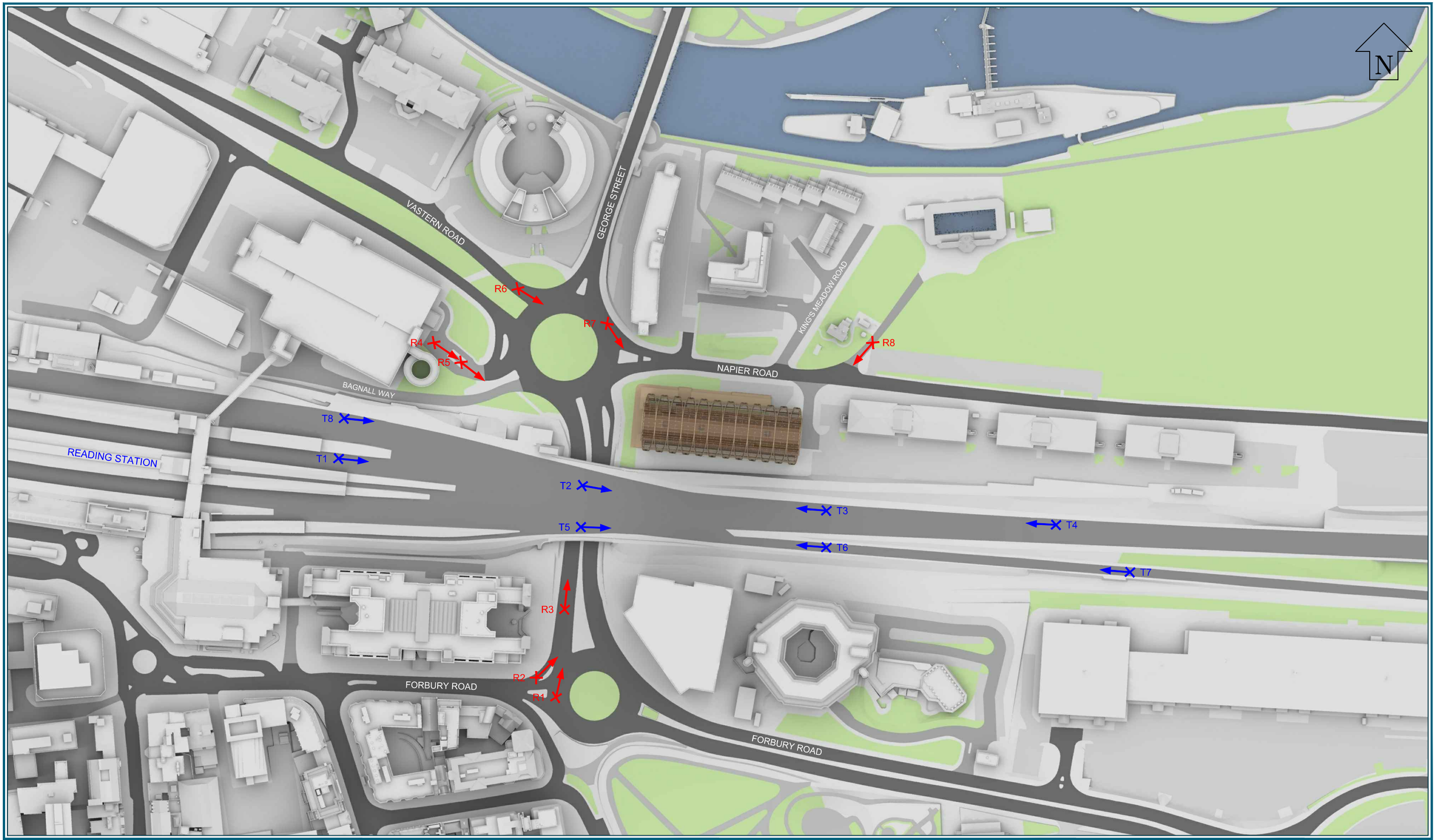

21st DEC 14:30 GMT


21st DEC 14:15 GMT


21st DEC 14:00 GMT


21st DEC 13:45 GMT

Appendix C – Annual Temporal Solar Glare Analysis - Glare Calendars



Sources: Zmapping Ltd.
3D Context Model (dated August 2016)
Reading_230816_Solids.dwg

Scott Brownrigg
Proposed 3D Model (received 20/08/17)
16367-A17-C_SwanHeights [bound].rvt

Key: Existing Buildings
Proposed Scheme

Project: The Arc
Reading

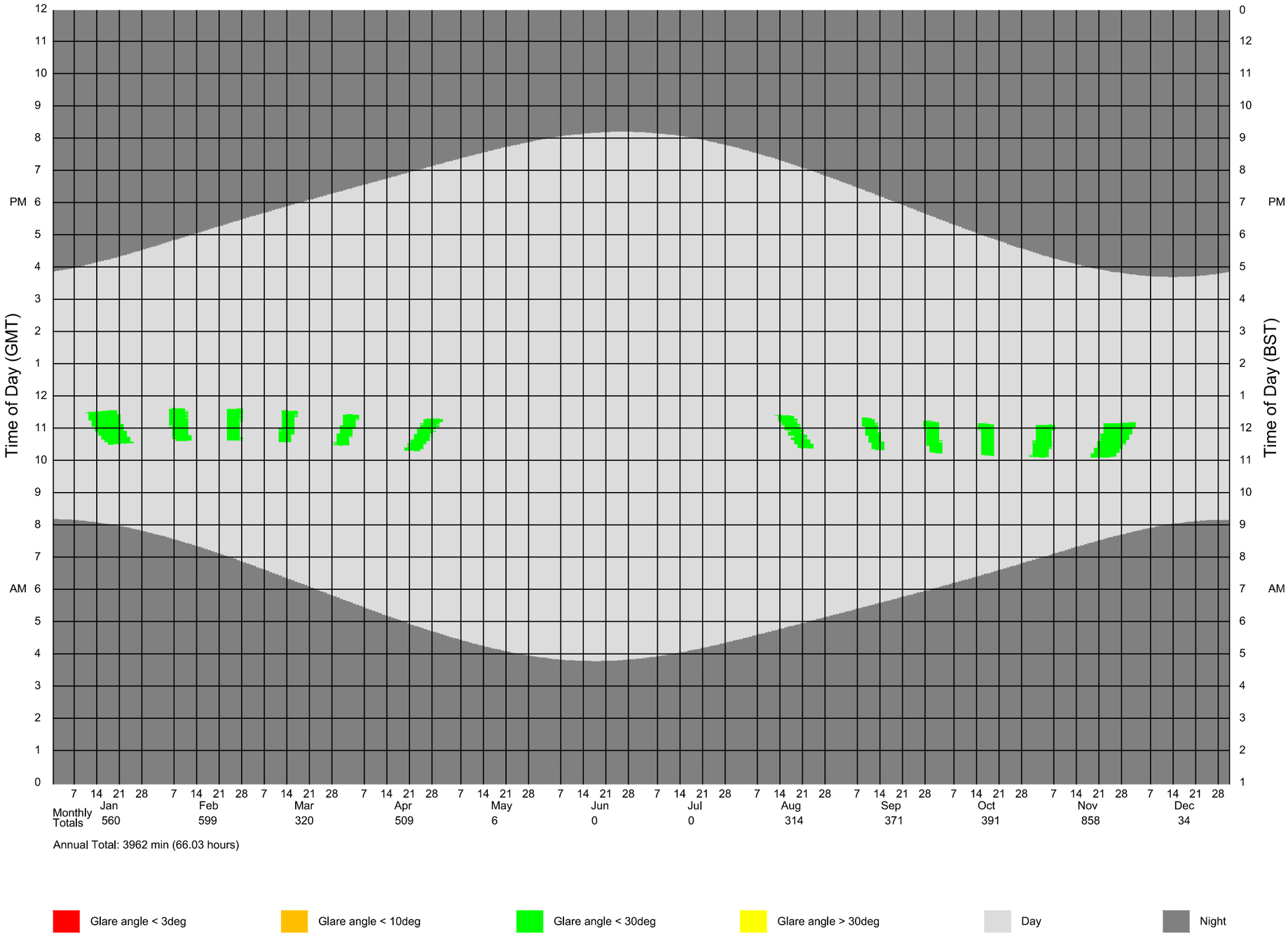
Title: Annual Temporal Solar Glare Analysis
Proposed Scheme 30/08/17
Viewpoint Locations

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

Scheme Confirmed: - Date : -

Drawn By: BW | Scale: 1:2000 @ A3 | Date: Sept 17 | Dwg No: **P1507/SGA/00** | Rel: 1

Annual Temporal Solar Glare Analysis



Sources: Zmapping Ltd.
3D Context Model (dated August 2016)
Reading_230816_Solids.dwg

Scott Brownrigg
Proposed 3D Model (received 20/08/17)
16367-A17-C_SwanHeights [bound].rvt

Key:

Project: The Arc
Reading

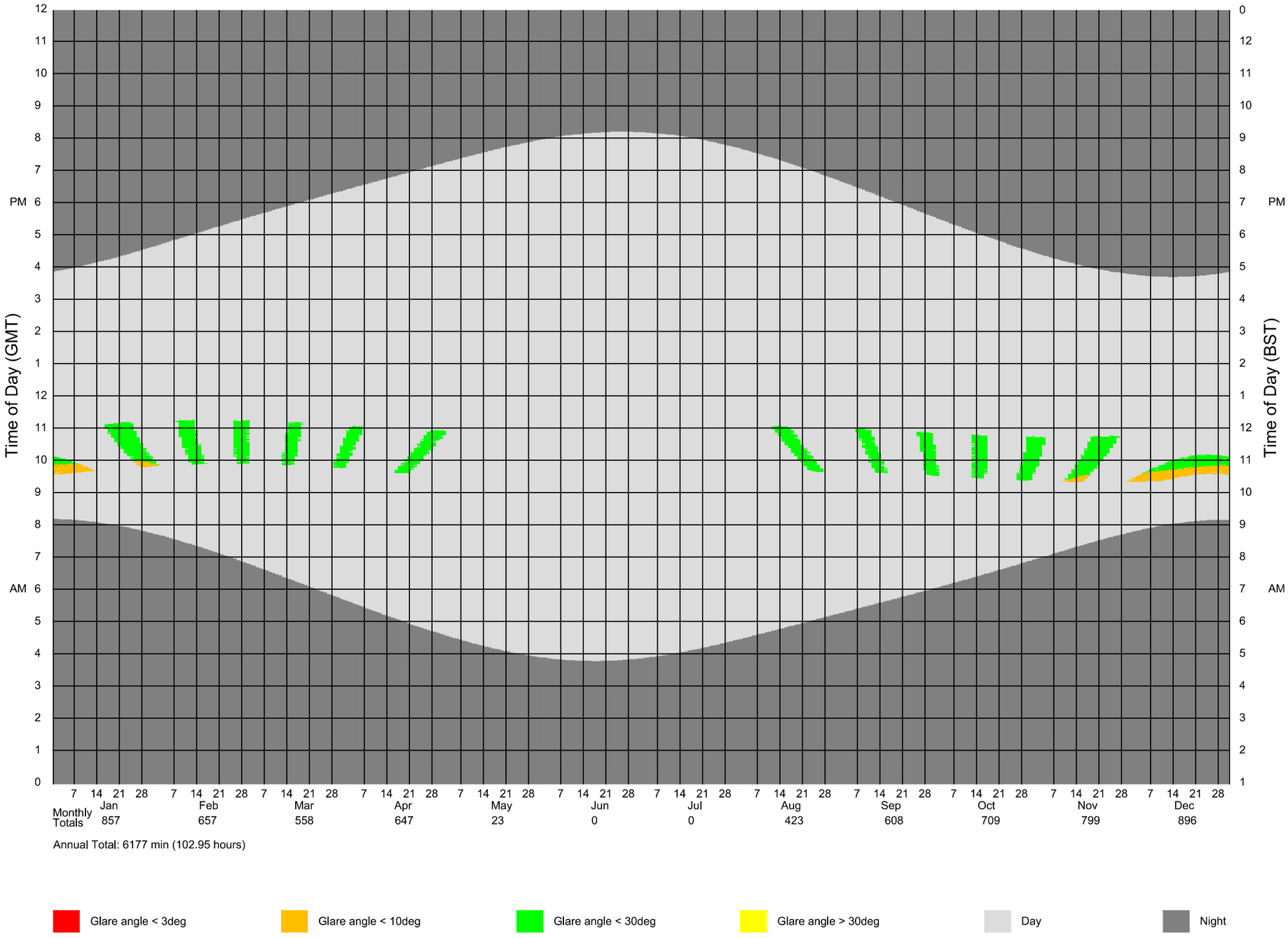
Title: Annual Temporal Solar Glare Analysis
Proposed Scheme 30/08/17
Viewpoint R1

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

Scheme Confirmed: - Date : -

Drawn By: BW | Scale: N/S @ A3 | Date: Sept 17 | Dwg No: **P1507/SGA/01** | Rel: 1

Annual Temporal Solar Glare Analysis



Sources: Zmapping Ltd.
3D Context Model (dated August 2016)
Reading_230816_Solids.dwg

Scott Brownrigg
Proposed 3D Model (received 20/08/17)
16367-A17-C_SwanHeights [bound].rvt

Key:

Project: The Arc
Reading

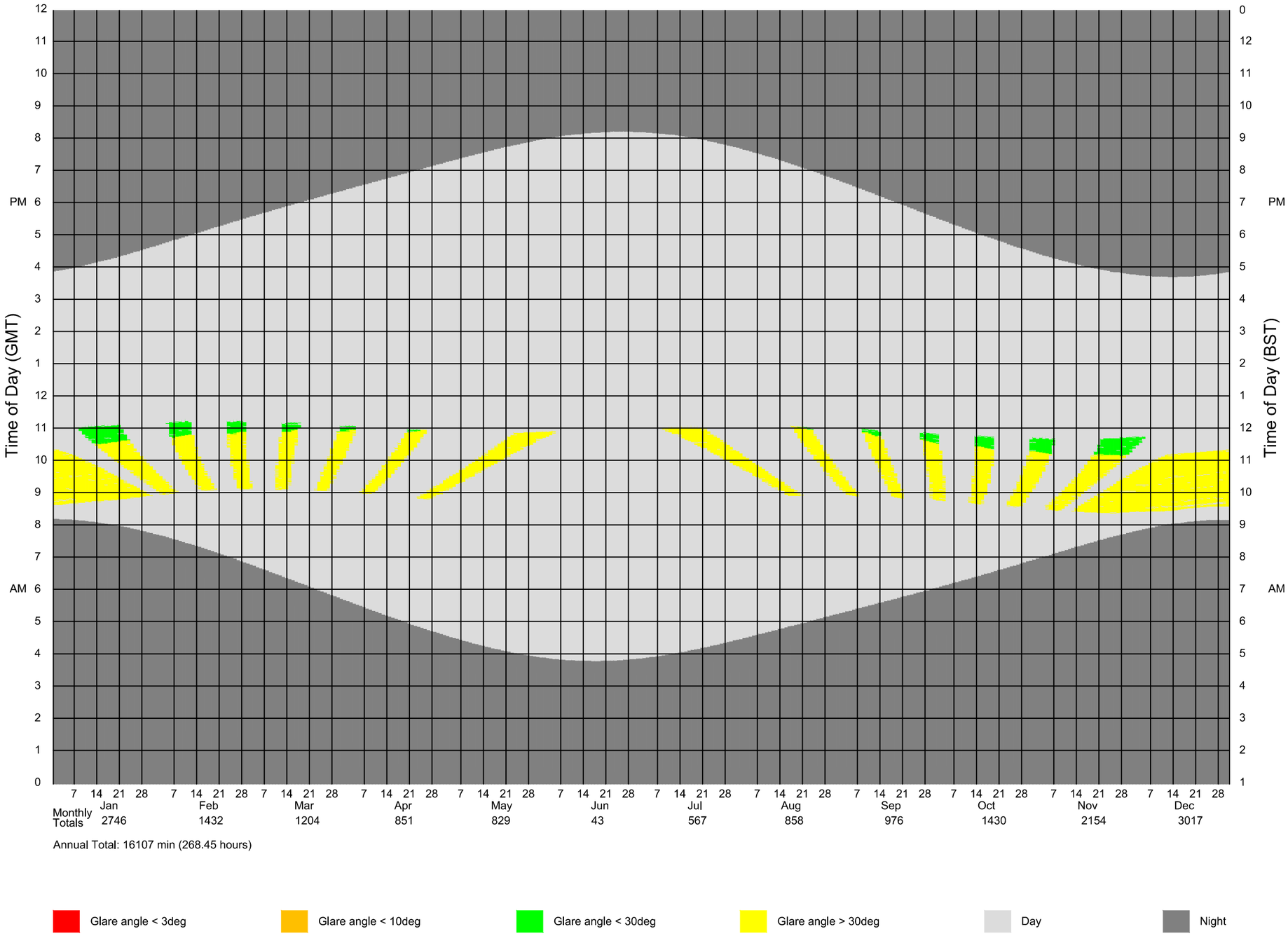
Title: Annual Temporal Solar Glare Analysis
Proposed Scheme 30/08/17
Viewpoint R2

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

Scheme Confirmed: - Date : -

Drawn By: BW | Scale: N/S @ A3 | Date: Sept 17 | Dwg No: **P1507/SGA/02** | Rel: 1

Annual Temporal Solar Glare Analysis



Annual Total: 16107 min (268.45 hours)

Glare angle < 3deg | Glare angle < 10deg | Glare angle < 30deg | Glare angle > 30deg | Day | Night

Sources: Zmapping Ltd.
3D Context Model (dated August 2016)
Reading_230816_Solids.dwg

Scott Brownrigg
Proposed 3D Model (received 20/08/17)
16367-A17-C_SwanHeights [bound].rvt

Key:

Project: The Arc
Reading

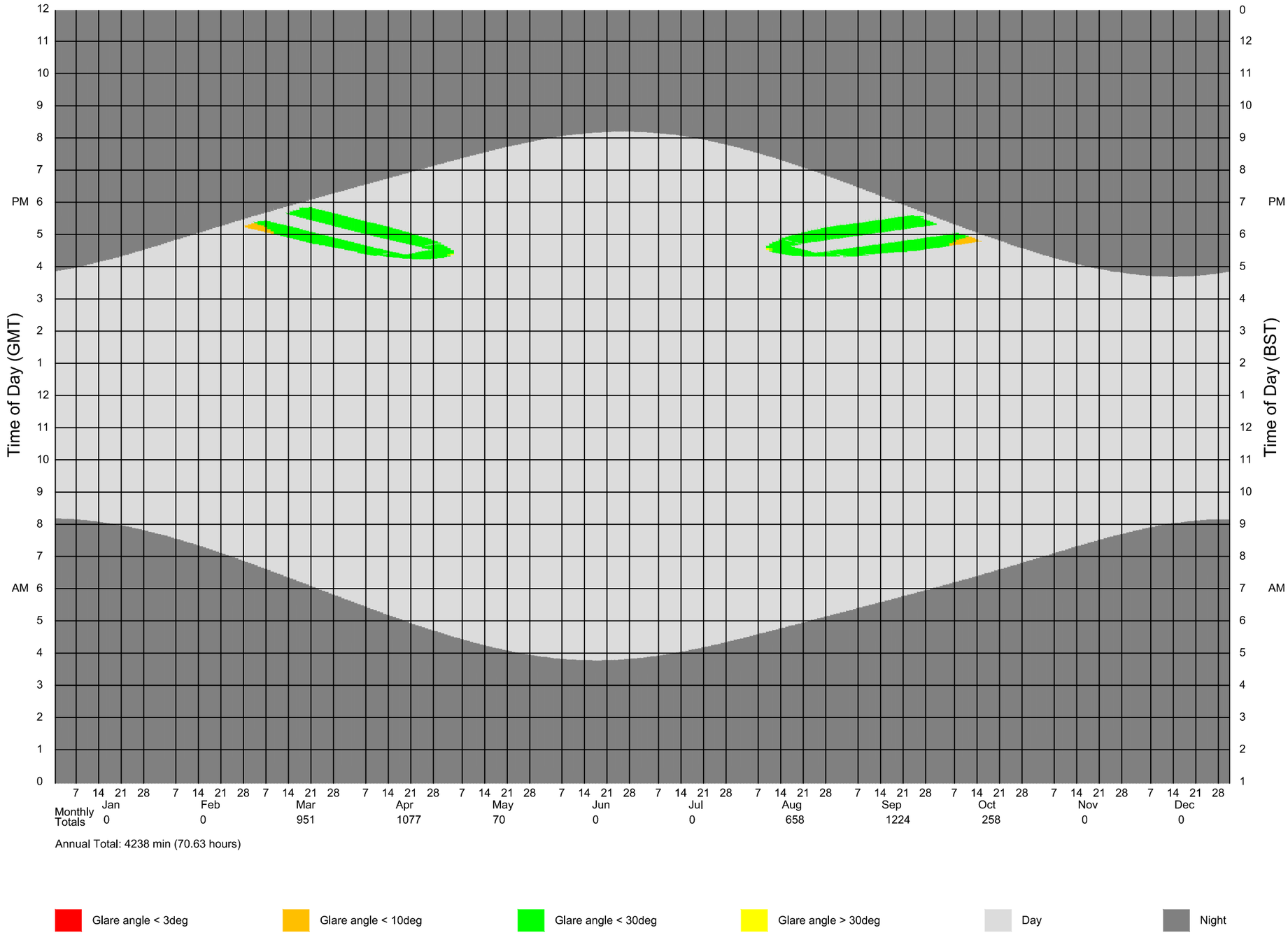
Title: Annual Temporal Solar Glare Analysis
Proposed Scheme 30/08/17
Viewpoint R3

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

Scheme Confirmed: - Date : -

Drawn By: BW | Scale: N/S @ A3 | Date: Sept 17 | Dwg No: **P1507/SGA/03** | Rel: 1

Annual Temporal Solar Glare Analysis



Sources: Zmapping Ltd.
3D Context Model (dated August 2016)
Reading_230816_Solids.dwg

Scott Brownrigg
Proposed 3D Model (received 20/08/17)
16367-A17-C_SwanHeights [bound].rvt

Key:

Project: The Arc
Reading

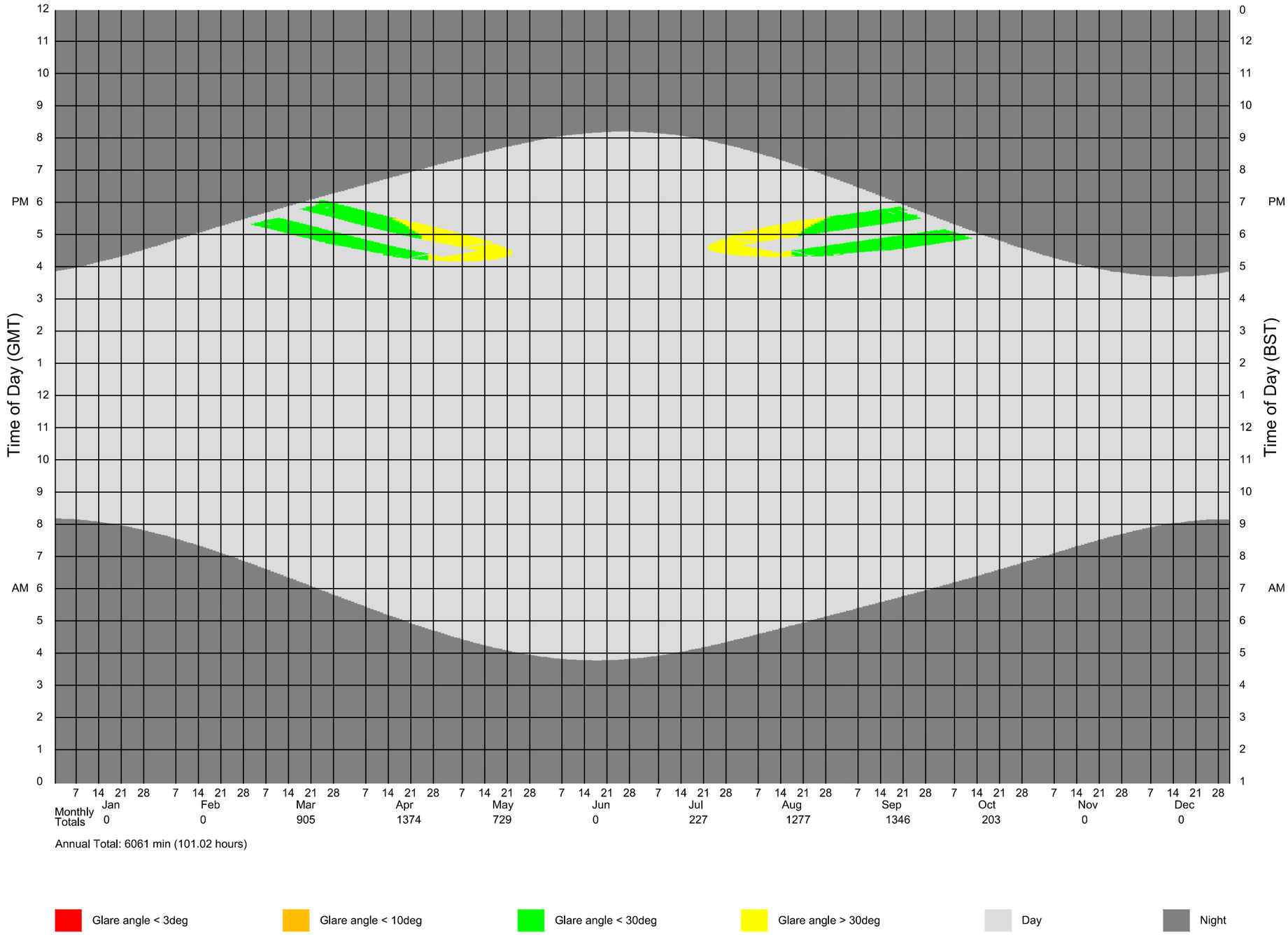
Title: Annual Temporal Solar Glare Analysis
Proposed Scheme 30/08/17
Viewpoint R4

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

Scheme Confirmed: - Date : -

Drawn By: BW | Scale: N/S @ A3 | Date: Sept 17 | Dwg No: **P1507/SGA/04** | Rel: 1

Annual Temporal Solar Glare Analysis



Sources: Zmapping Ltd.
3D Context Model (dated August 2016)
Reading_230816_Solids.dwg

Scott Brownrigg
Proposed 3D Model (received 20/08/17)
16367-A17-C_SwanHeights [bound].rvt

Key:

Project: The Arc
Reading

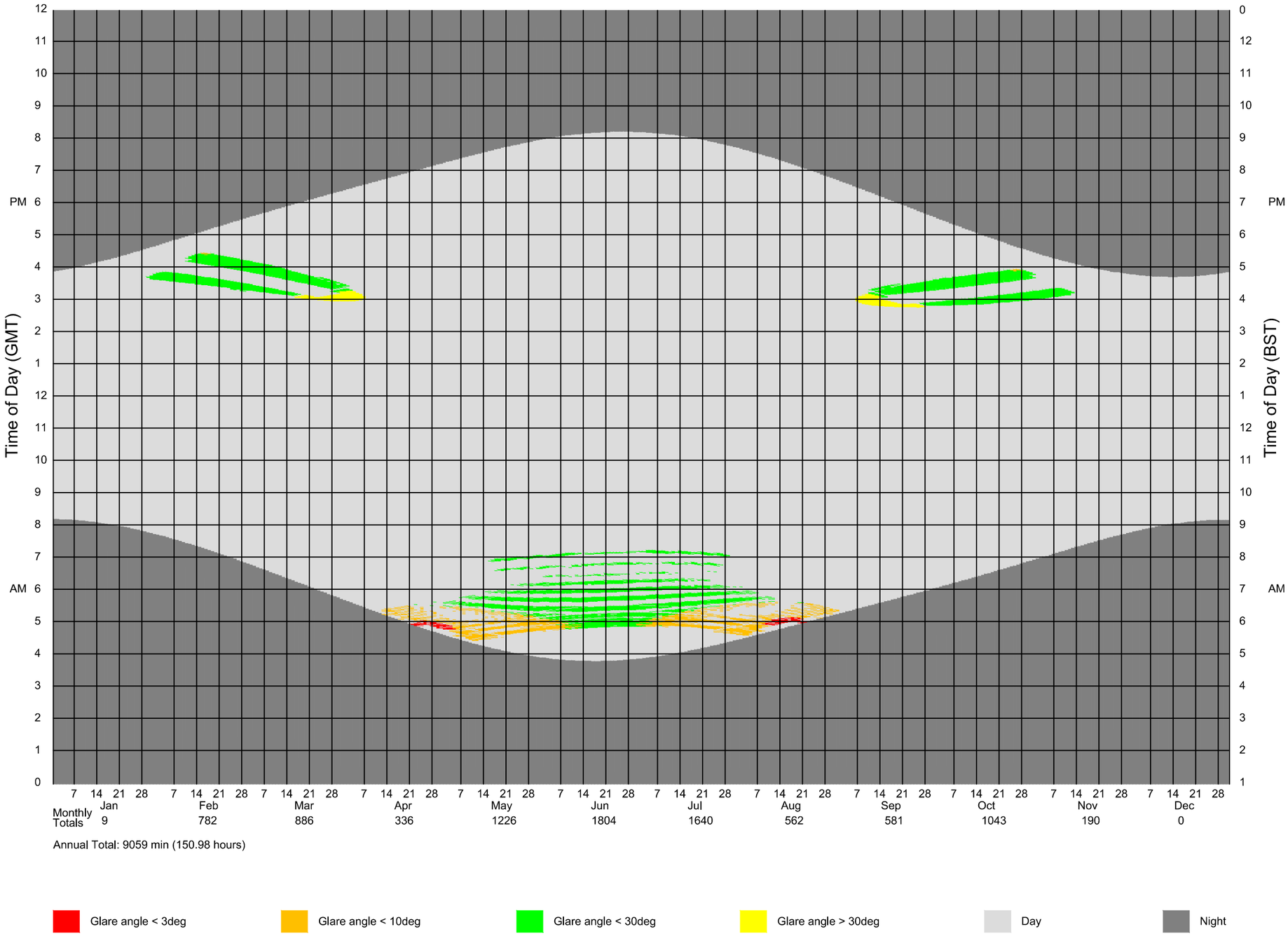
Title: Annual Temporal Solar Glare Analysis
Proposed Scheme 30/08/17
Viewpoint R5

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

Scheme Confirmed: - Date : -

Drawn By: BW | Scale: N/S @ A3 | Date: Sept 17 | Dwg No: **P1507/SGA/05** | Rel: 1

Annual Temporal Solar Glare Analysis



Sources: Zmapping Ltd.
3D Context Model (dated August 2016)
Reading_230816_Solids.dwg

Scott Brownrigg
Proposed 3D Model (received 20/08/17)
16367-A17-C_SwanHeights [bound].rvt

Key:

Project: The Arc
Reading

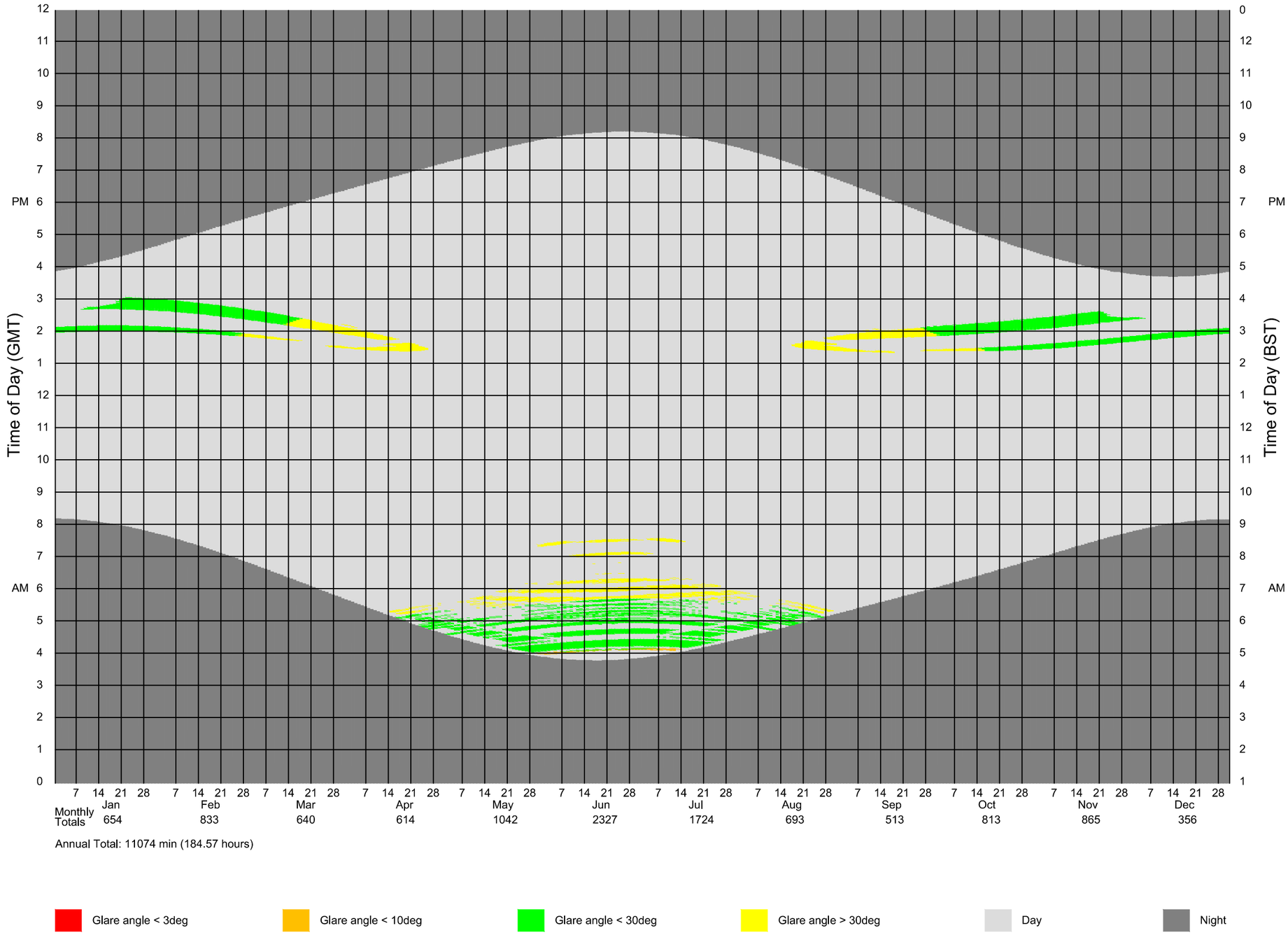
Title: Annual Temporal Solar Glare Analysis
Proposed Scheme 30/08/17
Viewpoint R6

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

Scheme Confirmed: - Date : -

Drawn By: BW | Scale: N/S @ A3 | Date: Sept 17 | Dwg No: **P1507/SGA/06** | Rel: 1

Annual Temporal Solar Glare Analysis



Sources: Zmapping Ltd.
3D Context Model (dated August 2016)
Reading_230816_Solids.dwg

Scott Brownrigg
Proposed 3D Model (received 20/08/17)
16367-A17-C_SwanHeights [bound].rvt

Key:

Project: The Arc
Reading

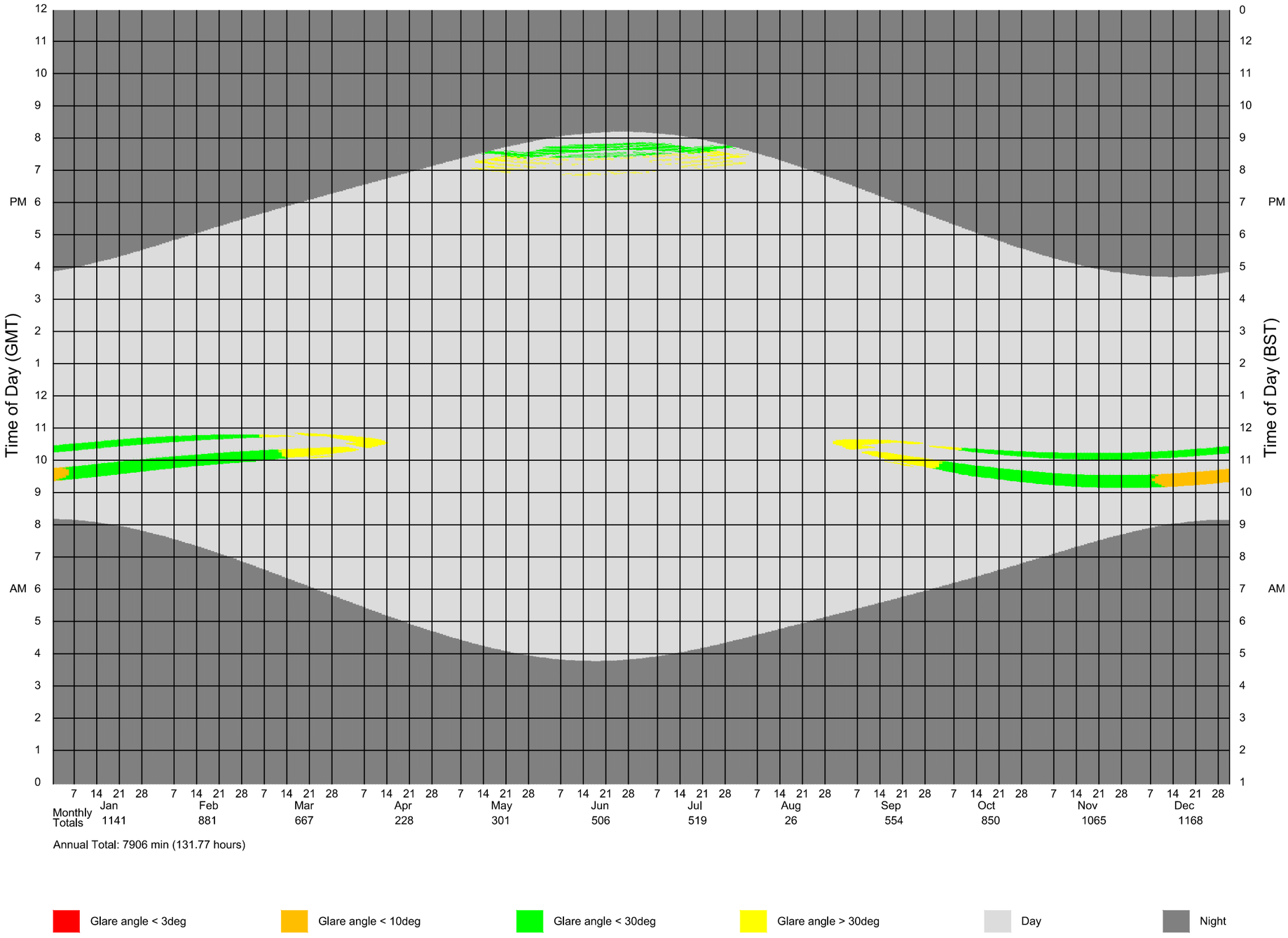
Title: Annual Temporal Solar Glare Analysis
Proposed Scheme 30/08/17
Viewpoint R7

Point 2 Surveyors Ltd,
3rd Floor,
17 Slingsby Place,
London WC2E 9AB
0207 836 5828
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Scheme Confirmed: - Date : -

Drawn By: BW | Scale: N/S @ A3 | Date: Sept 17 | Dwg No: **P1507/SGA/07** | Rel: 1

Annual Temporal Solar Glare Analysis



Sources: Zmapping Ltd.
3D Context Model (dated August 2016)
Reading_230816_Solids.dwg

Scott Brownrigg
Proposed 3D Model (received 20/08/17)
16367-A17-C_SwanHeights [bound].rvt

Key:

Project: The Arc
Reading

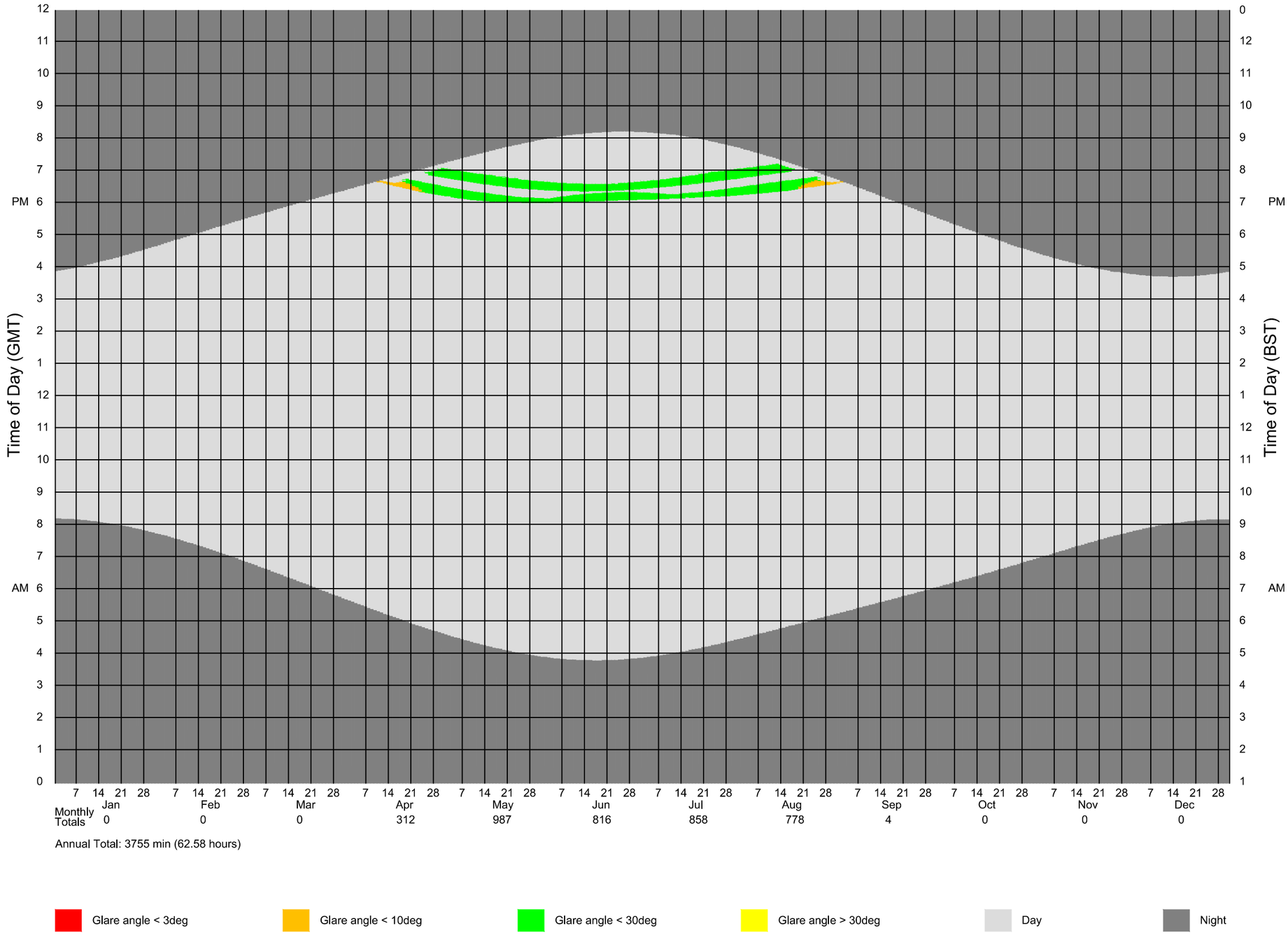
Title: Annual Temporal Solar Glare Analysis
Proposed Scheme 30/08/17
Viewpoint R8

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3rd Floor,
17 Slingsby Place,
London WC2E 9AB
0207 836 5828
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Scheme Confirmed: - Date : -

Drawn By: BW | Scale: N/S @ A3 | Date: Sept 17 | Dwg No: **P1507/SGA/08** | Rel: 1

Annual Temporal Solar Glare Analysis



Sources: Zmapping Ltd.
3D Context Model (dated August 2016)
Reading_230816_Solids.dwg

Scott Brownrigg
Proposed 3D Model (received 20/08/17)
16367-A17-C_SwanHeights [bound].rvt

Key:

Project: The Arc
Reading

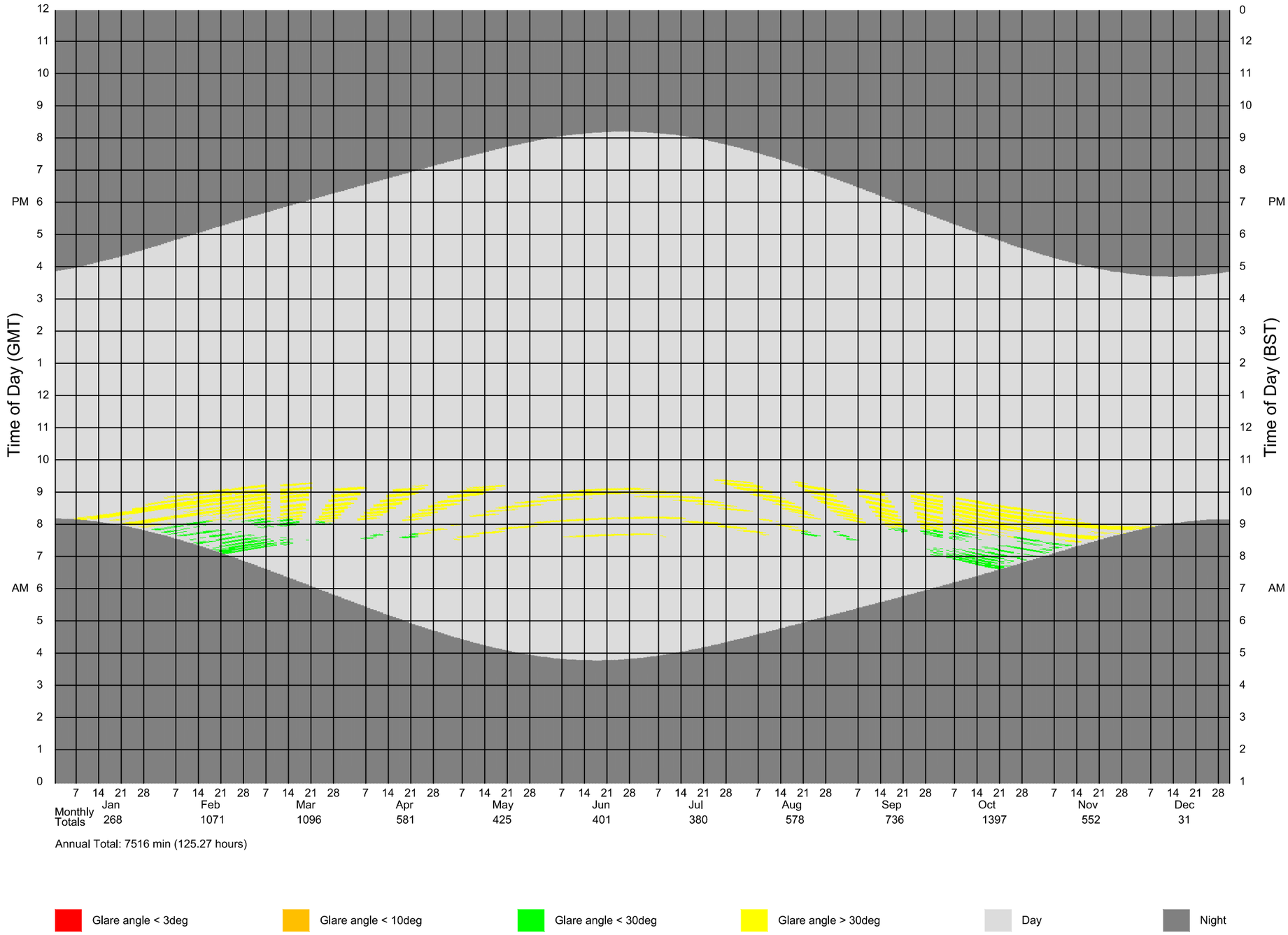
Title: Annual Temporal Solar Glare Analysis
Proposed Scheme 30/08/17
Viewpoint T1

Point 2 Surveyors Ltd,
3rd Floor,
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London WC2E 9AB
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Scheme Confirmed: - Date : -

Drawn By: BW | Scale: N/S @ A3 | Date: Sept 17 | Dwg No: **P1507/SGA/09** | Rel: 1

Annual Temporal Solar Glare Analysis



Sources: Zmapping Ltd.
3D Context Model (dated August 2016)
Reading_230816_Solids.dwg

Scott Brownrigg
Proposed 3D Model (received 20/08/17)
16367-A17-C_SwanHeights [bound].rvt

Key:

Project: The Arc
Reading

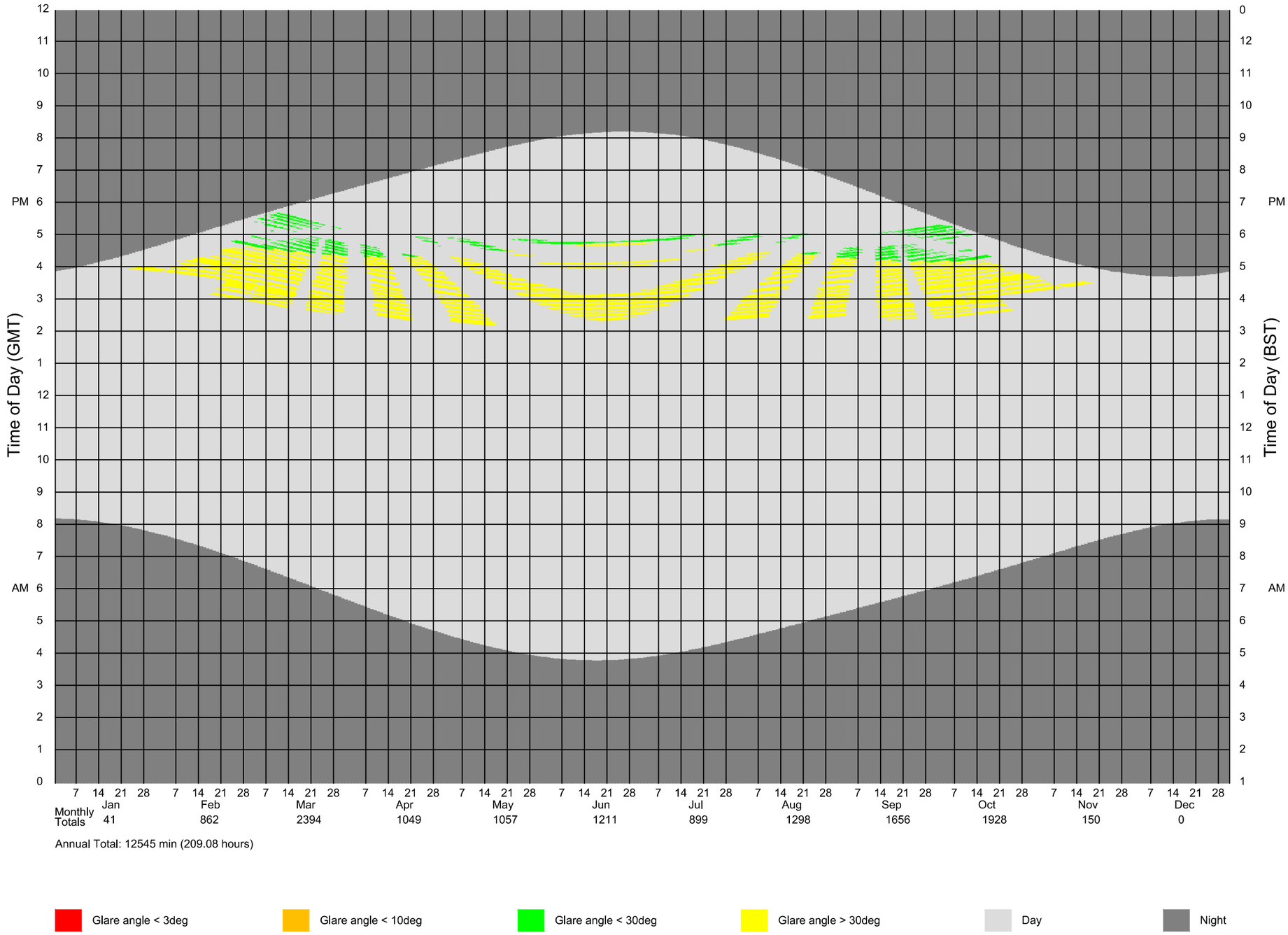
Title: Annual Temporal Solar Glare Analysis
Proposed Scheme 30/08/17
Viewpoint T2

Point 2 Surveyors Ltd,
3rd Floor,
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London WC2E 9AB
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Scheme Confirmed: - Date : -

Drawn By: BW | Scale: N/S @ A3 | Date: Sept 17 | Dwg No: **P1507/SGA/10** | Rel: 1

Annual Temporal Solar Glare Analysis



Sources: Zmapping Ltd.
3D Context Model (dated August 2016)
Reading_230816_Solids.dwg

Scott Brownrigg
Proposed 3D Model (received 20/08/17)
16367-A17-C_SwanHeights [bound].rvt

Key:

Project: The Arc
Reading

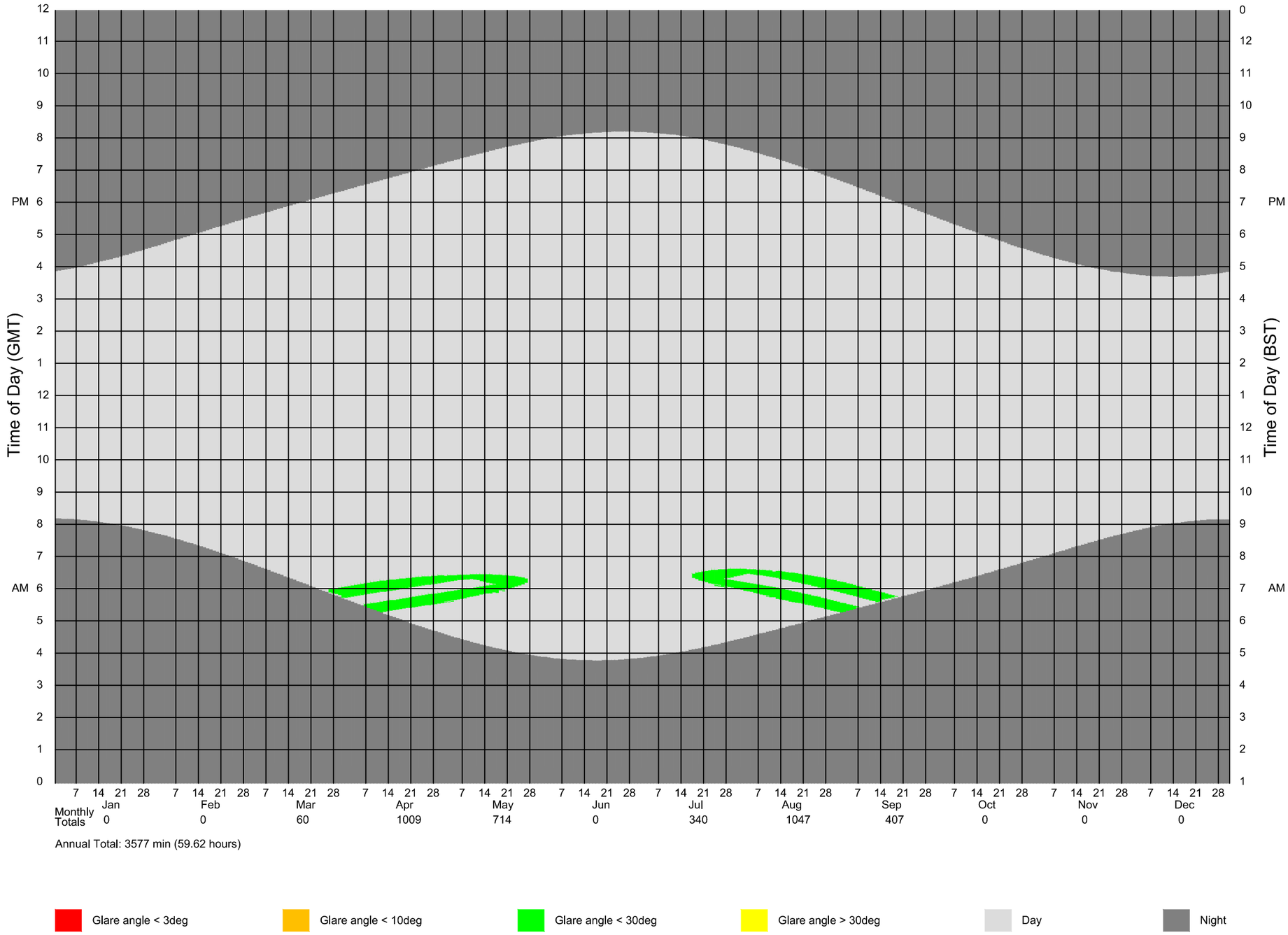
Title: Annual Temporal Solar Glare Analysis
Proposed Scheme 30/08/17
Viewpoint T3

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Scheme Confirmed: - Date : -

Drawn By: BW | Scale: N/S @ A3 | Date: Sept 17 | Dwg No: **P1507/SGA/11** | Rel: 1

Annual Temporal Solar Glare Analysis



Annual Total: 3577 min (59.62 hours)

Glare angle < 3deg | Glare angle < 10deg | Glare angle < 30deg | Glare angle > 30deg | Day | Night

Sources: Zmapping Ltd.
3D Context Model (dated August 2016)
Reading_230816_Solids.dwg

Scott Brownrigg
Proposed 3D Model (received 20/08/17)
16367-A17-C_SwanHeights [bound].rvt

Key:

Project: The Arc
Reading

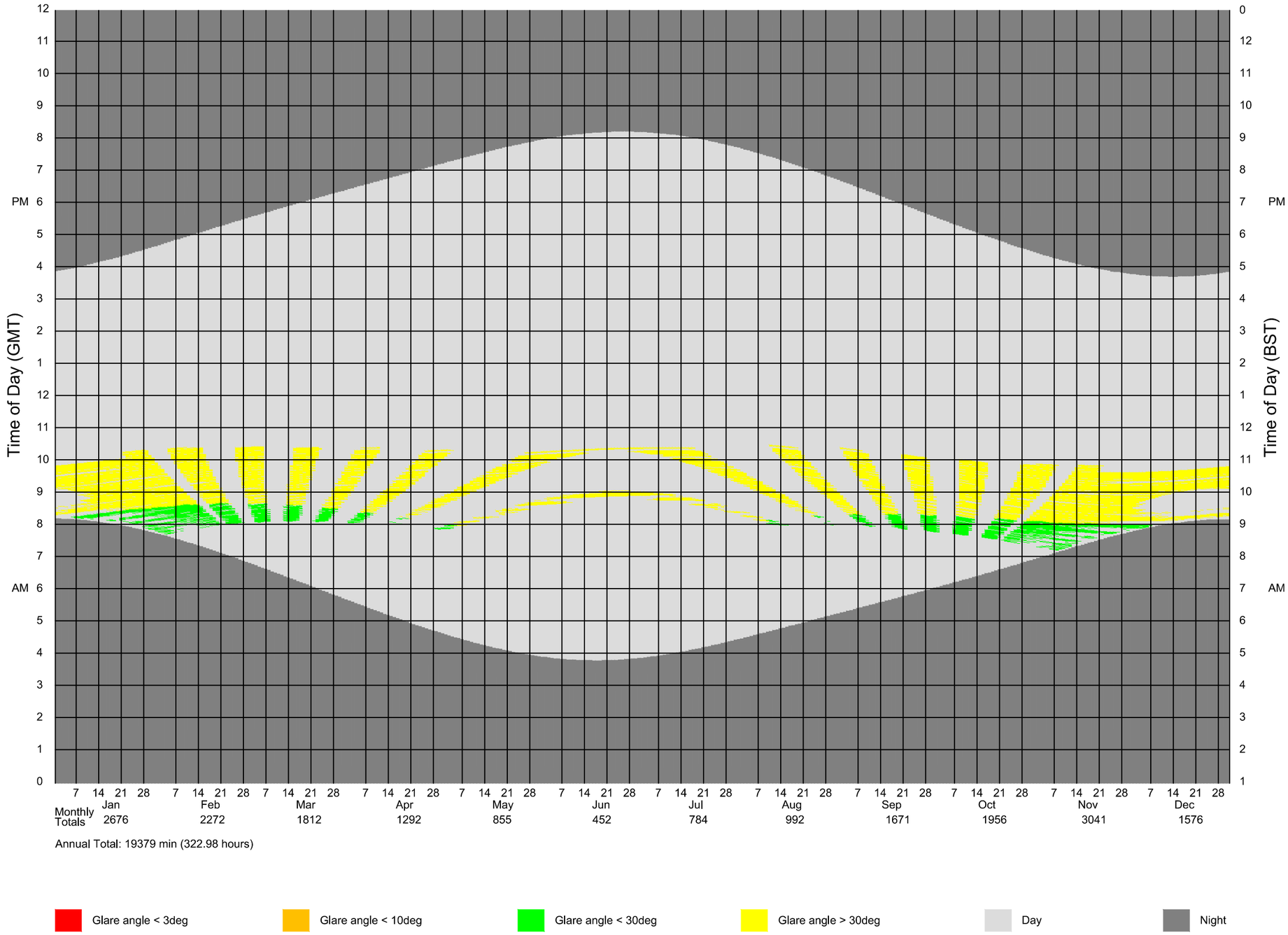
Title: Annual Temporal Solar Glare Analysis
Proposed Scheme 30/08/17
Viewpoint T4

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Scheme Confirmed: - Date : -

Drawn By: BW | Scale: N/S @ A3 | Date: Sept 17 | Dwg No: **P1507/SGA/12** | Rel: 1

Annual Temporal Solar Glare Analysis



Sources: Zmapping Ltd.
3D Context Model (dated August 2016)
Reading_230816_Solids.dwg

Scott Brownrigg
Proposed 3D Model (received 20/08/17)
16367-A17-C_SwanHeights [bound].rvt

Key:

Project: The Arc
Reading

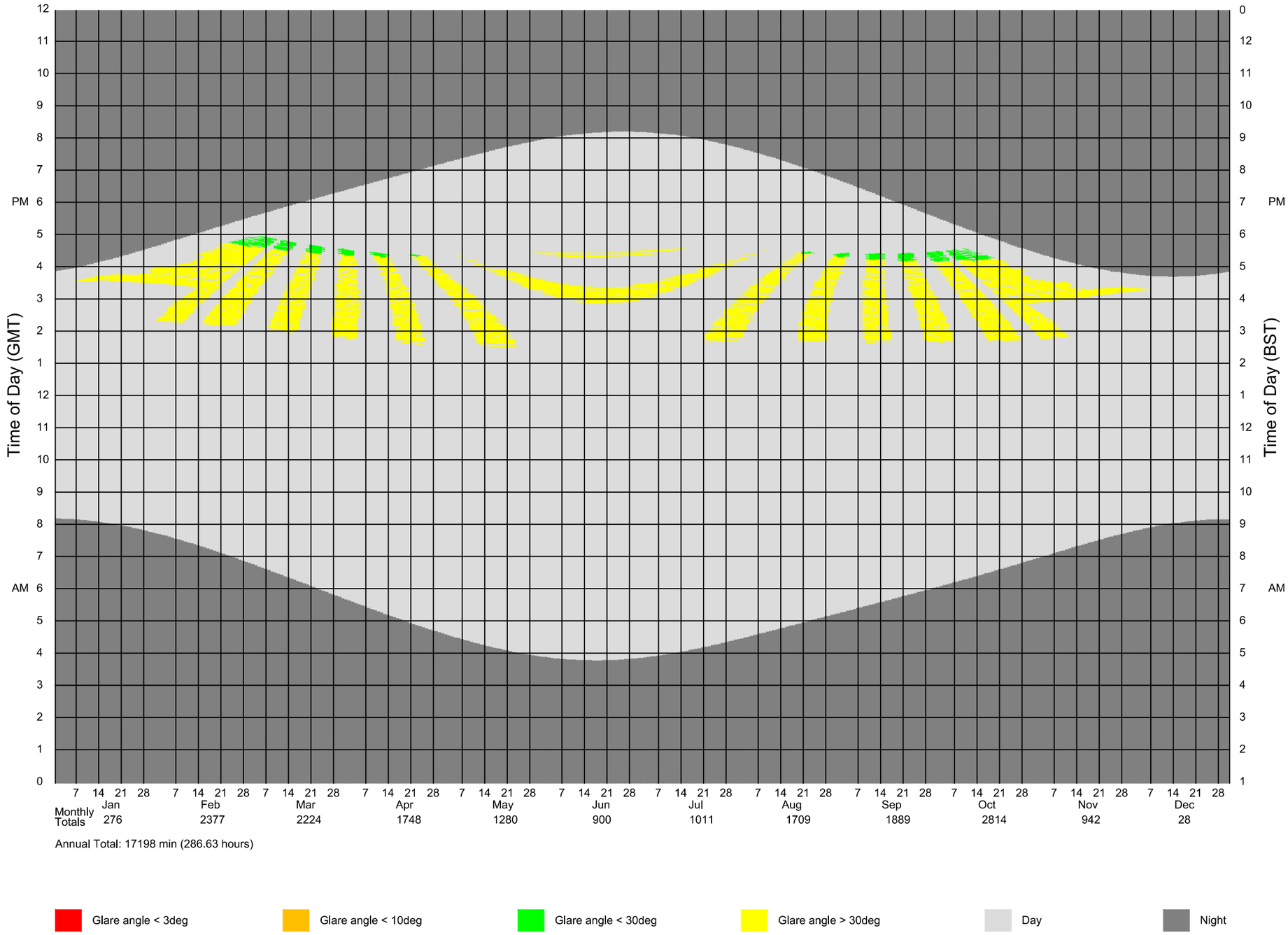
Title: Annual Temporal Solar Glare Analysis
Proposed Scheme 30/08/17
Viewpoint T5

Point 2 Surveyors Ltd,
3rd Floor,
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London WC2E 9AB
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Scheme Confirmed: - Date : -

Drawn By: BW | Scale: N/S @ A3 | Date: Sept 17 | Dwg No: **P1507/SGA/13** | Rel: 1

Annual Temporal Solar Glare Analysis



Sources: Zmapping Ltd.
3D Context Model (dated August 2016)
Reading_230816_Solids.dwg

Scott Brownrigg
Proposed 3D Model (received 20/08/17)
16367-A17-C_SwanHeights [bound].rvt

Key:

Project: The Arc
Reading

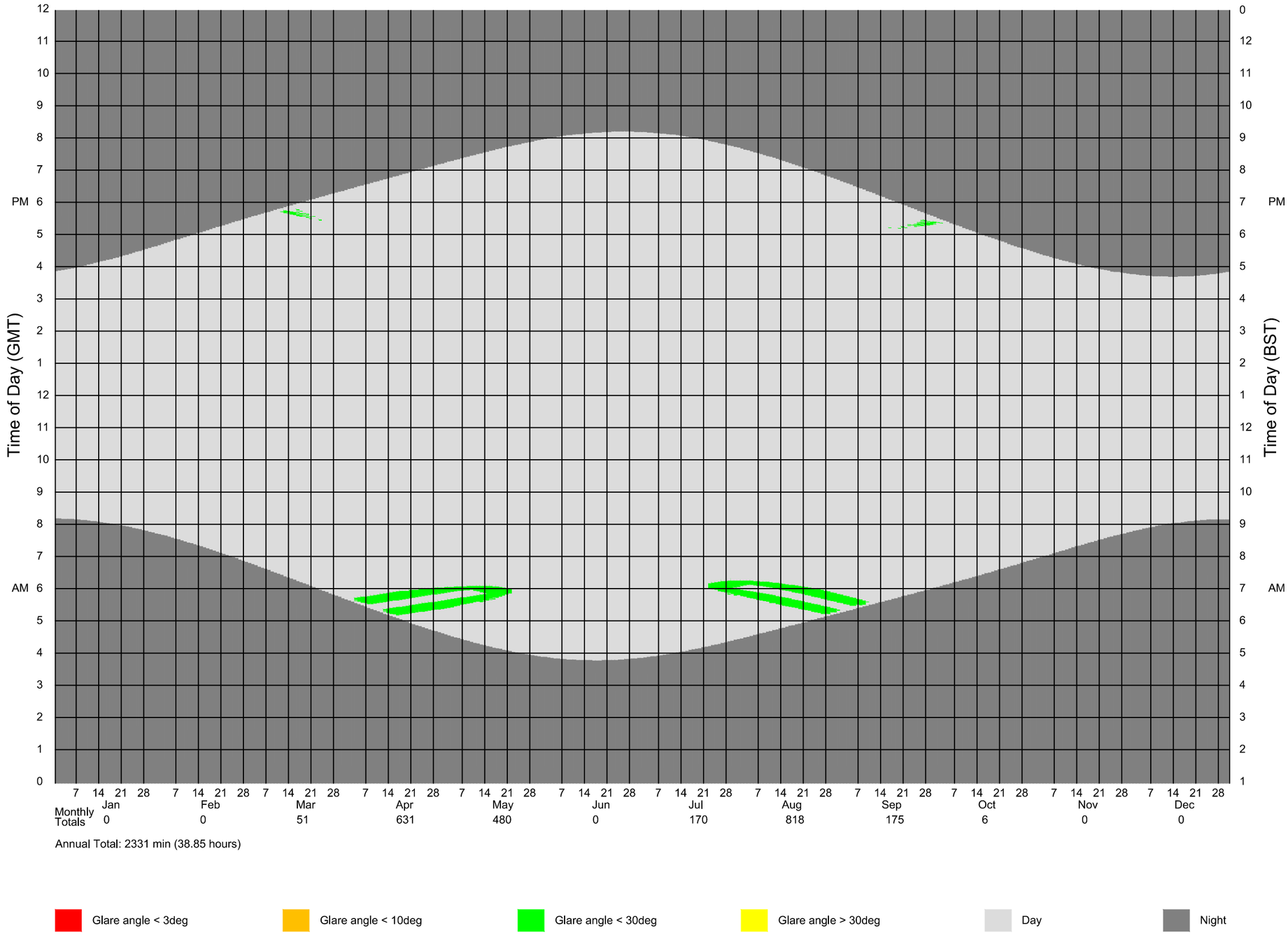
Title: Annual Temporal Solar Glare Analysis
Proposed Scheme 30/08/17
Viewpoint T6

Point 2 Surveyors Ltd,
3rd Floor,
17 Slingsby Place,
London WC2E 9AB
0207 836 5828
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Scheme Confirmed: - Date : -

Drawn By: BW | Scale: N/S @ A3 | Date: Sept 17 | Dwg No: **P1507/SGA/14** | Rel: 1

Annual Temporal Solar Glare Analysis



Sources: Zmapping Ltd.
3D Context Model (dated August 2016)
Reading_230816_Solids.dwg

Scott Brownrigg
Proposed 3D Model (received 20/08/17)
16367-A17-C_SwanHeights [bound].rvt

Key:

Project: The Arc
Reading

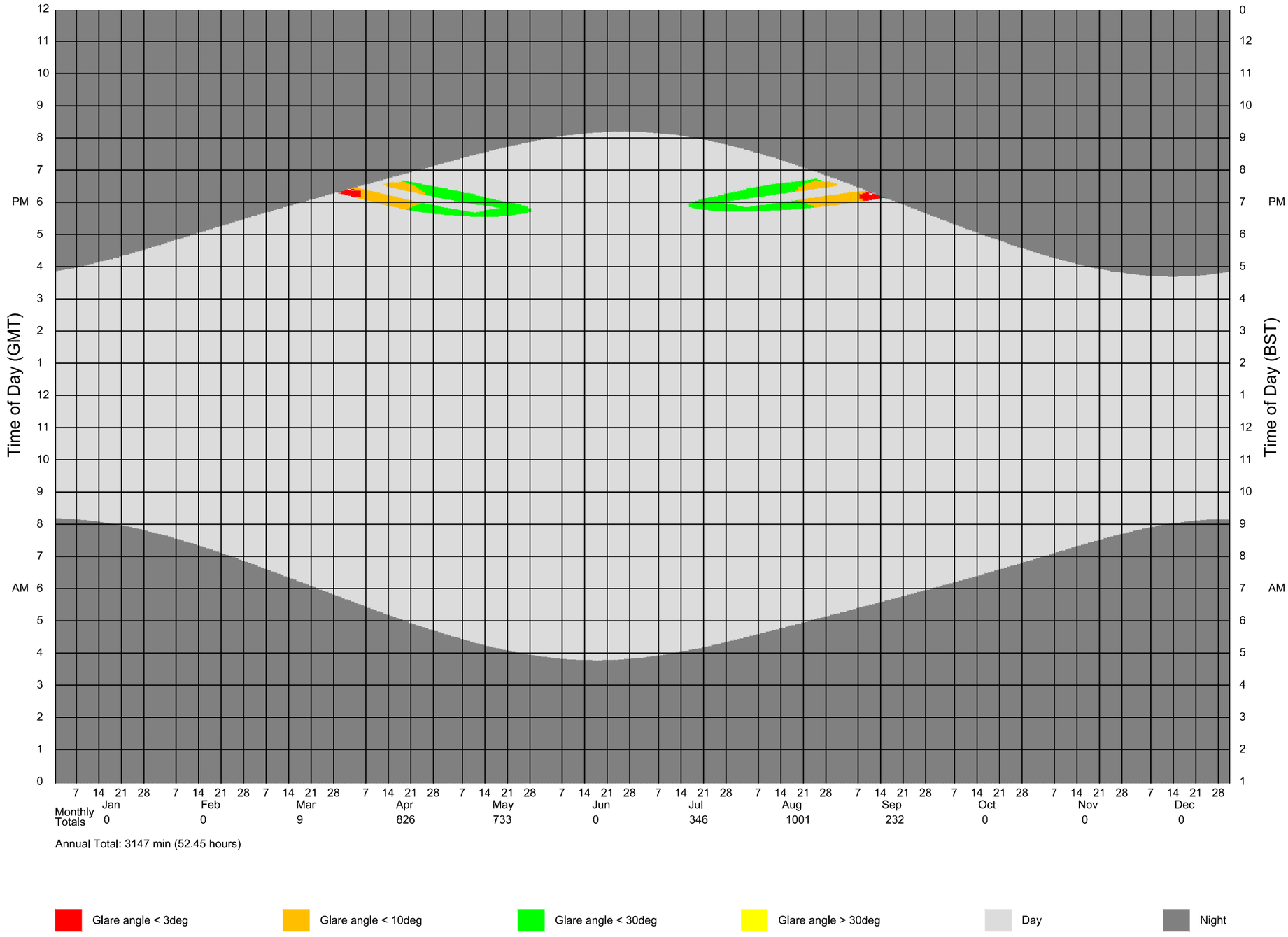
Title: Annual Temporal Solar Glare Analysis
Proposed Scheme 30/08/17
Viewpoint T7

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London WC2E 9AB
0207 836 5828
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Scheme Confirmed: - Date : -

Drawn By: BW | Scale: N/S @ A3 | Date: Sept 17 | Dwg No: **P1507/SGA/15** | Rel: 1

Annual Temporal Solar Glare Analysis



Annual Total: 3147 min (52.45 hours)

Glare angle < 3deg | Glare angle < 10deg | Glare angle < 30deg | Glare angle > 30deg | Day | Night

Sources: Zmapping Ltd.
3D Context Model (dated August 2016)
Reading_230816_Solids.dwg

Scott Brownrigg
Proposed 3D Model (received 20/08/17)
16367-A17-C_SwanHeights [bound].rvt

Key:

Project: The Arc
Reading

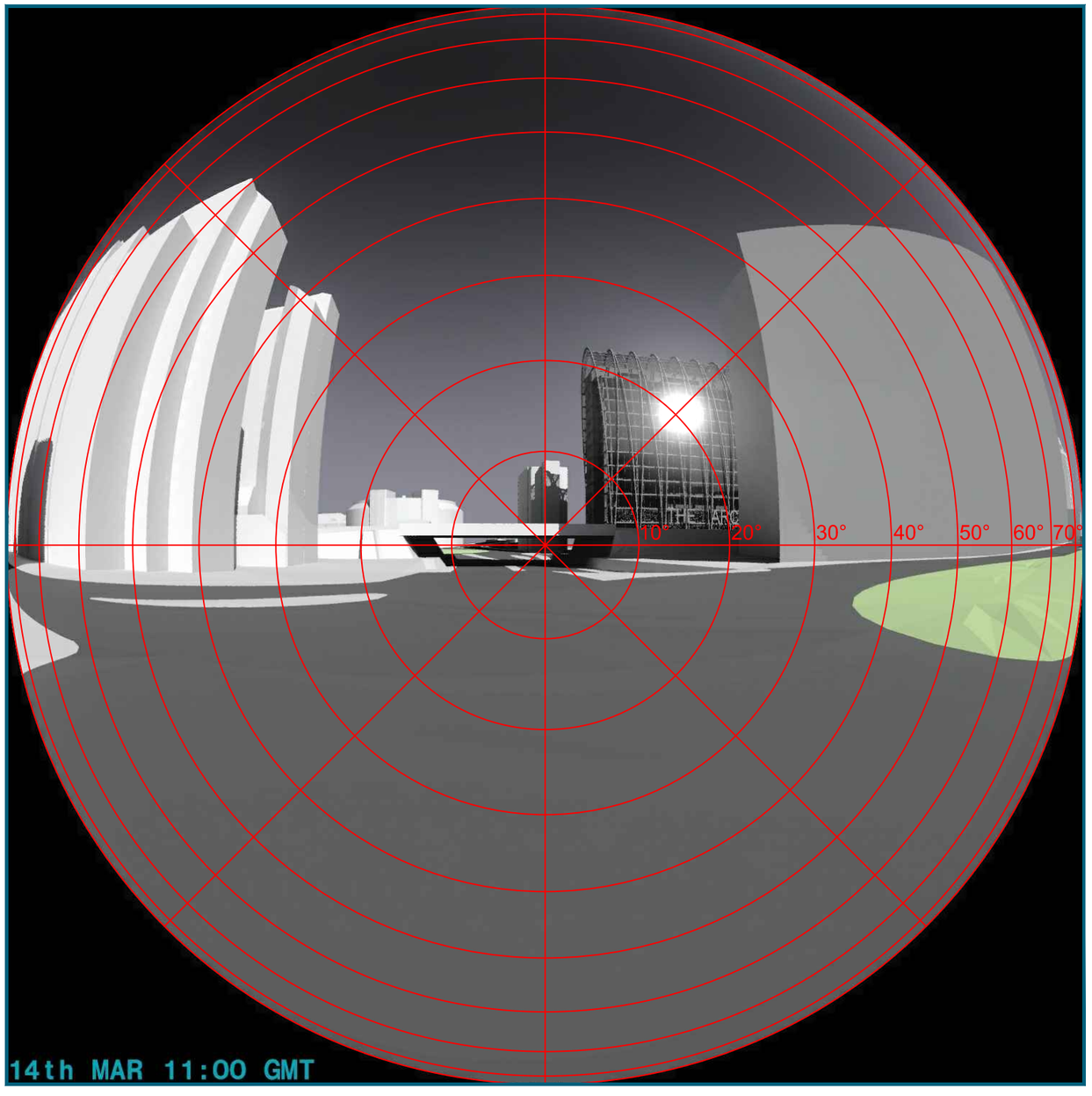
Title: Annual Temporal Solar Glare Analysis
Proposed Scheme 30/08/17
Viewpoint T8

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London WC2E 9AB
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Scheme Confirmed: - Date : -

Drawn By: BW | Scale: N/S @ A3 | Date: Sept 17 | Dwg No: **P1507/SGA/16** | Rel: 1

Appendix D – Solar Glare Visualisations



Sources: Zmapping Ltd.
3D Context Model (dated August 2016)
Reading_230816_Solids.dwg

Scott Brownrigg
Proposed 3D Model (received 20/08/17)
16367-A17-C_SwanHeights [bound].rvt

Key:

Project: The Arc
Reading

Title: Solar Glare Visualisations
Proposed Scheme 30/08/17
Viewpoint R1

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Scheme Confirmed: - Date : -

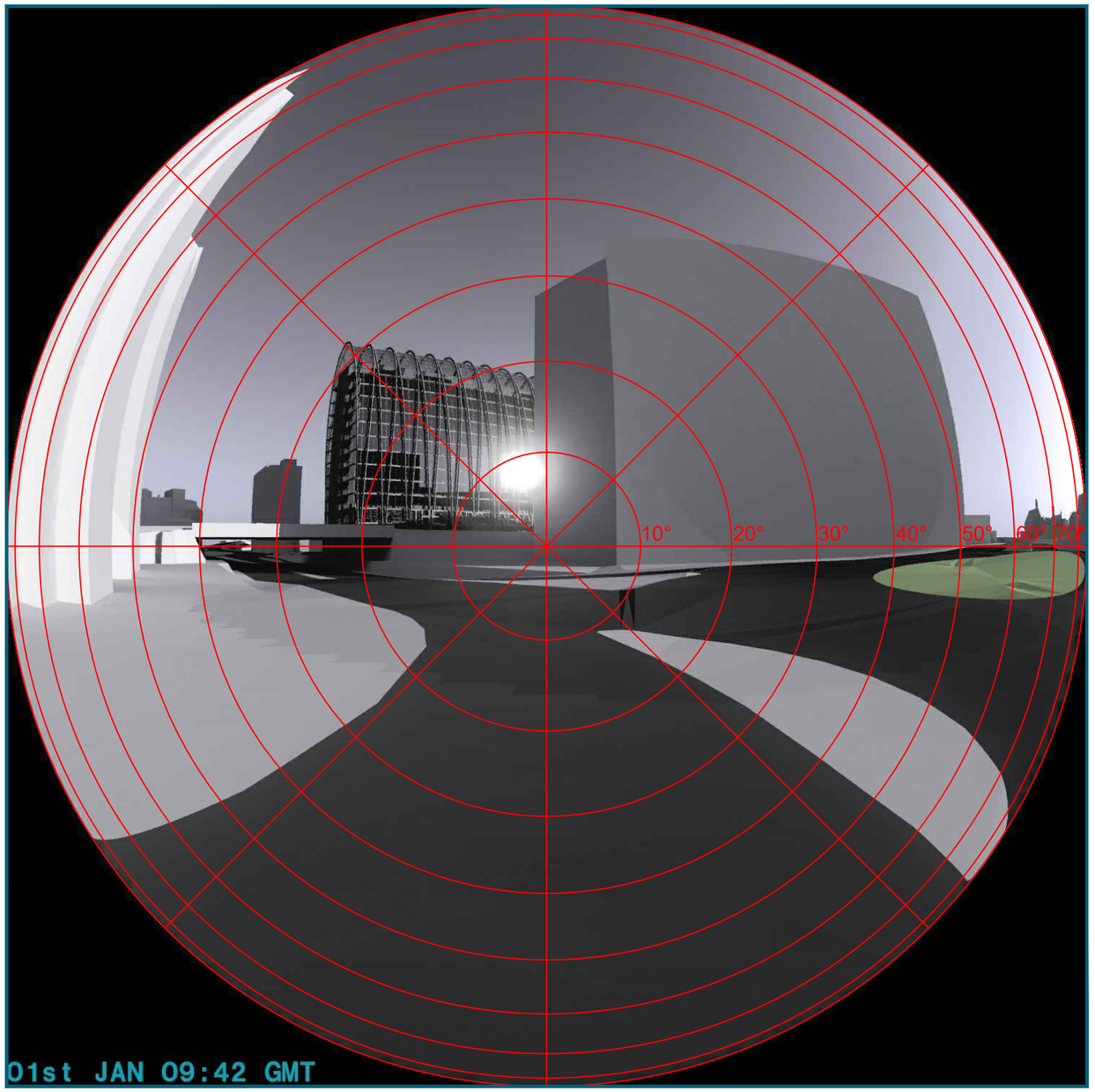
Drawn By: BW

Scale: N/S @ A3

Date: Sept 17

Dwg No: **P1507/SGV/01**

Rel: 1



Sources: Zmapping Ltd.
3D Context Model (dated August 2016)
Reading_230816_Solids.dwg

Scott Brownrigg
Proposed 3D Model (received 20/08/17)
16367-A17-C_SwanHeights [bound].rvt

Key:

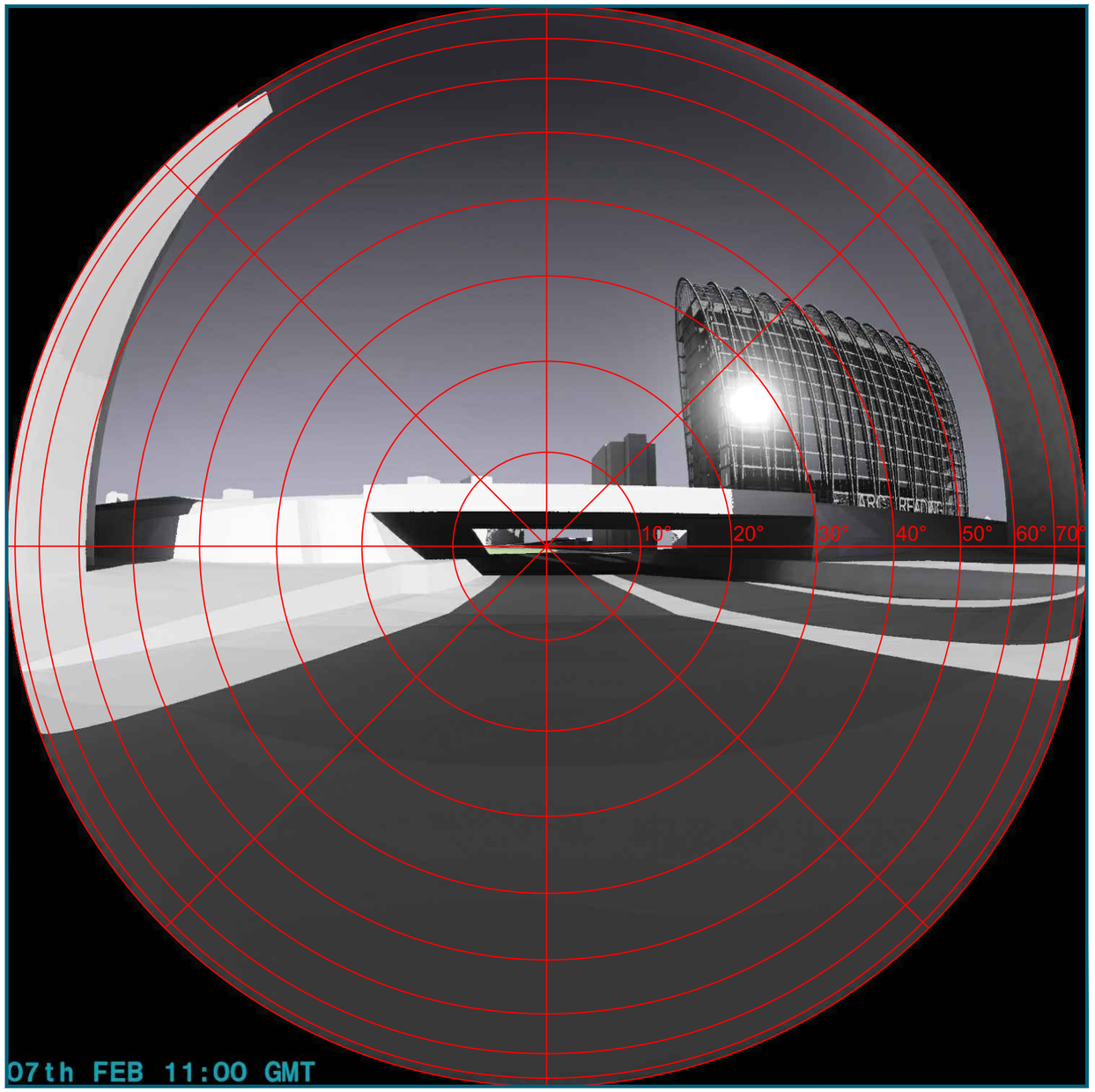
Project: The Arc
Reading

Title: Solar Glare Visualisations
Proposed Scheme 30/08/17
Viewpoint R2

Point 2 Surveyors Ltd,
3rd Floor,
17 Slingsby Place,
London WC2E 9AB
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Scheme Confirmed: - Date : -

Drawn By: BW | Scale: N/S @ A3 | Date: Sept 17 | Dwg No: **P1507/SGV/02** | Rel: 1



Sources: Zmapping Ltd.
3D Context Model (dated August 2016)
Reading_230816_Solids.dwg

Scott Brownrigg
Proposed 3D Model (received 20/08/17)
16367-A17-C_SwanHeights [bound].rvt

Key:

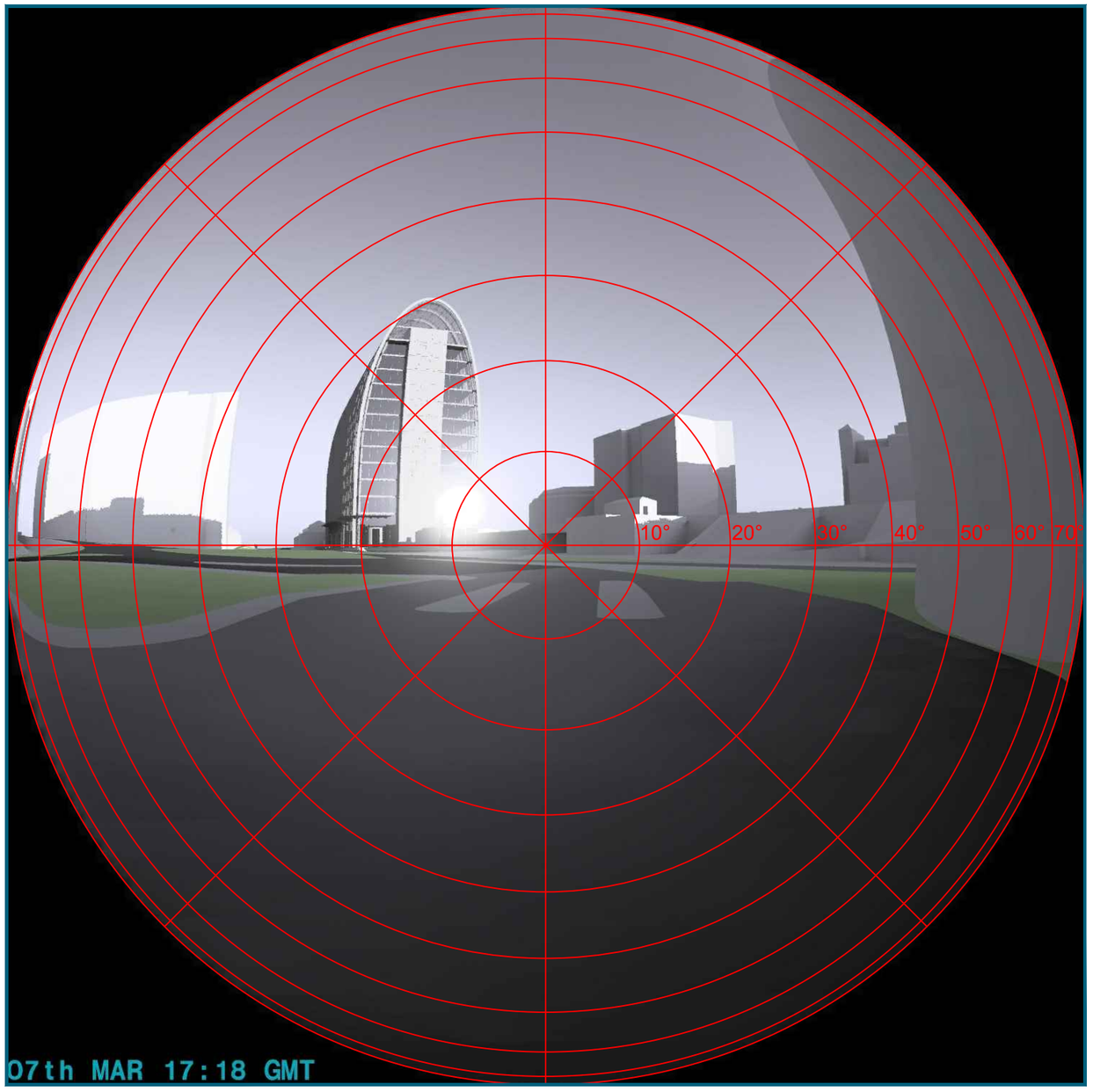
Project: The Arc
Reading

Title: Solar Glare Visualisations
Proposed Scheme 30/08/17
Viewpoint R3

Point 2 Surveyors Ltd,
3rd Floor,
17 Slingsby Place,
London WC2E 9AB
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Scheme Confirmed: - Date : -

Drawn By: BW | Scale: N/S @ A3 | Date: Sept 17 | Dwg No: **P1507/SGV/03** | Rel: 1



Sources: Zmapping Ltd.
3D Context Model (dated August 2016)
Reading_230816_Solids.dwg

Scott Brownrigg
Proposed 3D Model (received 20/08/17)
16367-A17-C_SwanHeights [bound].rvt

Key:

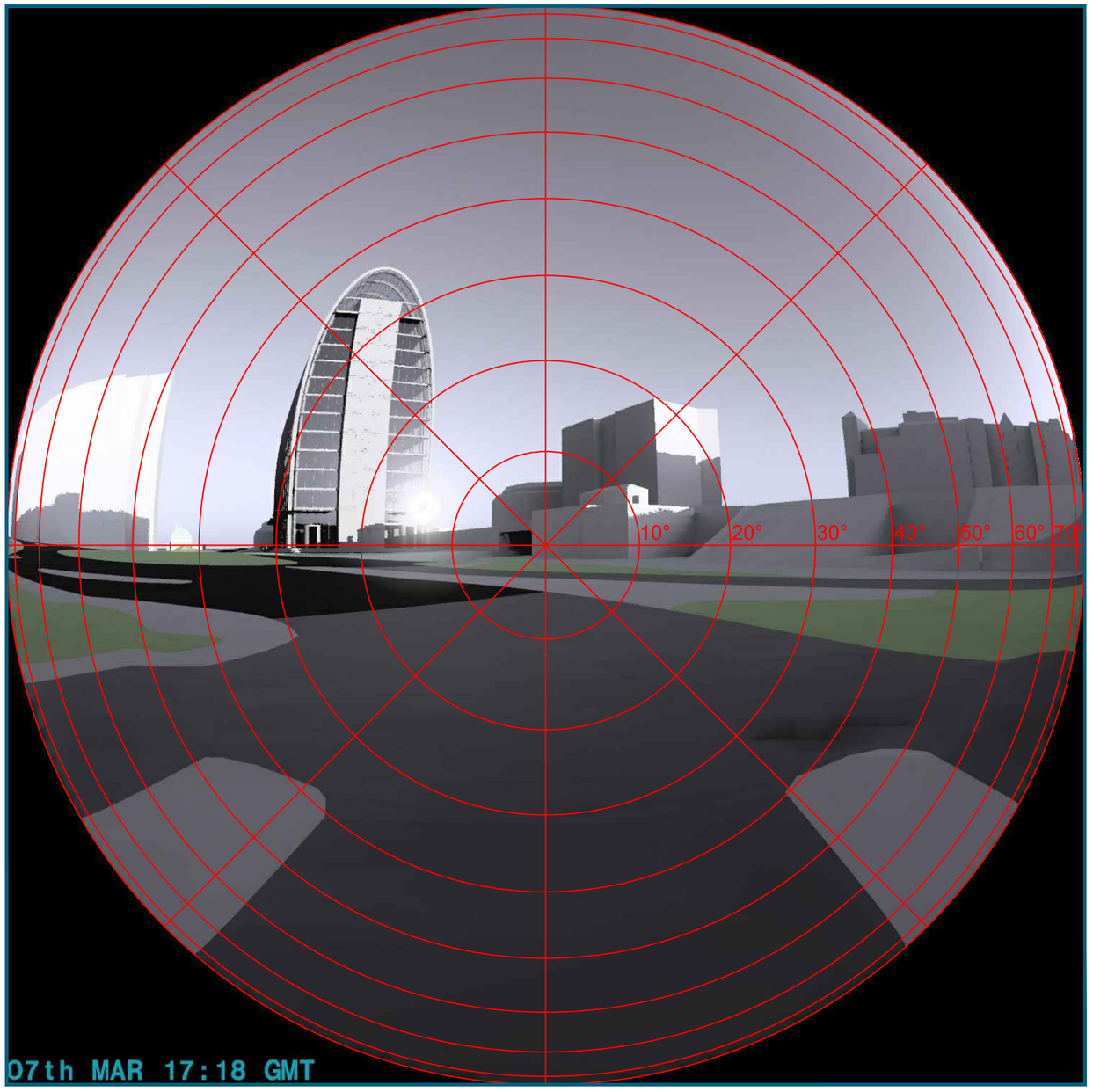
Project: The Arc
Reading

Title: Solar Glare Visualisations
Proposed Scheme 30/08/17
Viewpoint R4

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London WC2E 9AB
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Scheme Confirmed: - Date : -

Drawn By: BW | Scale: N/S @ A3 | Date: Sept 17 | Dwg No: **P1507/SGV/04** | Rel: 1



Sources: Zmapping Ltd.
3D Context Model (dated August 2016)
Reading_230816_Solids.dwg

Scott Brownrigg
Proposed 3D Model (received 20/08/17)
16367-A17-C_SwanHeights [bound].rvt

Key:

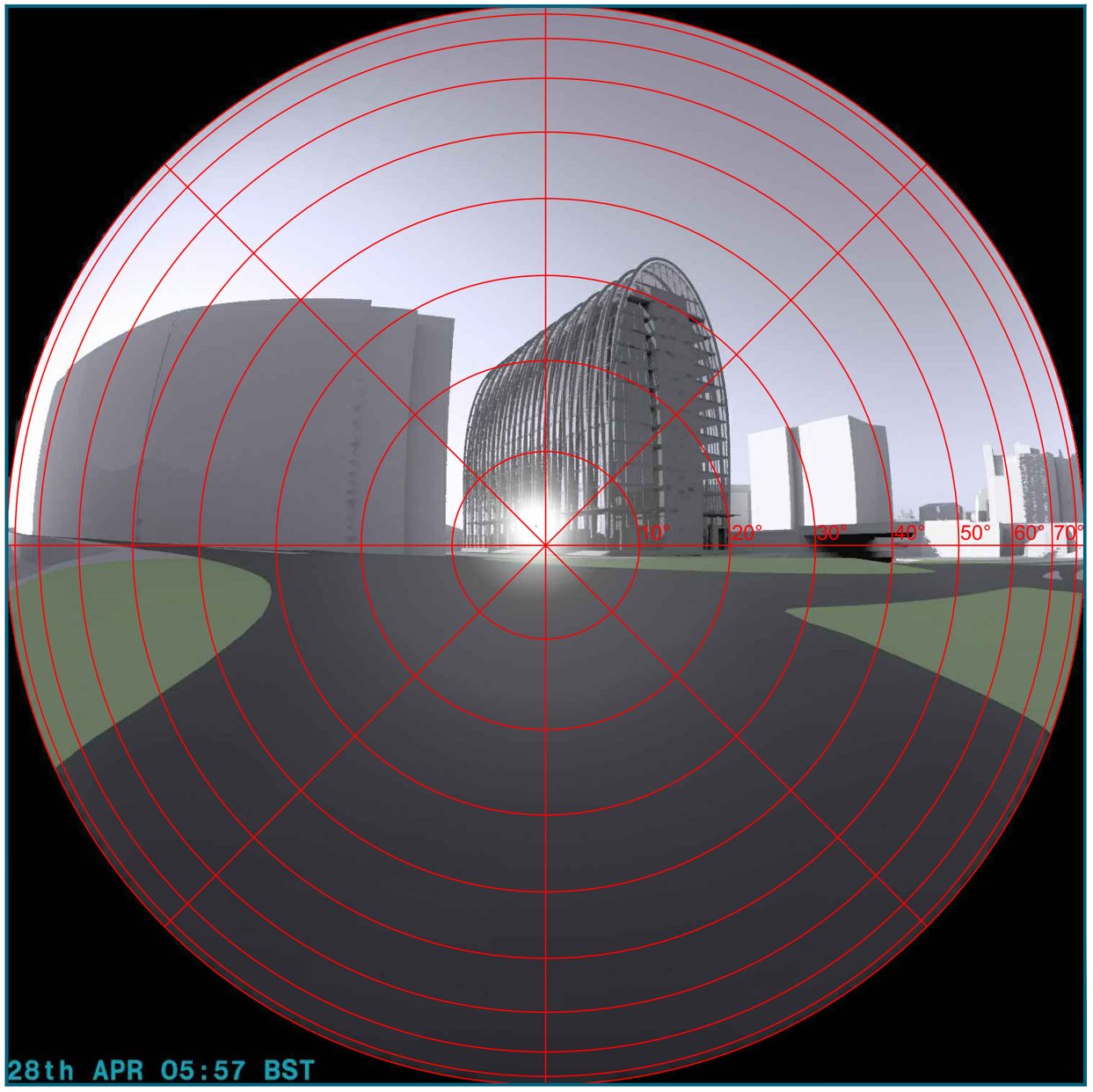
Project: The Arc
Reading

Title: Solar Glare Visualisations
Proposed Scheme 30/08/17
Viewpoint R5

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London WC2E 9AB
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Scheme Confirmed: - Date : -

Drawn By: BW | Scale: N/S @ A3 | Date: Sept 17 | Dwg No: **P1507/SGV/05** | Rel: 1



Sources: Zmapping Ltd.
3D Context Model (dated August 2016)
Reading_230816_Solids.dwg

Scott Brownrigg
Proposed 3D Model (received 20/08/17)
16367-A17-C_SwanHeights [bound].rvt

Key:

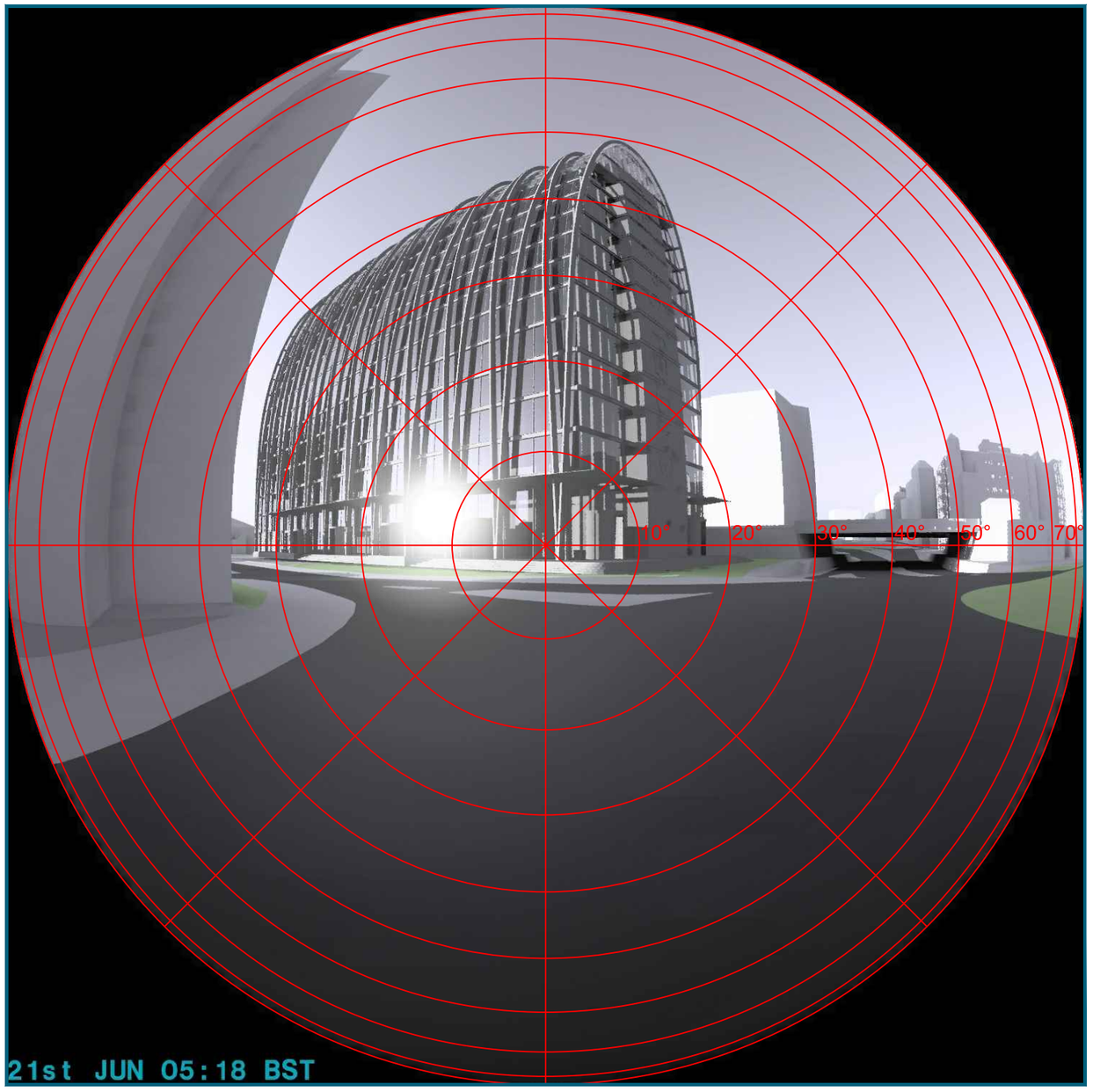
Project: The Arc
Reading

Title: Solar Glare Visualisations
Proposed Scheme 30/08/17
Viewpoint R6

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Scheme Confirmed: - Date : -

Drawn By: BW | Scale: N/S @ A3 | Date: Sept 17 | Dwg No: **P1507/SGV/06** | Rel: 1



Sources: Zmapping Ltd.
3D Context Model (dated August 2016)
Reading_230816_Solids.dwg

Scott Brownrigg
Proposed 3D Model (received 20/08/17)
16367-A17-C_SwanHeights [bound].rvt

Key:

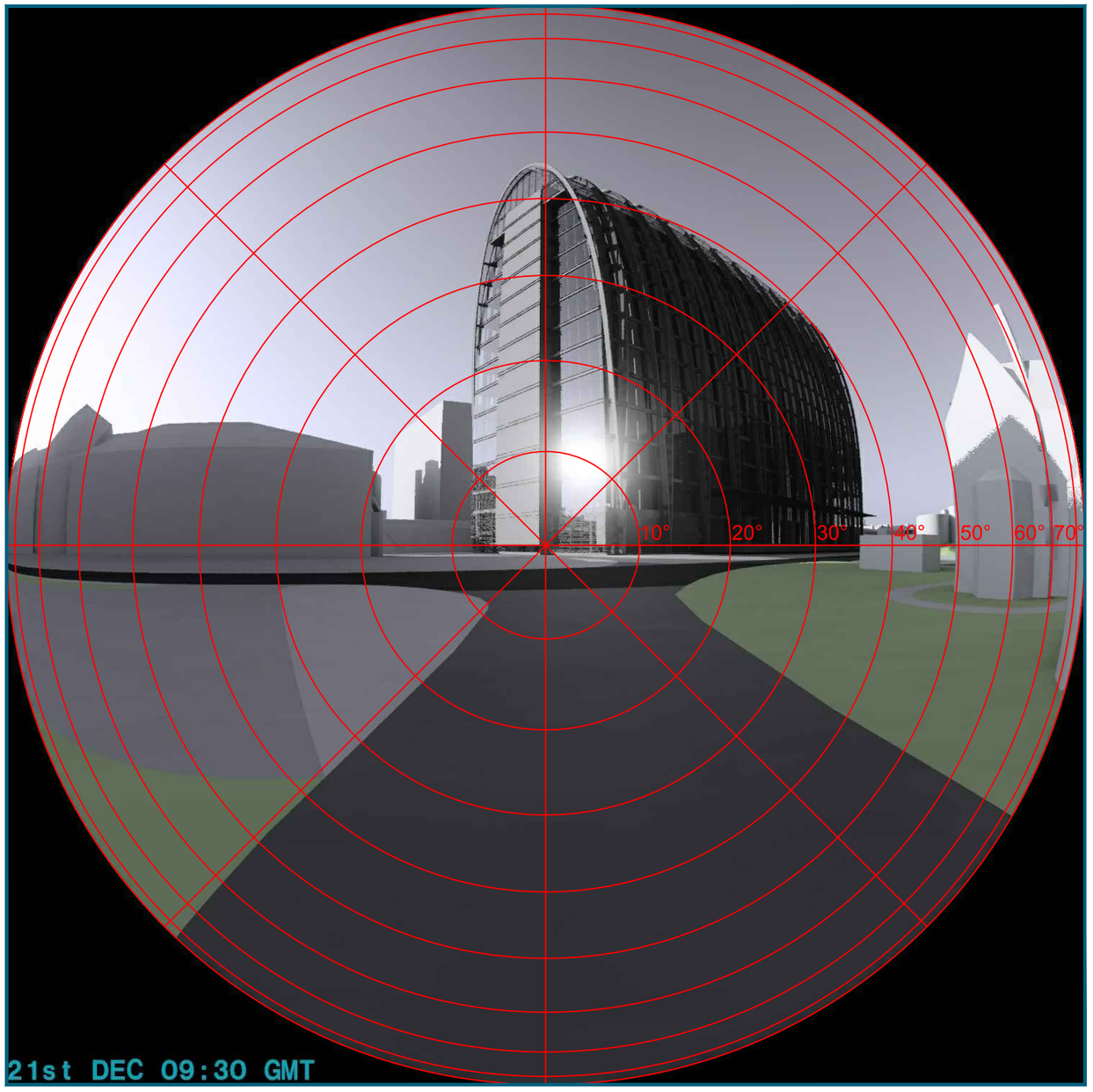
Project: The Arc
Reading

Title: Solar Glare Visualisations
Proposed Scheme 30/08/17
Viewpoint R7

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Scheme Confirmed: - Date : -

Drawn By: BW | Scale: N/S @ A3 | Date: Sept 17 | Dwg No: **P1507/SGV/07** | Rel: 1



Sources: Zmapping Ltd.
3D Context Model (dated August 2016)
Reading_230816_Solids.dwg

Scott Brownrigg
Proposed 3D Model (received 20/08/17)
16367-A17-C_SwanHeights [bound].rvt

Key:

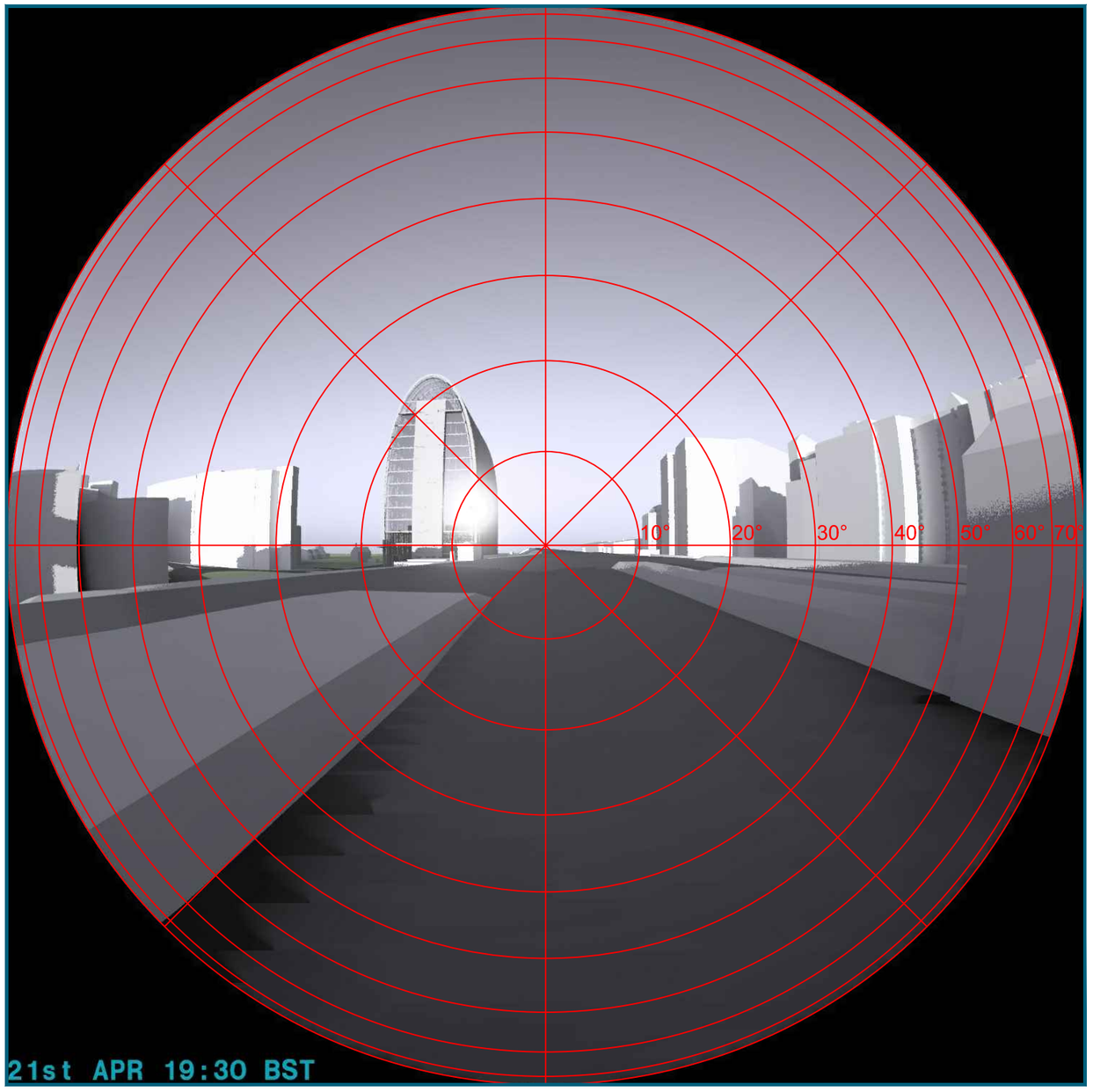
Project: The Arc
Reading

Title: Solar Glare Visualisations
Proposed Scheme 30/08/17
Viewpoint R8

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Scheme Confirmed: - Date : -

Drawn By: BW | Scale: N/S @ A3 | Date: Sept 17 | Dwg No: **P1507/SGV/08** | Rel: 1



Sources: Zmapping Ltd.
3D Context Model (dated August 2016)
Reading_230816_Solids.dwg

Scott Brownrigg
Proposed 3D Model (received 20/08/17)
16367-A17-C_SwanHeights [bound].rvt

Key:

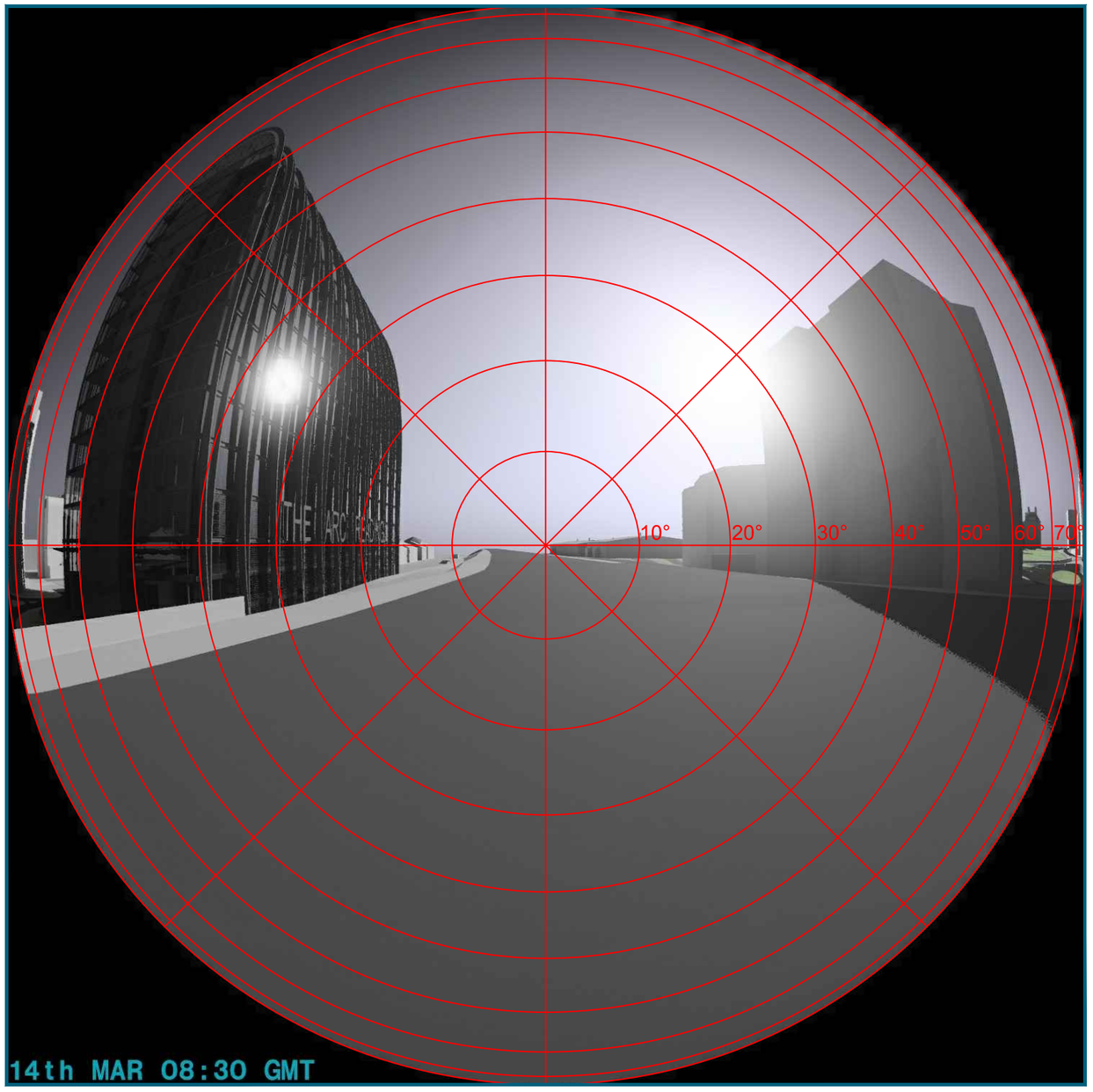
Project: The Arc
Reading

Title: Solar Glare Visualisations
Proposed Scheme 30/08/17
Viewpoint T1

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London WC2E 9AB
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Scheme Confirmed: - Date : -

Drawn By: BW | Scale: N/S @ A3 | Date: Sept 17 | Dwg No: **P1507/SGV/09** | Rel: 1



Sources: Zmapping Ltd.
3D Context Model (dated August 2016)
Reading_230816_Solids.dwg

Scott Brownrigg
Proposed 3D Model (received 20/08/17)
16367-A17-C_SwanHeights [bound].rvt

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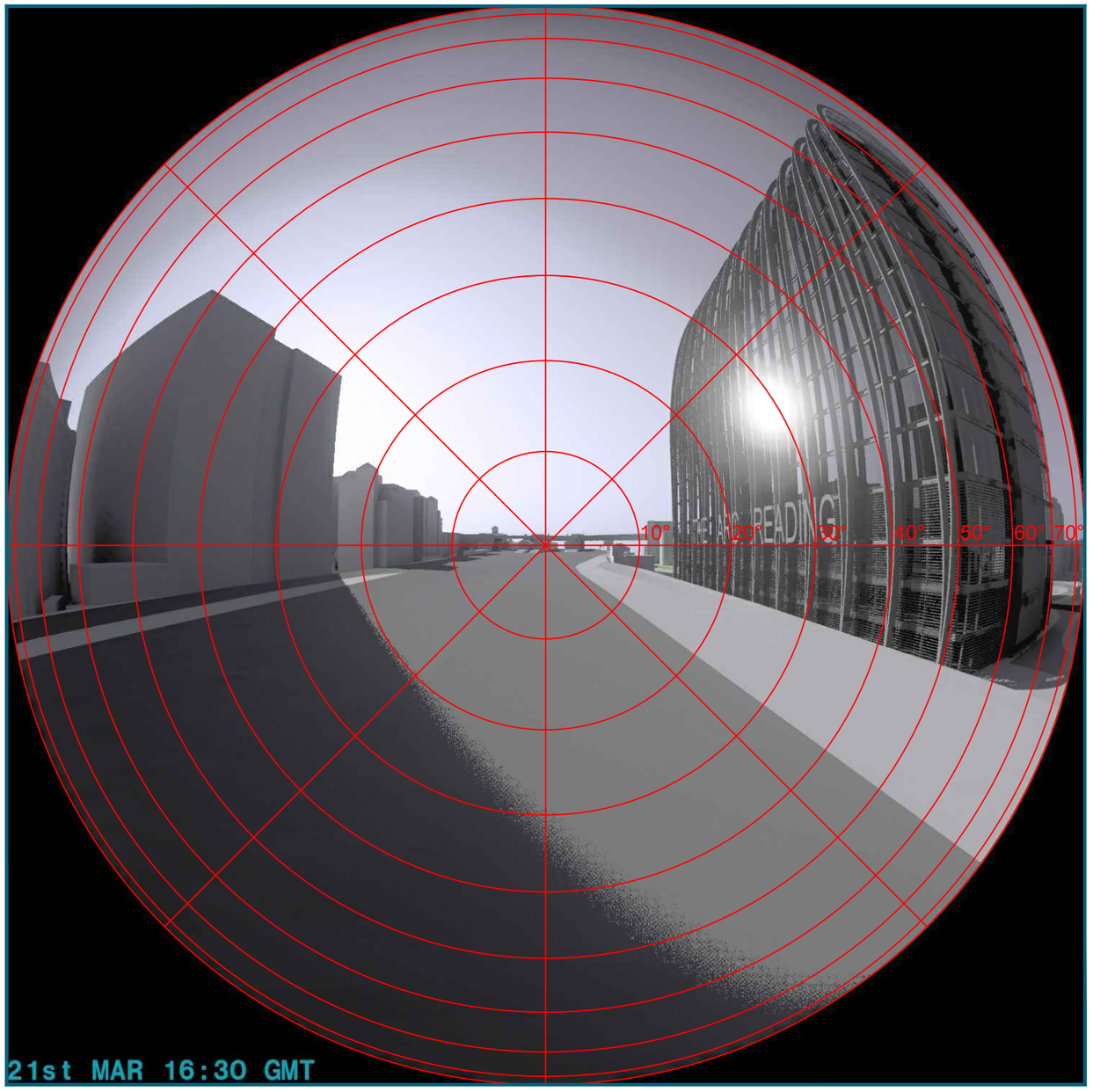
Project: The Arc
Reading

Title: Solar Glare Visualisations
Proposed Scheme 30/08/17
Viewpoint T2

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Scheme Confirmed: - Date : -

Drawn By: BW | Scale: N/S @ A3 | Date: Sept 17 | Dwg No: **P1507/SGV/10** | Rel: 1



Sources: Zmapping Ltd.
3D Context Model (dated August 2016)
Reading_230816_Solids.dwg

Scott Brownrigg
Proposed 3D Model (received 20/08/17)
16367-A17-C_SwanHeights [bound].rvt

Key:

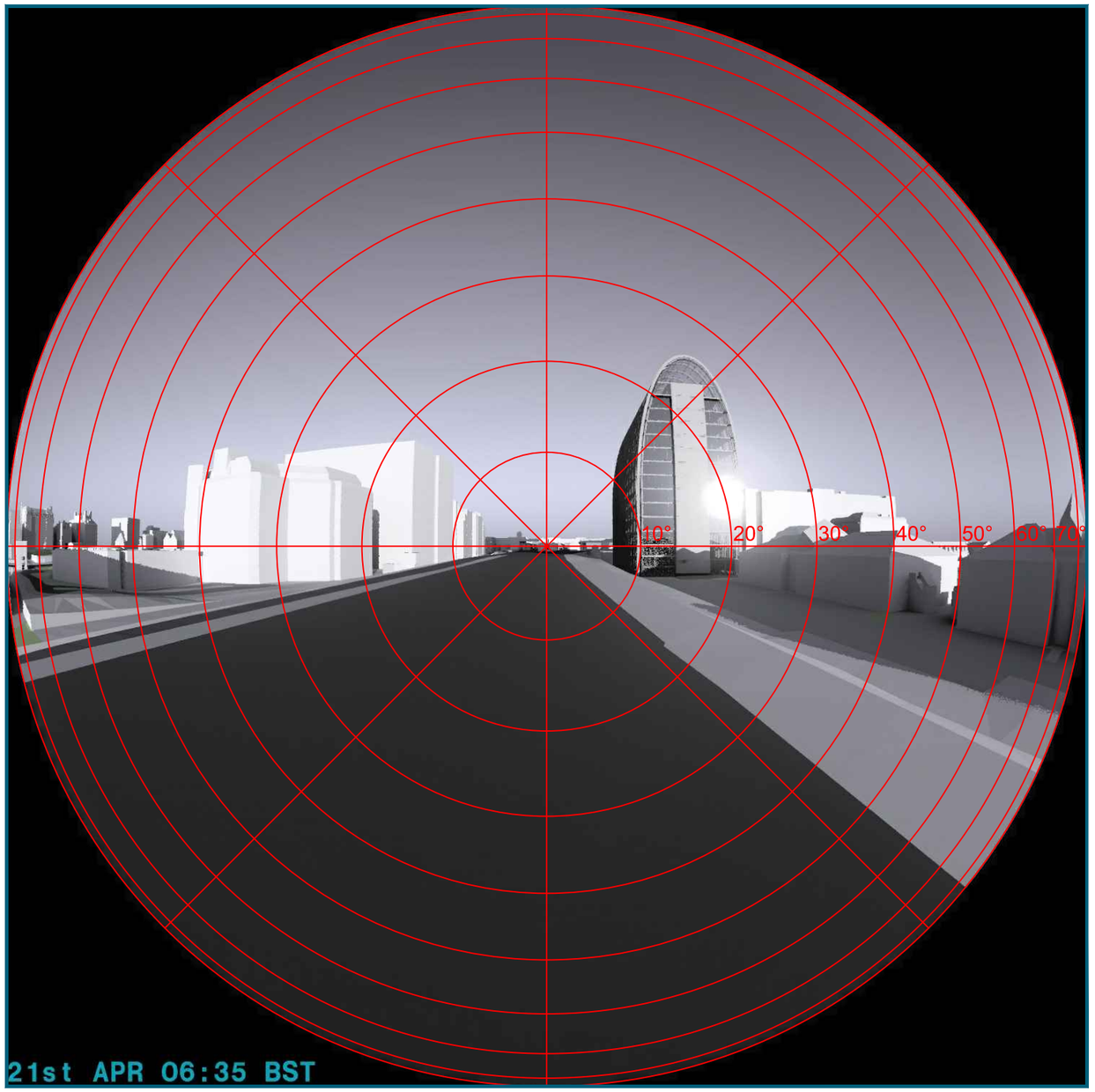
Project: The Arc
Reading

Title: Solar Glare Visualisations
Proposed Scheme 30/08/17
Viewpoint T3

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Scheme Confirmed: - Date : -

Drawn By: BW | Scale: N/S @ A3 | Date: Sept 17 | Dwg No: **P1507/SGV/11** | Rel: 1



Sources: Zmapping Ltd.
3D Context Model (dated August 2016)
Reading_230816_Solids.dwg

Scott Brownrigg
Proposed 3D Model (received 20/08/17)
16367-A17-C_SwanHeights [bound].rvt

Key:

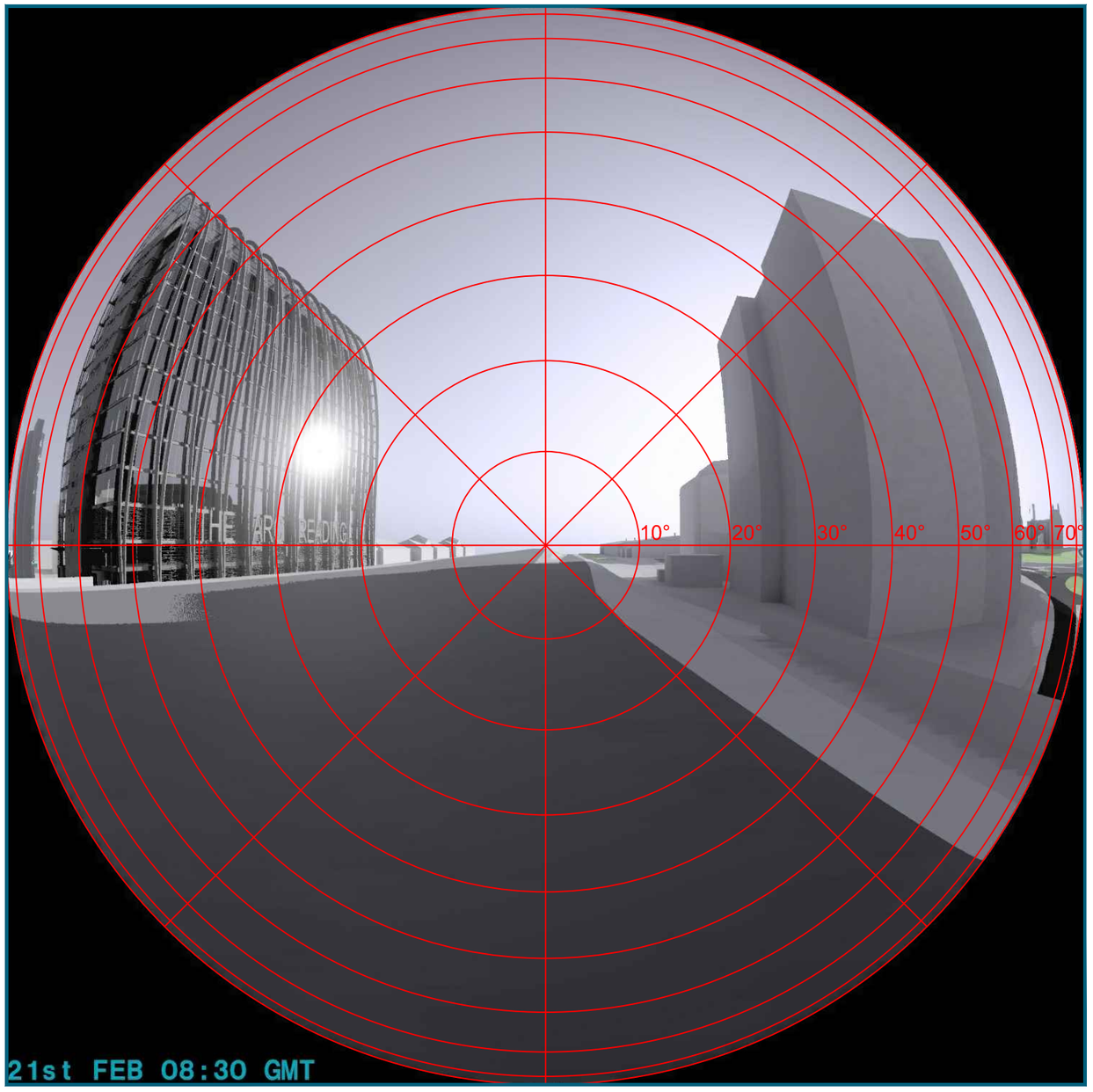
Project: The Arc
Reading

Title: Solar Glare Visualisations
Proposed Scheme 30/08/17
Viewpoint T4

Point 2 Surveyors Ltd,
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London WC2E 9AB
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Scheme Confirmed: - Date : -

Drawn By: BW | Scale: N/S @ A3 | Date: Sept 17 | Dwg No: **P1507/SGV/12** | Rel: 1



Sources: Zmapping Ltd.
3D Context Model (dated August 2016)
Reading_230816_Solids.dwg

Scott Brownrigg
Proposed 3D Model (received 20/08/17)
16367-A17-C_SwanHeights [bound].rvt

Key:

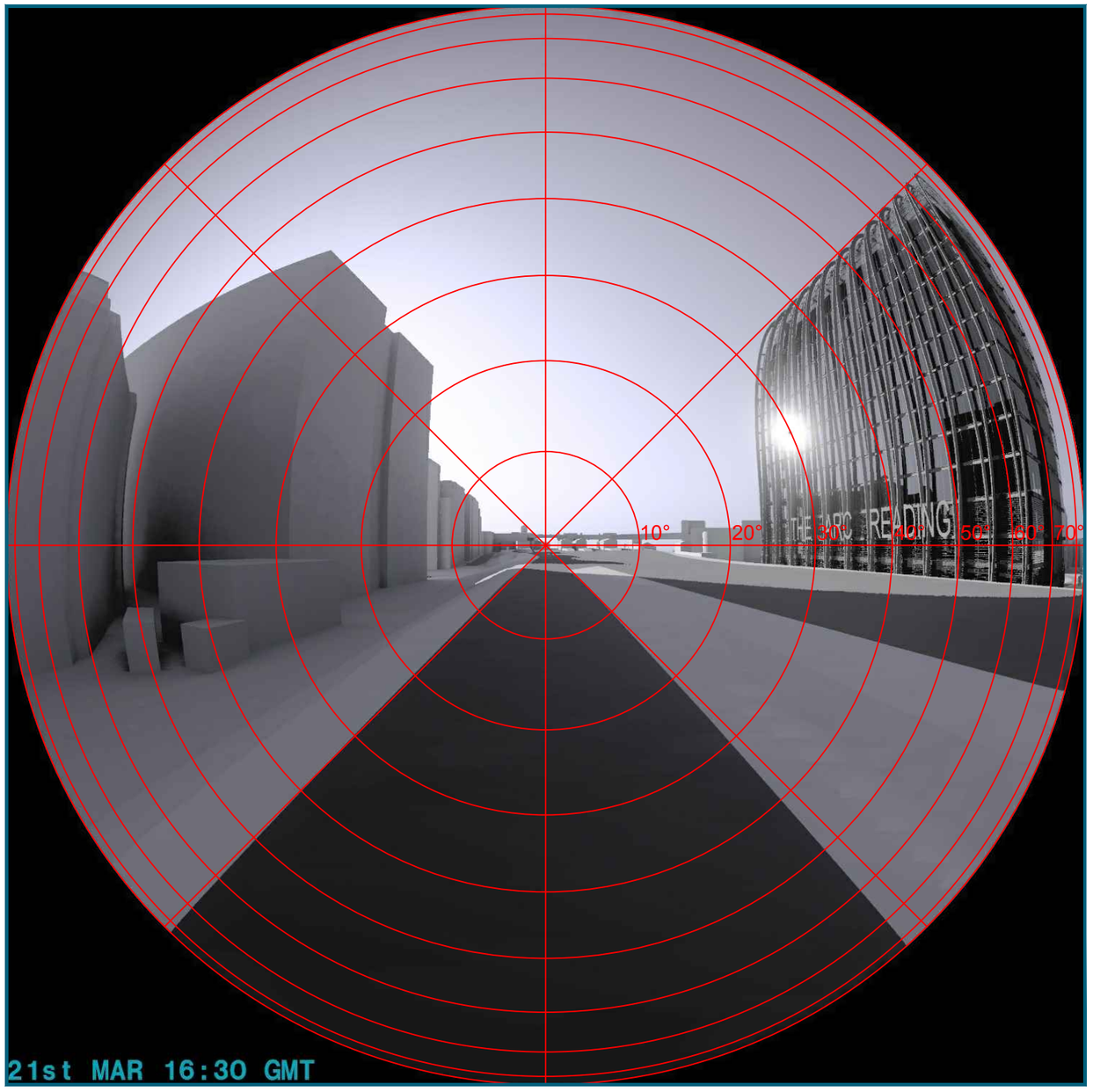
Project: The Arc
Reading

Title: Solar Glare Visualisations
Proposed Scheme 30/08/17
Viewpoint T5

Point 2 Surveyors Ltd,
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Scheme Confirmed: - Date : -

Drawn By: BW | Scale: N/S @ A3 | Date: Sept 17 | Dwg No: **P1507/SGV/13** | Rel: 1



Sources: Zmapping Ltd.
3D Context Model (dated August 2016)
Reading_230816_Solids.dwg

Scott Brownrigg
Proposed 3D Model (received 20/08/17)
16367-A17-C_SwanHeights [bound].rvt

Key:

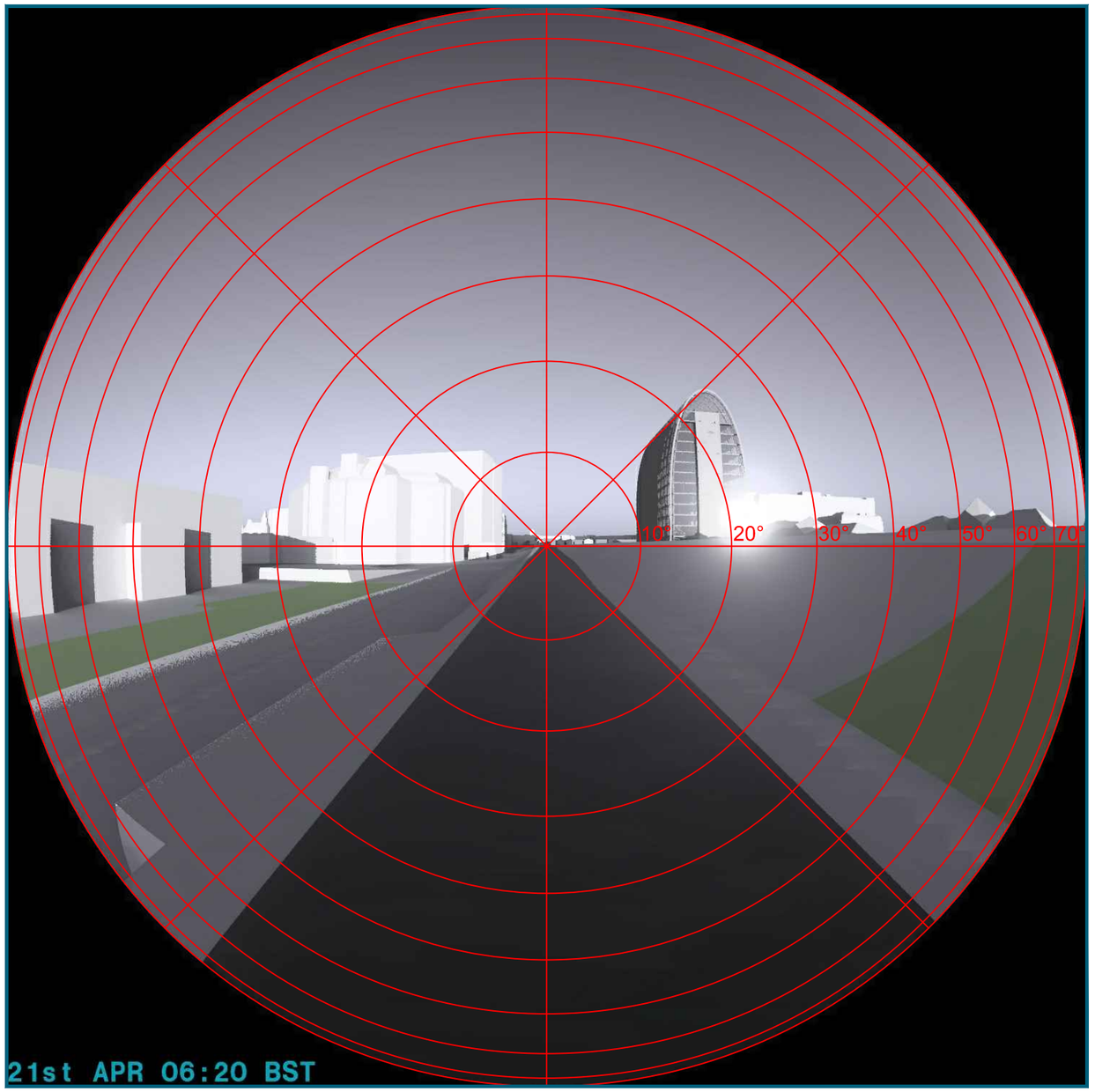
Project: The Arc
Reading

Title: Solar Glare Visualisations
Proposed Scheme 30/08/17
Viewpoint T6

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Scheme Confirmed: - Date : -

Drawn By: BW | Scale: N/S @ A3 | Date: Sept 17 | Dwg No: **P1507/SGV/14** | Rel: 1



Sources: Zmapping Ltd.
3D Context Model (dated August 2016)
Reading_230816_Solids.dwg

Scott Brownrigg
Proposed 3D Model (received 20/08/17)
16367-A17-C_SwanHeights [bound].rvt

Key:

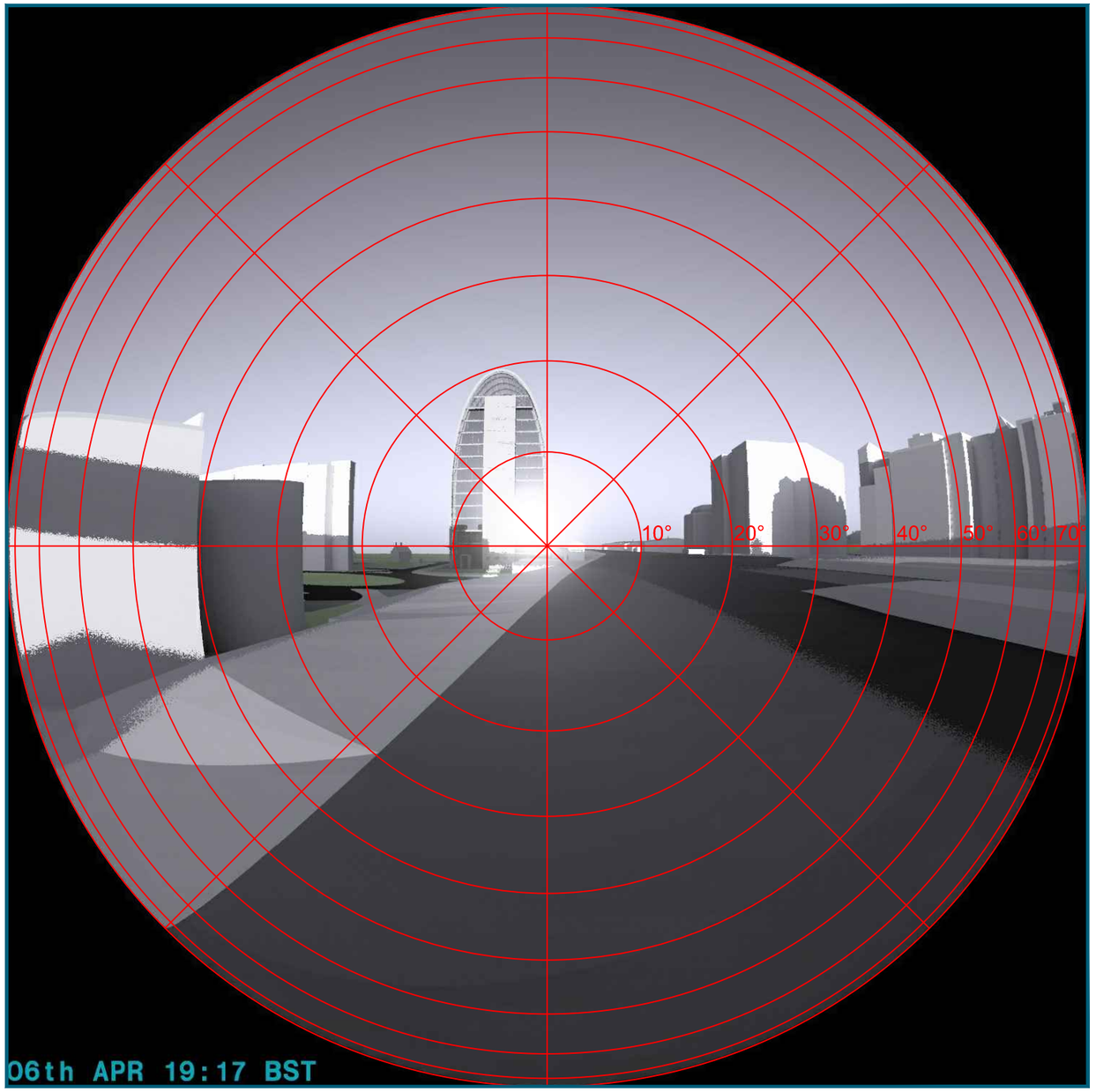
Project: The Arc
Reading

Title: Solar Glare Visualisations
Proposed Scheme 30/08/17
Viewpoint T7

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Scheme Confirmed: - Date : -

Drawn By: BW | Scale: N/S @ A3 | Date: Sept 17 | Dwg No: **P1507/SGV/15** | Rel: 1



Sources: Zmapping Ltd.
3D Context Model (dated August 2016)
Reading_230816_Solids.dwg

Scott Brownrigg
Proposed 3D Model (received 20/08/17)
16367-A17-C_SwanHeights [bound].rvt

Key:

Project: The Arc
Reading

Title: Solar Glare Visualisations
Proposed Scheme 30/08/17
Viewpoint T8

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Scheme Confirmed: - Date : -

Drawn By: BW

Scale: N/S @ A3

Date: Sept 17

Dwg No: **P1507/SGV/16**

Rel: 1