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DAYLIGHT & SUNLIGHT

SOLAR GLARE ASSESSMENT

CIS Tower, Manchester

16 September 2025

GIA No: **23075**

PROJECT DATA:

Client	**Colliers**
Architect	**Simpson Haugh**
Project Title	**CIS Tower, Manchester**
Project Number	**23075**

REPORT DATA:

Report Title	**Solar Glare Assessment**
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Prepared by	**CN**
Checked by	**JF**
Type	

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1 INTRODUCTION

GIA have assessed the proposed scheme in order to ascertain whether solar reflections given off the proposed building's facade will be visible from sensitive viewpoints which may affect road users and train drivers.

1.1 GLARE

Glare is a phenomenon occurring in the eye that is caused by the presence of bright light sources within the visual field. It can lead to visual discomfort and, if the glare source is very bright compared to its surrounding, even be disabling in the sense that objects become hard or impossible to see (Fig. 01 and Fig. 02). This is because they are cloaked by the high intensity glare source, whose light gets scattered within the eye.

The CIE 146:2002 Collection on Glare expresses the latter type of glare more formally as:

"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."

Glare is of particular concern if it affects drivers of motor vehicles or trains, since it might impair the visibility of signals and traffic signs, potentially putting the driver, passengers or other parties at risk.

1.2 GLARE FROM REFLECTED SUNLIGHT

Whether or not a sun reflection will cause an instance of glare depends upon a number of factors, these are summarised below:

- The location of the observer and his view direction;
- The sun's position in the sky, which changes not only with the hour of the day, but with the seasons too;
- The location and orientation of the reflective surface, e.g. a glazed facade, in relation to the observer's view direction;
- The specific quality of the reflective surface, e.g. sheen, specularity, etc.;
- The observer's physiology, e.g. age and eye pigmentation; and
- The background brightness defining the state of adaptation in the observer's eye;

This final point is an important one as the same brightness which could cause glare against a dark background may be perfectly acceptable when looked against a light one. A typical example of adaptation is illustrated in Fig. 01 and Fig. 02 where the same headlights cause glare at night whereas they do not during daytime hours.

Understanding whether solar glare is likely to occur is based on the observer's position and view direction. Given the transitory nature of the phenomenon, due to the sun's constant movement, any glare assessment should be carried out for a number of representative locations and view directions.

Such studies are often carried out with the help of sun path protractors or with the aid of a full three-dimensional computer simulation.

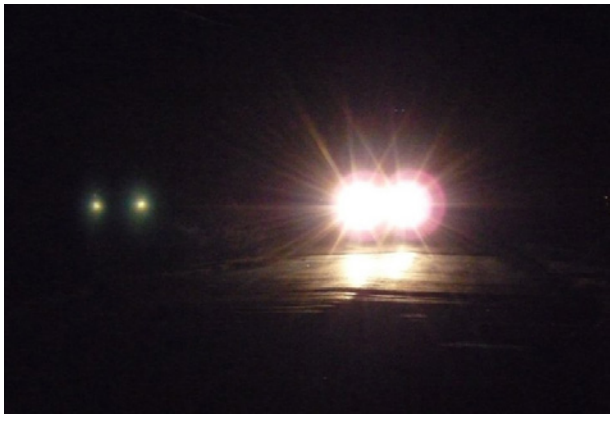


Fig. 01: Headlights at night



Fig. 02: Headlights during day

2 GUIDANCE

In the UK, guidance that is relevant to glare assessments is limited to a short section in the BRE's guidance "Site Layout Planning for Daylight and Sunlight: a guide to good practice" (BR209 - 2022 edition). It suggests that:

"If it is likely that a building may cause solar dazzle the exact scale of the problem should be evaluated. This is done 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. BRE Information Paper IP 3/87 gives details."

BR IP3/87 provides more detailed instructions on why and how solar dazzle can be calculated:

"Glare or dazzle can occur when sunlight is reflected from a glazed facade. For vertical façades this problem usually occurs only when the sun is low in the sky; but some types of modern design incorporate sloping glazed façades which can, under certain circumstances, reflect unwanted high altitude sunlight into the eyes of motorists, pedestrians and people in nearby buildings."

Both BR 209 and BR IP3/87 only deal with geometrical considerations of glare by identifying when and where reflections occur.

The City of London (CoL) published their own guidance in the from of a Planning Advice Note in July 2017. The aim was to establish "Guidelines and best practice for assessing solar glare in the City of London".

The CoL Guidelines distinguish between discomfort glare and disability glare.

"There are two types of reflected glare problem that can occur. Discomfort glare causes visual discomfort without necessarily affecting the ability to see. Disability glare happens when a bright source of light (such as the reflected sun) impairs the vision of other objects.

"Outdoors, disability glare is easily the more serious problem, as it can affect motorists' ability to drive safely. It is especially important at locations where a driver has to make a key decision, for example approaching a road junction, traffic signal or pedestrian crossing. It can also affect train drivers, particularly if they are looking at illuminated signals.

"Discomfort glare is a less dangerous problem because it does not impair the ability to see. It can be important where work involves continuous viewing of the outdoor space from a fixed vantage point, for example in security surveillance."

Because discomfort glare a) does not impair the ability to see; and b) it only needs to be looked at where work involves continuous viewing of the outdoor space from a fixed vantage point – which is clearly to the case for a train driver – GIA's solar glare assessments do not assess disability glare.

The CoL Guidelines also explains with regard to disability glare that:

"If the reflected sun would be visible close to the driver's line of sight, then either a more detailed calculation of solar glare is required, or measures should be taken to reduce the glare."

3 GIA'S APPROACH AND METHODOLOGY

Following the guidance documents referenced above, GIA have developed specialised computer software to undertake reflected glare assessments.

The preparation of reflected solar glare assessments is based upon the steps described below:

- The construction of a 3d-computer model that includes the proposed building and its relevant setting (Paragraph 3.1);
- The physically accurate description of the reflective surface properties (Paragraph 3.2);
- Rendering of stills of the solar reflections (Paragraph 3.3);
- Masking the images to represent the Human Field of View (Para. 3.4); and
- Image analysis of the Static Assessment (Paragraph 3.5)
- The limitations of this apprach and methodology are set out in Paragraph 3.6.

3.1 3D-COMPUTER MODEL

The detailed geometry of the proposed building, and specifically of its facade and glazing configuration, is provided by the project architects either in 2d format (i.e. plans, sections and elevation drawings) or 3d format as a computer model. The received information is processed by GIA and prepared for assessment with our proprietary software. GIA also prepares the context 3d-model from photogrammetry and high resolution stereoscopic aerial photographs, including details relevant for assessment such rail tracks, sleepers, gantries and signals as well as road junctions and traffic lights (where relevant). An example of the detailes included in the solar glare context 3d-model is provided in Fig. 03, Fig. 04 and Fig. 05.

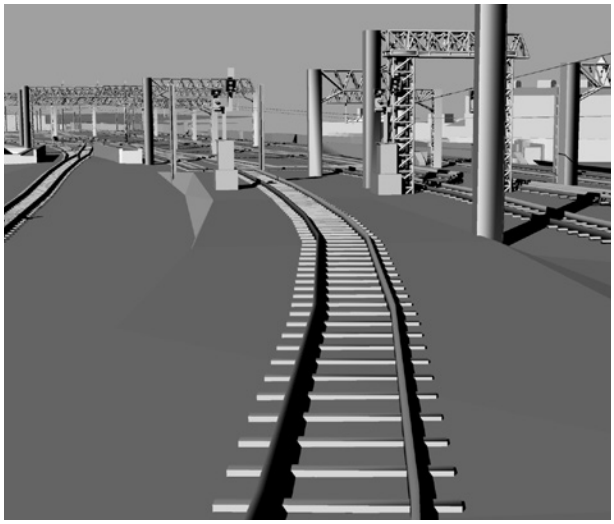


Fig. 03: Computer model of train tracks & signals from photogrammetry

3.2 REFLECTIVE SURFACE PROPERTIES

The static assessment assumes all potential reflective portions of the Proposed Development as "mirrors", therefore portraying an absolute worst-case scenario which is however aimed at identifying whether a reflection can occur or not.



Fig. 04: High-resolution aerial photograph



Fig. 05: High-resolution aerial photograph (close-up)

3.3 RENDERING OF STILLS

As mentioned above, glare is a phenomenon that depends on the observer's location, but also on his view direction.

For road drivers, sensitive viewpoints around the site are selected in locations where reflected solar glare may cause adverse impacts to those travelling towards the Proposed Development. The viewpoints are generally located at the minimum stopping distance and at the driver's eye height. The focal point is a relevant traffic element, such as signals or incoming traffic.

The stopping distance is calculated as the combination of thinking and breaking distances $D_{total} = D_{thinking} + D_{breaking} = V*T + V^2/(2\mu*g)$, where each component is:

V = Relevant vehicle speed, typically the road speed limit.

T = Thinking time (0.67 sec)

μ = Breaking effort (considered 0.65 for cars, 0.5 for buses and 0.031 for trains)

g = Gravity acceleration.

The height of the viewpoint is considered to be 1.5 m for cars, 2.0 m for buses and 2.75 m for trains.

I.e. A viewpoint for car driving at 30 mph would be placed at 23m from a traffic light and at 1.5 m above the ground (see Fig. 06).

For train drivers, the view direction is defined by the rail tracks. UK recommendations set the eye level of the driver at 2.75 m above the rails. The view point is centred between the tracks for ease of reference. Although train drivers sit slightly to the left within the cabin, this bears no material effect on the analysis of the images as the signals are visible at a distance of hundreds of metres at which point the slight shift in the cabin equates to a very small angular change. Fig. 07 shows the typical set up of our viewpoints. Actual trains and driver's cabin are not included in our 3d computer model.

Individual virtual cameras located accordingly in our 3d computer model are spaced between 1 and 3m apart in the direction of travel. Before the stills are compiled, a human field of view mask is overlayed onto them in order to define the angular distance between the instance of reflection and the observer's line of sight.

This procedure allows for the assessment of entire stretches of railway tracks providing a complete overview of potential risks as well as information about signal sighting.

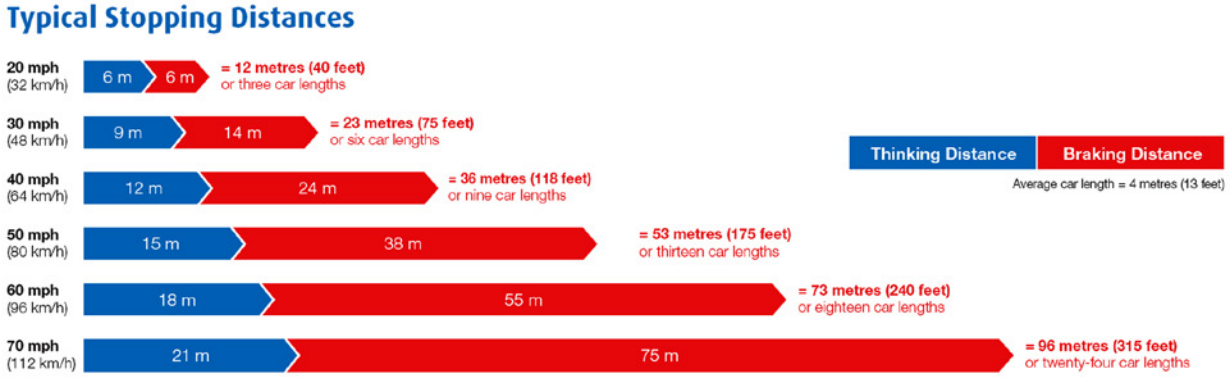


Fig. 06: Typical car stopping distances for various speed limits

3.4 HUMAN FIELD OF VIEW

The field of view is the angular extent within which objects can be observed by one or both eyes. Owing to the arrangement of the human eyes, the stereoscopic visual field extends to approximately 60° either side on the vertical and 90° either side on the horizontal.

In the United Kingdom, the minimum field requirement for driving is 60° either side of the vertical meridian, and 20° above and below horizontal.

The fovea centralis is the central area of the retina. It extends about 3° in all directions. The fovea is responsible for sharp vision that is used for reading, driving, and any other activity where visual detail is important. Fig. 08 shows our typical field of view overlay.

The CIE 146:2002 suggests that occurrences at angles beyond 30° would be of little significance in most situations, but may be relevant in exceptional circumstances. Any reflection within 30° is looked at in greater detail in terms of its duration, size of the reflective surface and where appropriate, predicted intensity.

3.5 STATIC ASSESSMENT

The methodology described below is aimed at addressing the occurrence and duration throughout the year and the location of this occurrence in respect of a driver's line of sight. This will inform the necessity of implementing mitigations at either early or detailed design stage.

For this purpose the glazed facade of the Proposed Development is assumed to have the same properties of a mirror, i.e. it is fully reflective and all of its reflected component is specular. This therefore portrays a worst-case scenario.

The potential for reflected solar glare or dazzle from the glazed or reflective façades of the development are assessed using specialist lighting software.

In Stage 1, stills or a computer animation are generated with which the potential for the occurrence of reflected sunlight is evaluated with regards to the times of the year and hours of the day when this may happen, as well as its relative location to the observer's line of sight.

In order to achieve this, the yearly sun path is mapped onto the sky and colour-coded so that the hours of the day and the period of the year can be distinguished. This sun path is picked up by the reflective elements of the proposed buildings in our rendered stills.

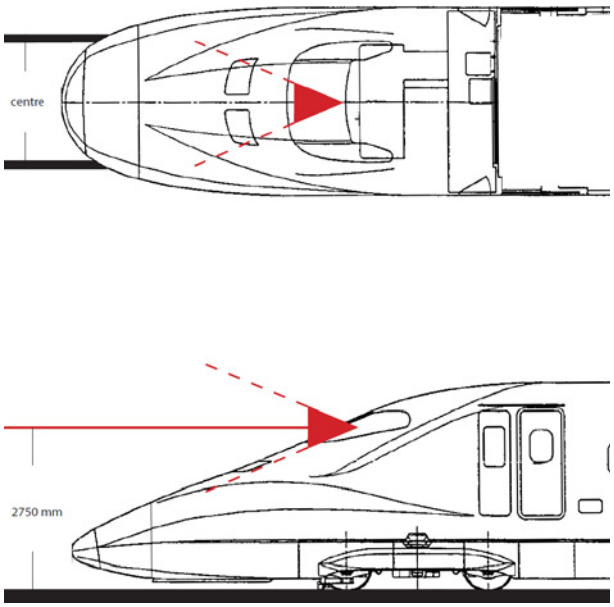


Fig. 07: Driver Viewpoint

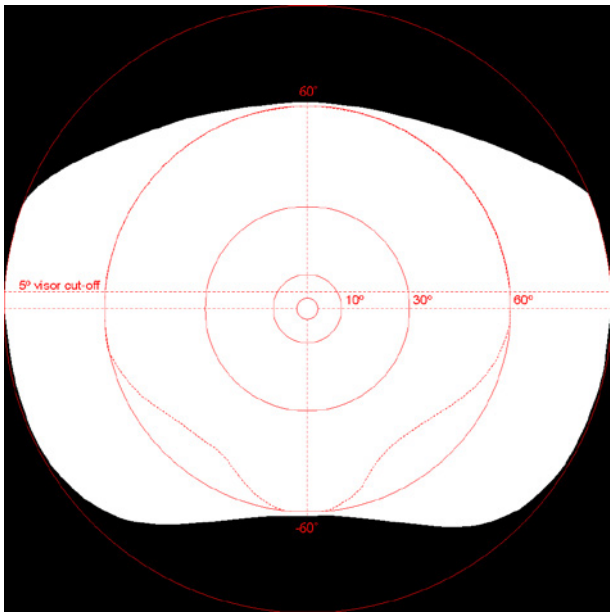


Fig. 08: Typical human field of view

Fig. 09 shows the colour coded sunpaths projected onto the sky dome to visualise the time of day and season during which solar reflections occur.

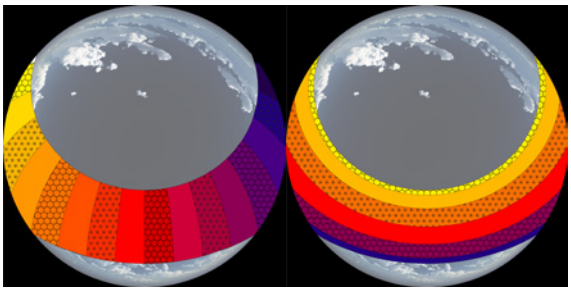


Fig. 09: Stage 1 - Colour coded sunpath for time of day and seasons

Two identical viewpoints are rendered as shown in Fig. 10 and Fig. 11: one focusing on the times of the day when the reflection would be visible, and the second looking at the months throughout the year.

The following guidance is used to determine whether an intensity study is necessary:

- Solar reflections are visible within 30° to 10° of the driver's line of sight for a long period of time (large reflective surface) or between 10° to 5° for a short period of time;
- Solar reflections are visible within 10° and 5° of the driver's line of sight occurring for a long period of time;
- Solar reflections are visible within 5° of a driver's line of sight;

3.6 LIMITATIONS

Great care is taken in identifying typical viewpoints around a new development. However, this does not guarantee that all sensitive locations where reflected solar glare could present a particular risk are covered, especially where these are farther away from the site.

IMPORTANT: The hours shown in the diagrams and described in the text reflect solar time and therefore do not take British Summer Time into account.

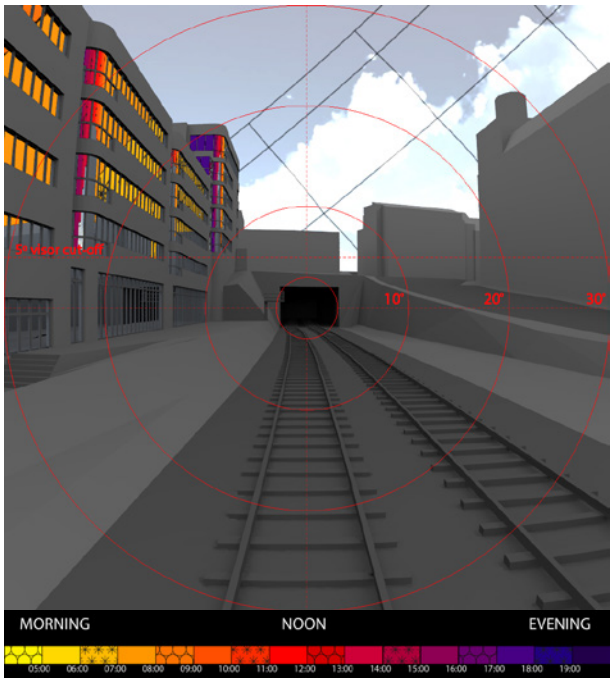


Fig. 10: Stage 1 Example - Hours

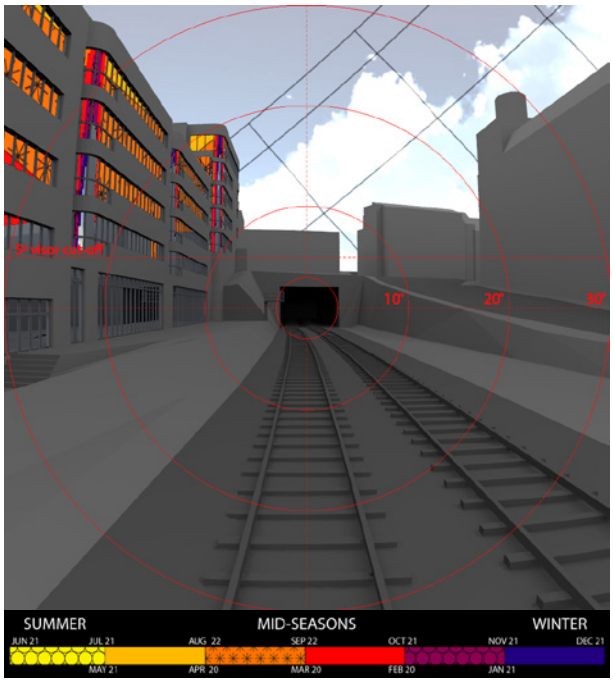


Fig. 11: Stage 1 Example - Months

4 SCENARIO OVERVIEW

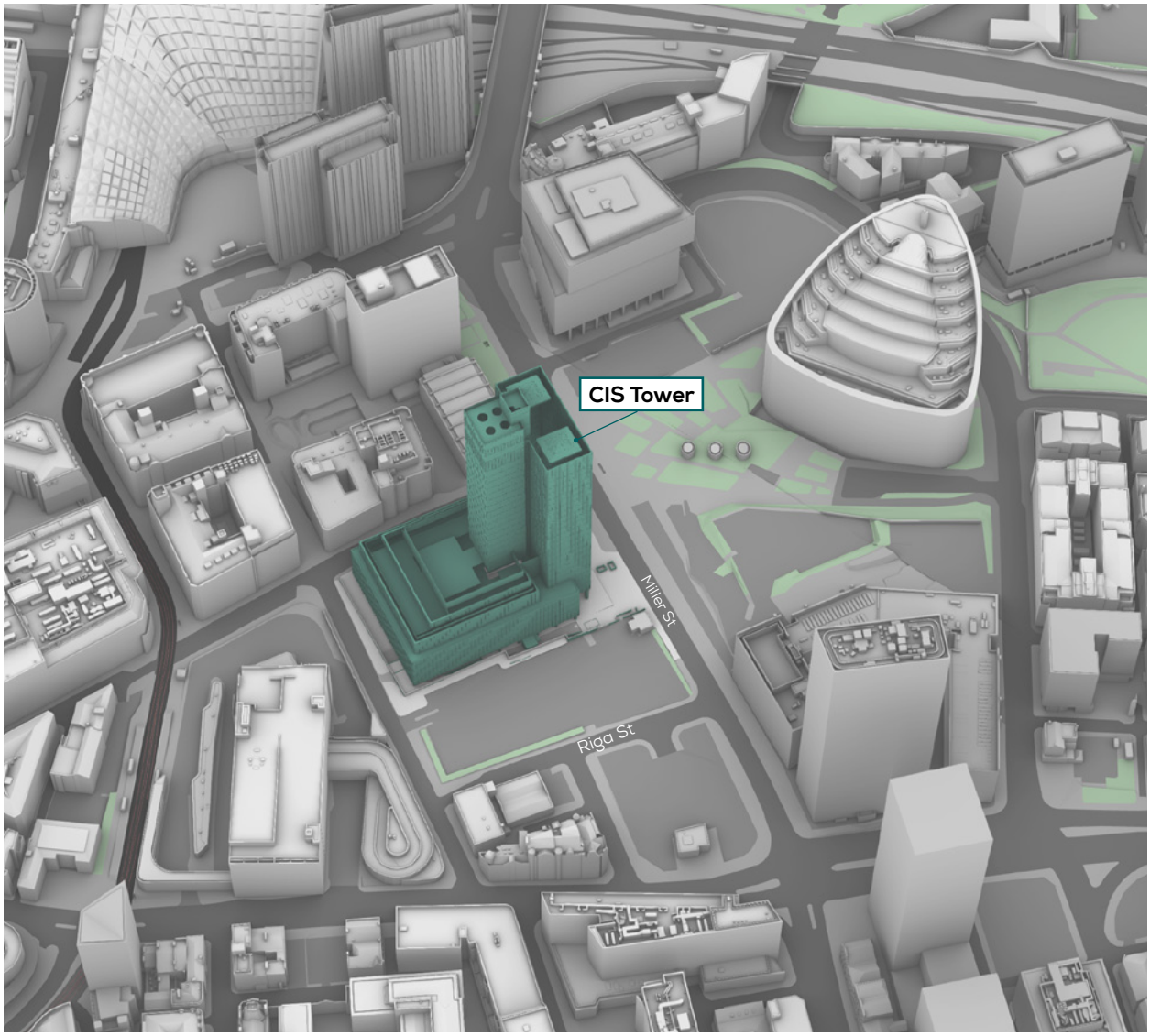


Fig. 12: Perspective view



Fig. 13: Site Plan - Viewpoints

→ Road location

→ Tram location

→ Scheme not visible or no reflections within 30°

5 DISCUSSION OF RESULTS AND CONCLUSIONS

This report has been prepared in relation to the redevelopment of the CIS Tower in Manchester, an existing Grade II listed building. The refurbishment entails the replacement of the existing single-glazed façade system, the construction of a 3-storey extension to the podium, and alterations to the ground floor entrance lobby.

Glare is not a comparative assessment. The presence of glare in the existing scenario does not automatically justify its presence in a new proposal. However, it is noted that this is essentially a like-for-like refurbishment of a glazed building. As the orientation and materiality of the proposed façades remain consistent with the existing, the time of day and year when reflections may occur will remain unchanged.

A solar glare assessment has been undertaken to determine when reflections are likely to occur and whether these may result in significant effects from sensitive locations around the building.

While it is inevitable for heavily glazed buildings to produce solar reflections, the proposed glazing will be a less-reflective alternative to the existing cladding, thereby reducing the risk of glare compared to the existing scenario, where a highly reflective silver coating is currently applied. Performance data for the existing glass coating, along with two proposed replacement options, are provided in Section 6 (these have been provided to GIA and are assumed to be correct).

Road Viewpoints

A total of 10 locations looking towards the Proposed Development have been identified for traffic junctions and pedestrian crossings on main and secondary roads where an action by drivers is required.

From five of these locations, reflections would not be visible or would be outside 30° of a driver's field of view. As such, potential effects are unlikely to be of any significance.

The remaining five locations are discussed in more detail below.

E1 - Ring Road

Reflections may be given off at different heights of the tower during winter and mid-season months (between the end of September to the end of March) in the morning from 07:00 to 09:00 GMT.

When looking straight ahead, reflections would occur beyond 15° of the driver's line of sight and mainly above the visor cut-off line and so are unlikely to cause significant glare issues with the proposed products.

When focusing on the traffic signal to the left-hand side, reflections would be closer to the driver's line of sight (within 3°), and in these instances reflections may be of sufficient intensity to cause glare. The traffic light on the right would however provide an alternative viewpoint.

It is noted that the tower is already in place and that the proposed glazing would reduce the likelihood and intensity of glare effects, as it is less reflective than the existing glass. In addition, the majority of reflections would occur above the visor cut-off line and can therefore be mitigated by use of a standard car visor.

E2 - Ring Road (left-turn lane)

This viewpoint is located at the same junction as E1 but considers the lane turning left.

Reflections may occur within 10°, and in some cases within 3°, of a driver's field of view. This means that there is potential for solar reflections to be of sufficient intensity to result in glare. However, as discussed for E1, the proposed glazing would be significantly less reflective than the existing façade, thereby reducing both the likelihood and severity of any potential effects.

From this location, the proposed podium extension would also be visible. It is therefore recommended that the final product selected for the replacement glazing has a very low external reflectance value in order to minimise reflection intensity.

E3 - Great Ancoats Street

Reflections may be visible between late February and late March and between late September and late October, between 07:00 and 08:00 GMT.

These would be visible almost entirely beyond 10° of a driver's field of view and above the visor cut-off line.

While potential instances of glare cannot be ruled out, these are considered of minor significance owing to the angle and location above the visor cut-off line.

S1 - Dantzic Street

Reflections may be visible between late September to late March and between late September and late October, between 11:00 and 13:00 GMT.

These would be visible almost entirely beyond 10° of a driver's field of view and above the visor cut off line.

While potential instances of glare cannot be ruled out, these are considered of minor significance owing to the angle and location above the visor cut-off line.

NW1 - Ring Road

Reflections may be visible between late March and late September, between 16:00 and 18:00 GMT and between 07:00 and 08:00 GMT.

These would be visible almost entirely beyond 10° of a driver's field of view and above the visor cut off line.

While the rendered view represents a worst-case scenario (looking straight ahead towards), drivers focusing on traffic lights at either side of the road would view the building more peripherally, further reducing potential impact.

The rendered view looks straight ahead towards the scheme as a worst-case scenario. When looking at the traffic lights at either side of the road, the view of the scheme would be slightly more peripheral.

Tram Line

Selected viewpoints along the tram line between Market Street and Shudehill stops (westbound towards Victoria Station) have been assessed.

When travelling towards the proposal from a distance (T3), the building is visible beyond other buildings and outside 10° of a driver's field of view, with potential reflections occurring between late September and late March. These would be visible between 10:00 and 11:00 GMT or between 14:00 and 16:00 GMT and would all occur above the 5° visor cut-off line and can therefore be mitigated by deploying the visor.

As the track turns west (T2, T1), the building moves progressively further into the driver's peripheral vision, beyond 20° and then outside 30°.

No significant effects are anticipated when travelling in the opposite direction (T4).

Overall, while solar reflections may occur, they would lie above the visor cut-off line and predominantly in winter months, when sunlight intensity is lower. The risk of glare is therefore considered of minor significance. Additionally, there is a reduced chance for sunshine in winter, further mitigating the potential impact onto drivers.

Conclusions

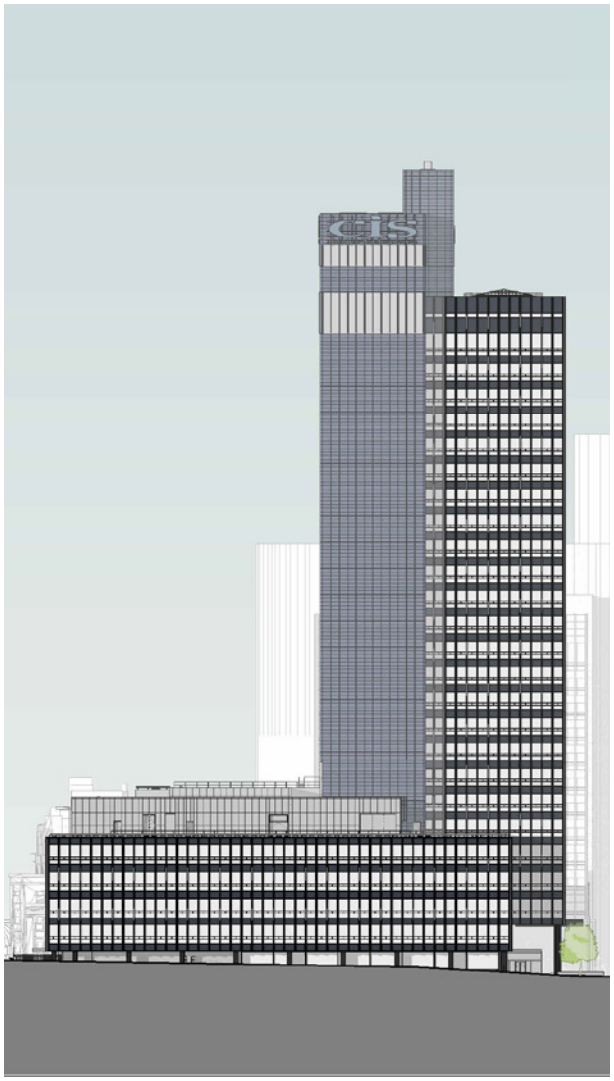
A number of viewpoints have been assessed, and it has been found that most locations would experience no risk or only a low risk of glare.

Potential for more notable effects has been identified at the junction of the Ring Road and Rochdale Road, particularly when turning left, as the building is visible right behind the traffic lights. However, any reflections from the tower are expected to be of lower intensity than those currently experienced, owing to the proposed use of less-reflective glazing.

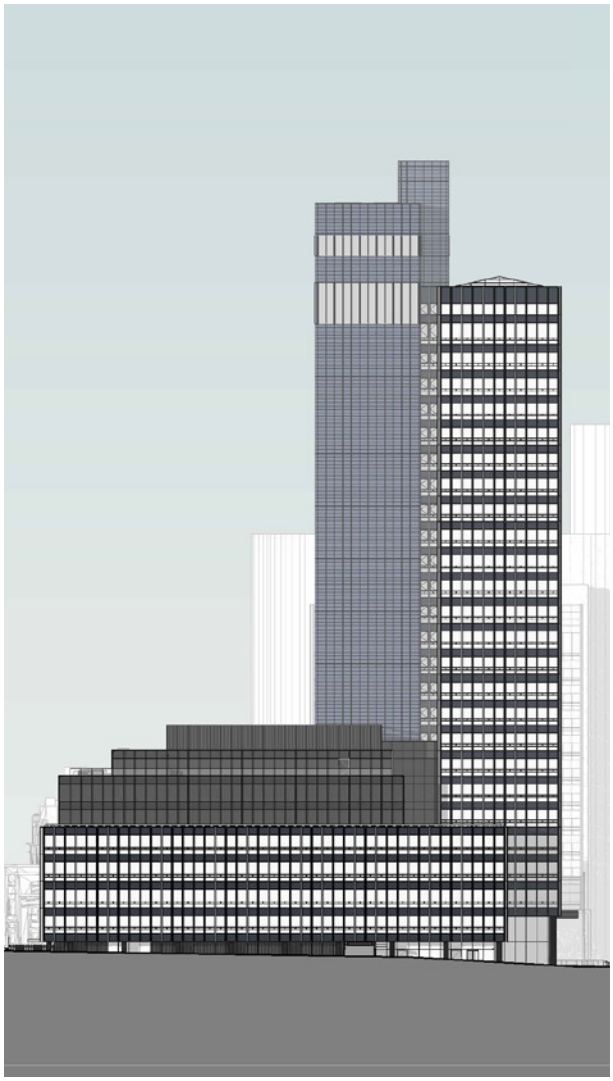
The only additional reflective surface introduced by the scheme would be the new podium extension. This is proposed in a dark colour with very low reflective properties, thereby inherently reducing the potential intensity of reflected sunlight.

6 GLAZING SPECIFICATIONS

EXISTING
SOUTH-EAST ELEVATION



PROPOSED
SOUTH-EAST ELEVATION



EXISTING ASSUMPTION

AGC

Calculated by	Kai Richter	Calculated on	7 AUGUST 2025	Country	Great Britain

① 6 mm Stopsol Supersilver Clear pos.2 Annealed

Glass performance data simulation

Light properties - EN 410	
Light transmittance : τv [%]	63
External light reflection : ρv [%]	34
Internal light reflection : ρvi [%]	35
Colour rendering index : Ra [%]	95

NEW CLADDING OPTION 1

AGC

Calculated by	Kai Richter	Calculated on	19/06/2024	Country	Great Britain

① Stratobel 55.4 (5 mm Planibel Clearlite + 1.52 mm PVB Clear + 5 mm Energy 70/37 pos.2) Annealed ② 15 mm Argon 90% ③ 6 mm Planibel Clearlite Annealed

Glass performance data simulation

Light properties - EN 410	
Light transmittance : τv [%]	**68**
External light reflection : ρv [%]	**12**
Internal light reflection : ρvi [%]	**15**
Colour rendering index : Ra [%]	**95**

Energy properties - EN 410

NEW CLADDING OPTION 2

COMBI Neutral 70/35 T #4 – 55.4 EF | 16 Ar 90 | 6 EF-FT-HST

EUROFLOAT 5 mm, Clear 0.38 mm x 4, EUROFLOAT 5 mm, COMBI Neutral 70/35 T, Ar 90 16 mm, EUROFLOAT FT HST 6 mm

Optical properties	EN 410:2011
Light transmittance (τ_v)	68 %
External light reflectance ($\rho_{v,e}$)	14 %
Internal light reflectance ($\rho_{v,i}$)	15 %
General colour-rendering index (R_a)	94

PODIUM EXTENSION GREY OPTION

AGC

Calculated by	Kai Richter	Calculated on	7 AUGUST 2025	Country	Great Britain

① Stratobel 55.4 (5 mm Planibel Dark Grey + 1.52 mm PVB Argon 90% ③ Stratobel 55.4 (5 mm iplus 1.0 pos.3 + 1.52

Glass performance data simulation

Light properties - EN 410	
Light transmittance : τv [%]	**2**
External light reflection : ρv [%]	**4**
Internal light reflection : ρvi [%]	**13**
Colour rendering index : Ra [%]	**74**

7 SOLAR GLARE ASSESSMENT

The following pages present the results of the Static Assessment

60° FIELD OF VIEW: TIME OF DAY
VIEWPOINT E1A - LOOKING FORWARD

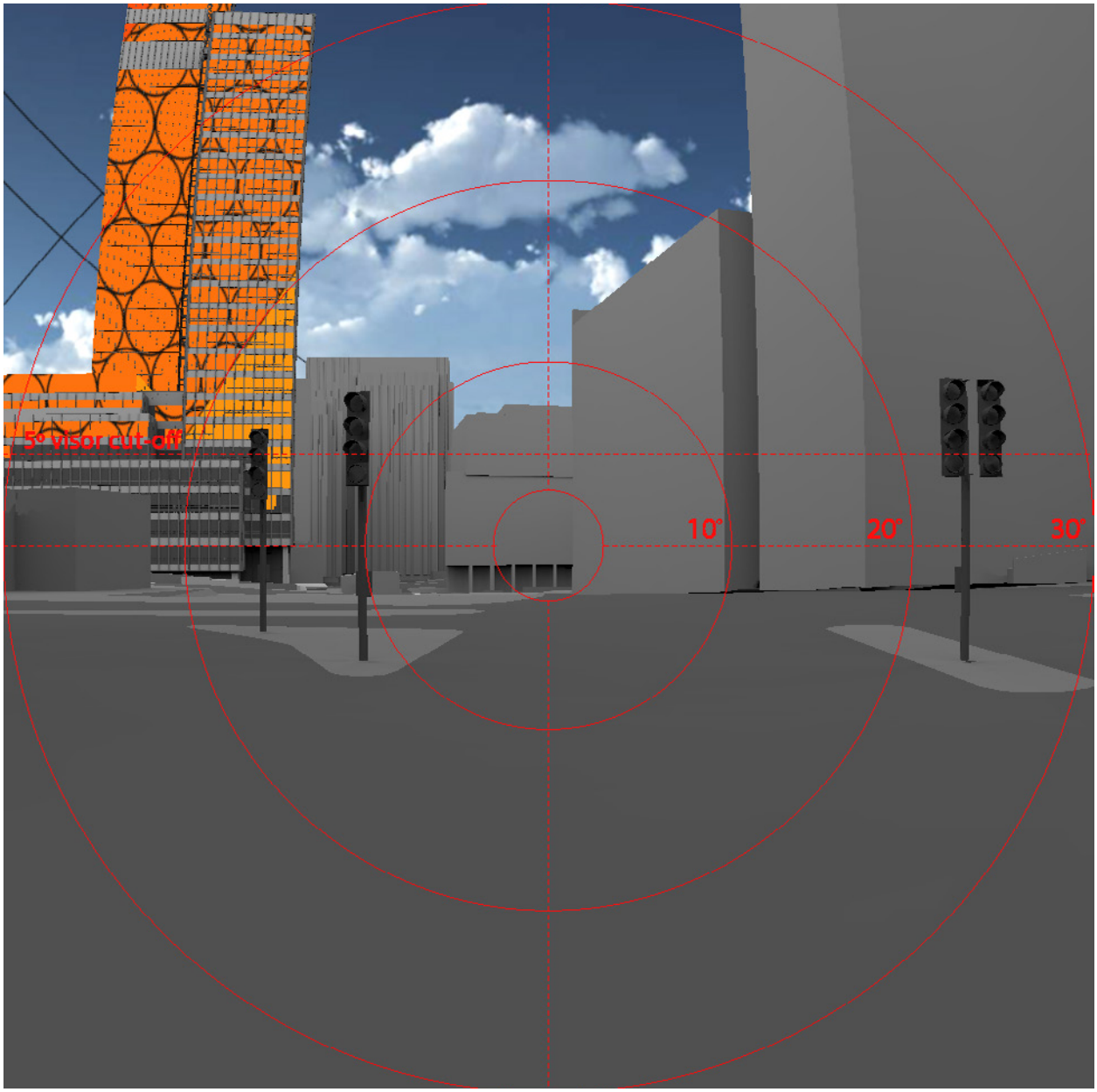
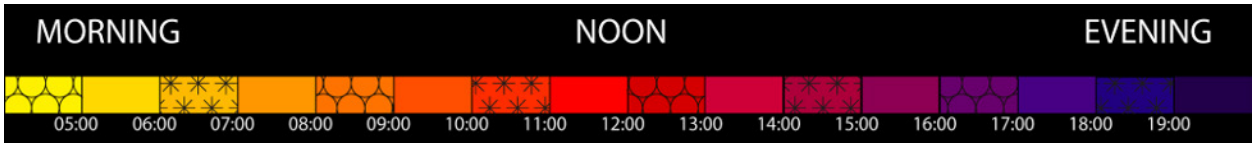


Fig. 14: Solar reflections



60° FIELD OF VIEW: SEASON
VIEWPOINT E1A - LOOKING FORWARD

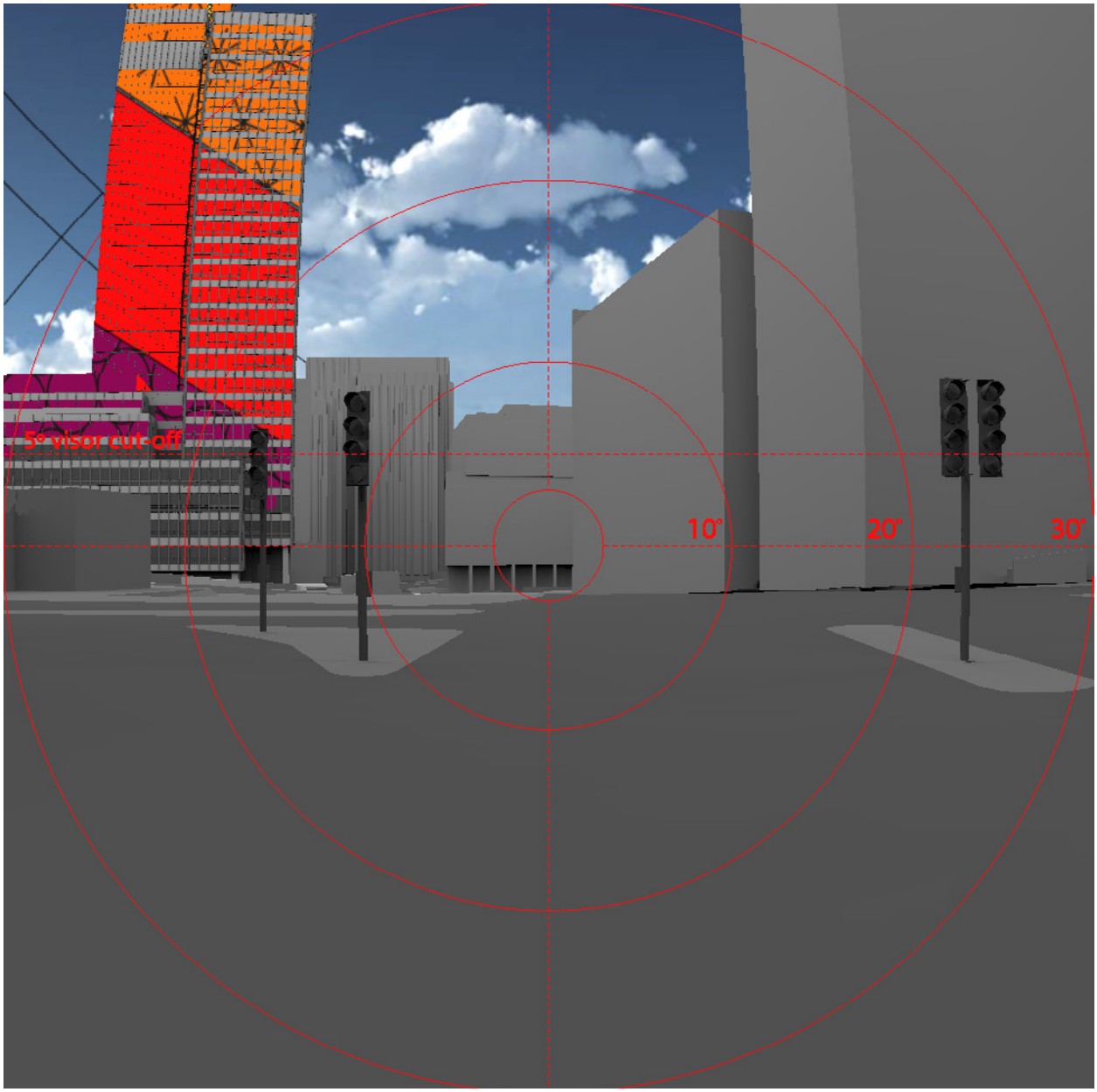


Fig. 15: Solar reflections



60° FIELD OF VIEW: TIME OF DAY
VIEWPOINT E1B - LOOKING AT LEFT TRAFFIC LIGHT

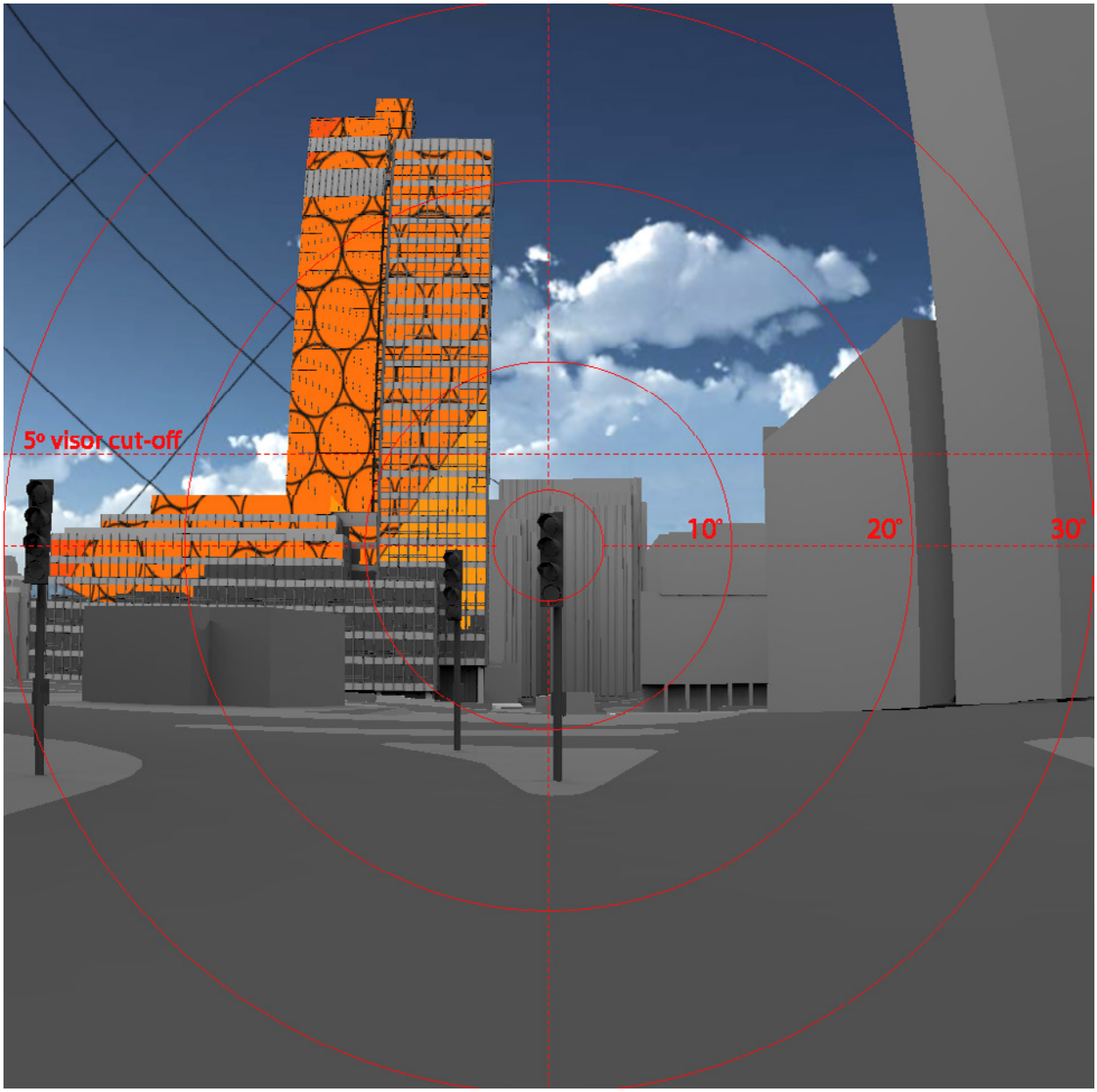
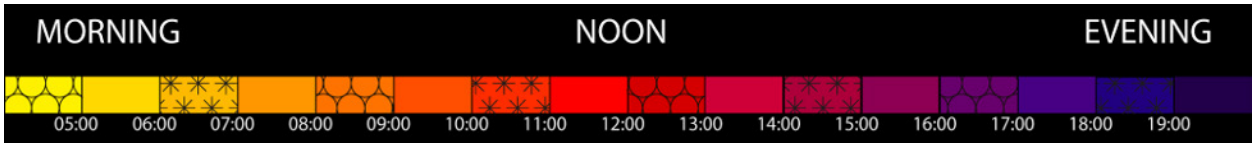


Fig. 16: Solar reflections



60° FIELD OF VIEW: SEASON
VIEWPOINT E1B - LOOKING AT LEFT TRAFFIC LIGHT

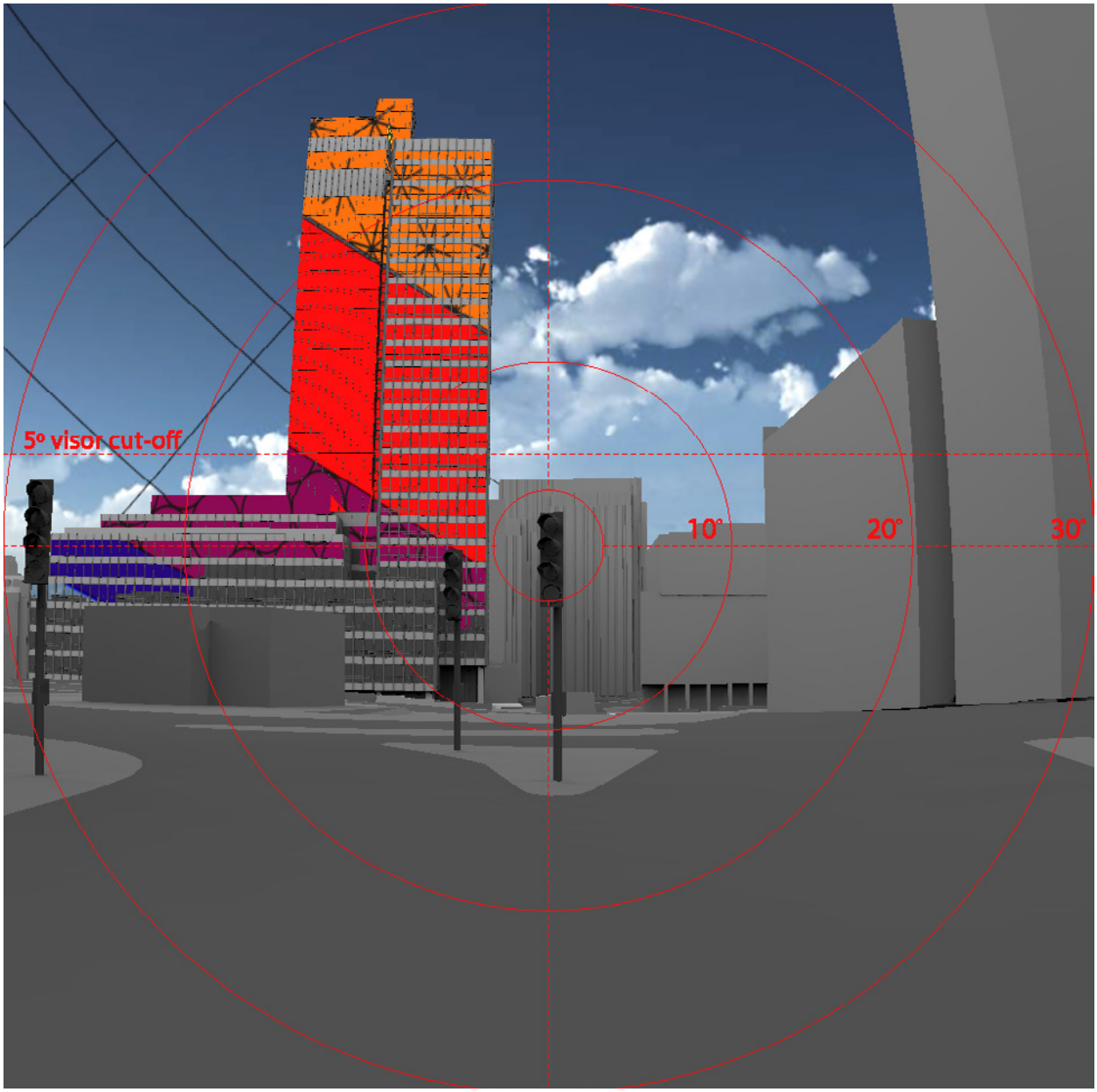


Fig. 17: Solar reflections



60° FIELD OF VIEW: TIME OF DAY
VIEWPOINT E2A - LOOKING FORWARD

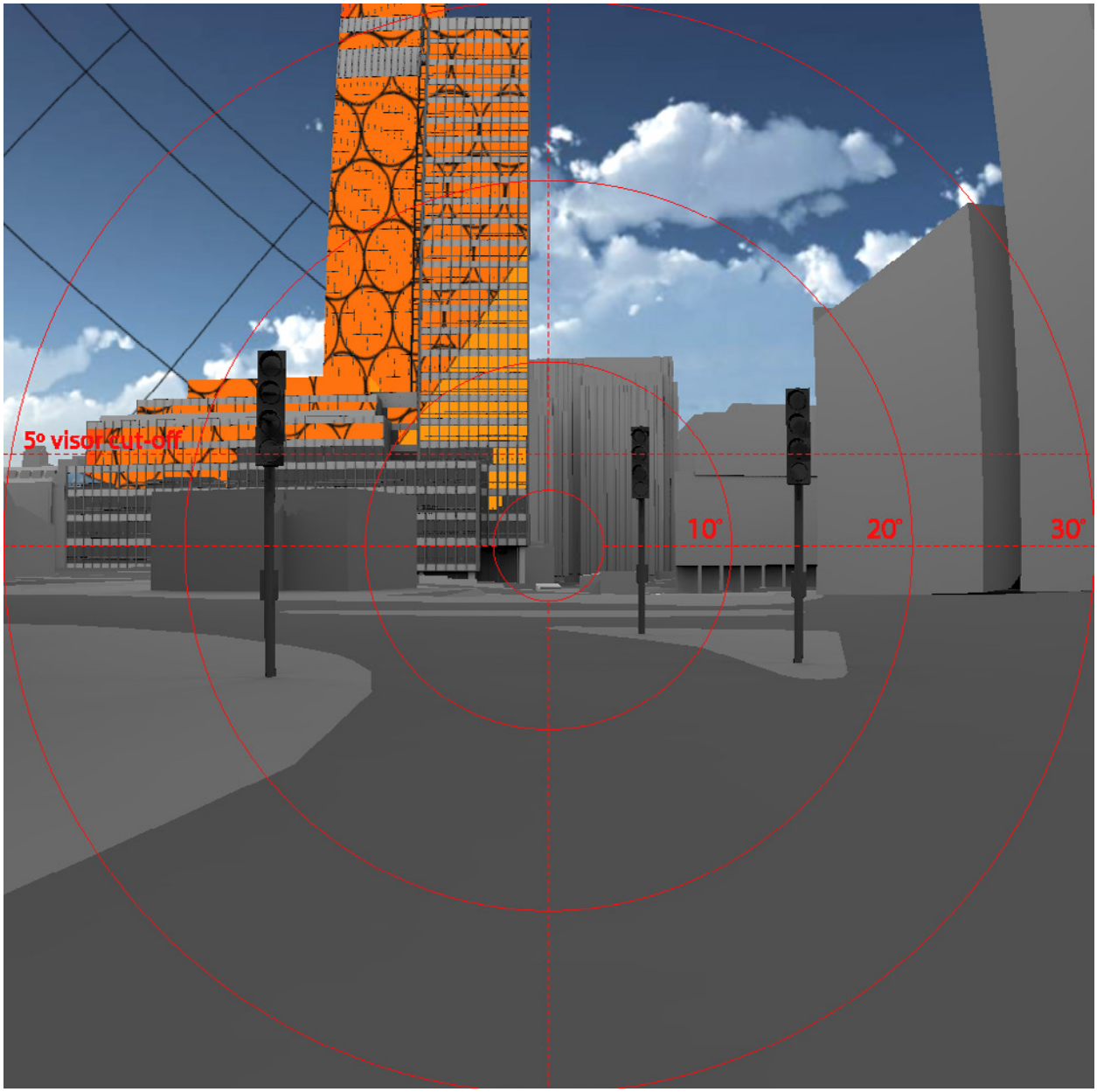
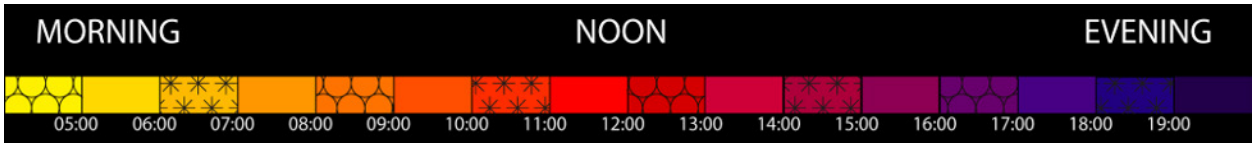


Fig. 18: Solar reflections



60° FIELD OF VIEW: SEASON
VIEWPOINT E2A - LOOKING FORWARD

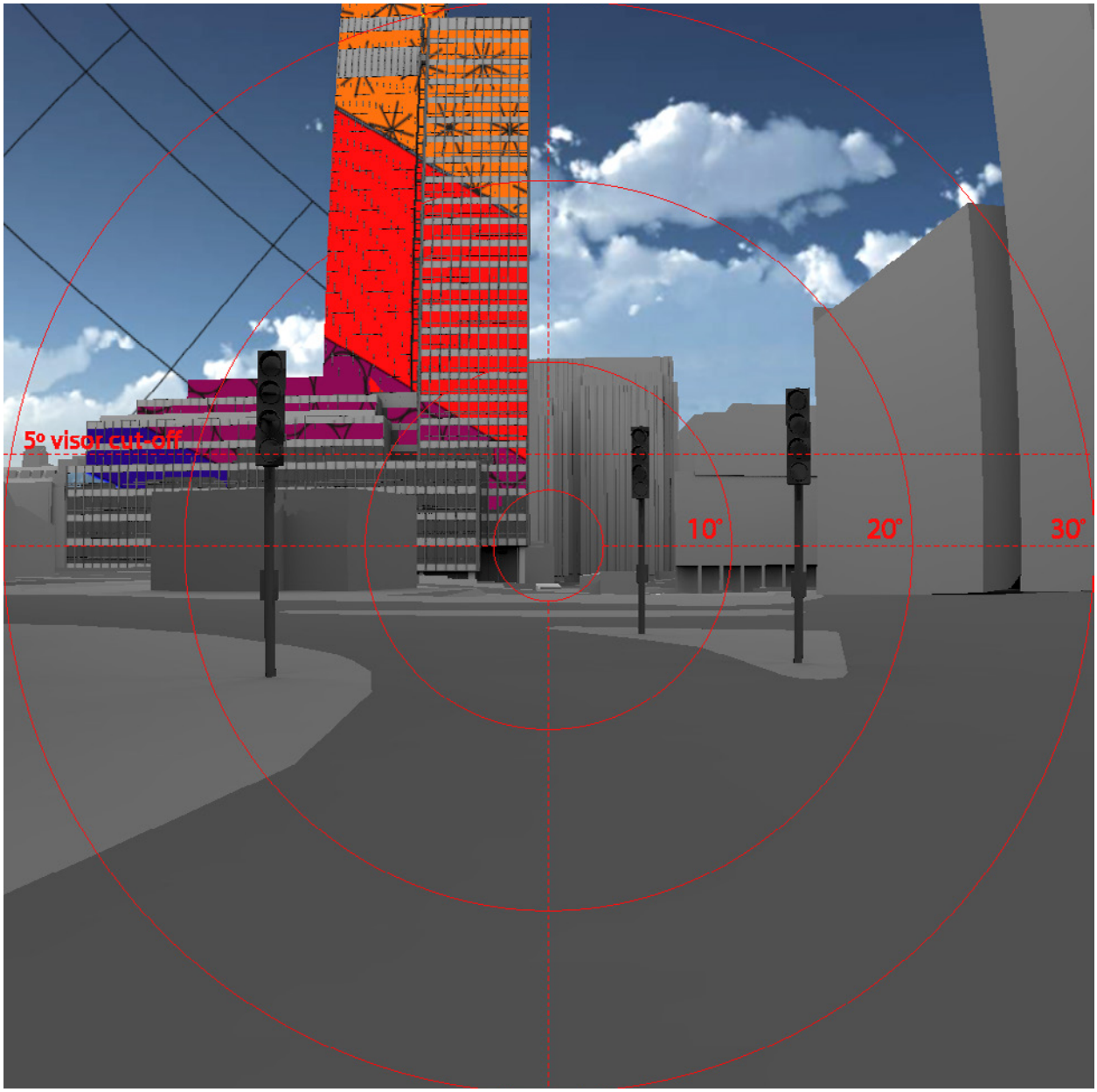


Fig. 19: Solar reflections



60° FIELD OF VIEW: TIME OF DAY
VIEWPOINT E2B - LOOKING AT LEFT TRAFFIC LIGHT

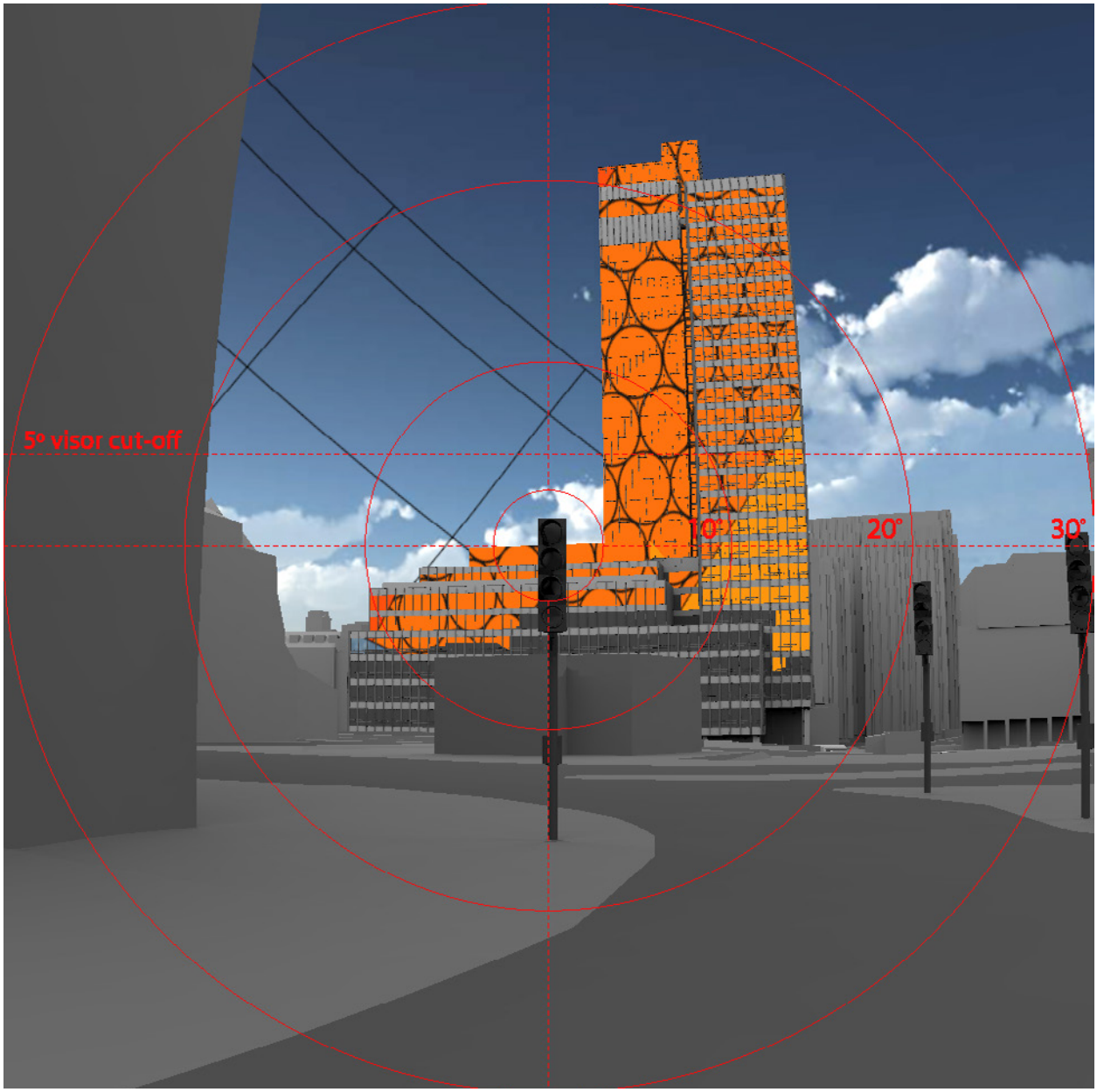
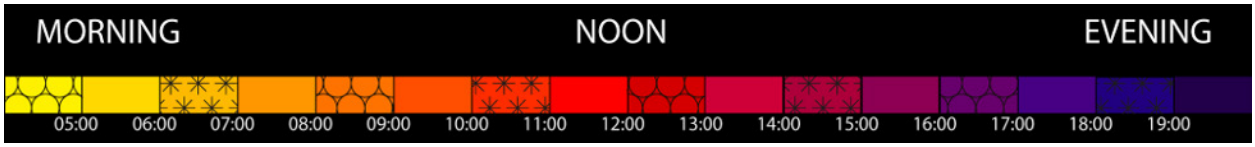


Fig. 20: Solar reflections



60° FIELD OF VIEW: SEASON
VIEWPOINT E2B - LOOKING AT LEFT TRAFFIC LIGHT

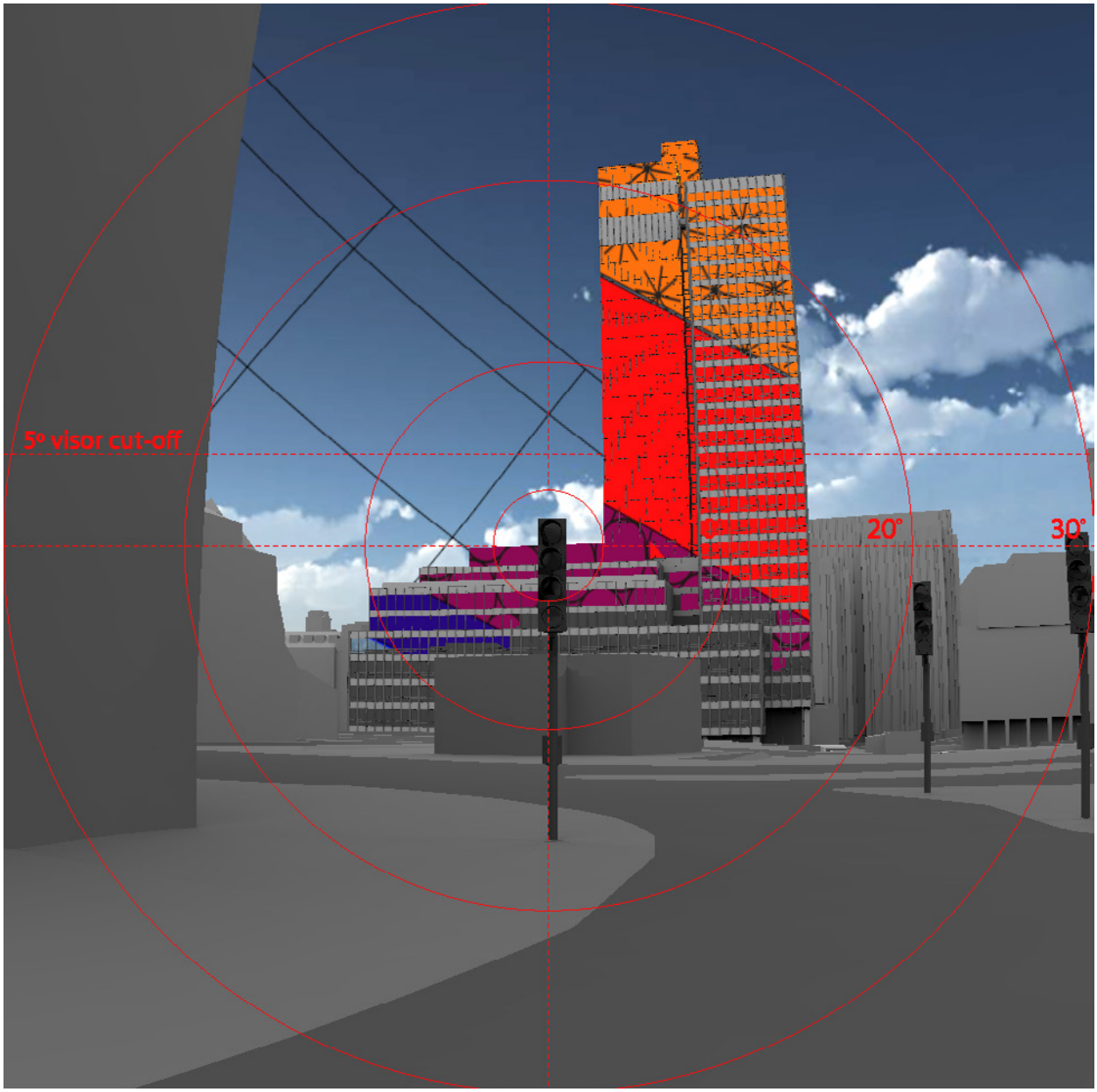


Fig. 21: Solar reflections



60° FIELD OF VIEW: TIME OF DAY
VIEWPOINT E2C - LOOKING AT RIGHT TRAFFIC LIGHT

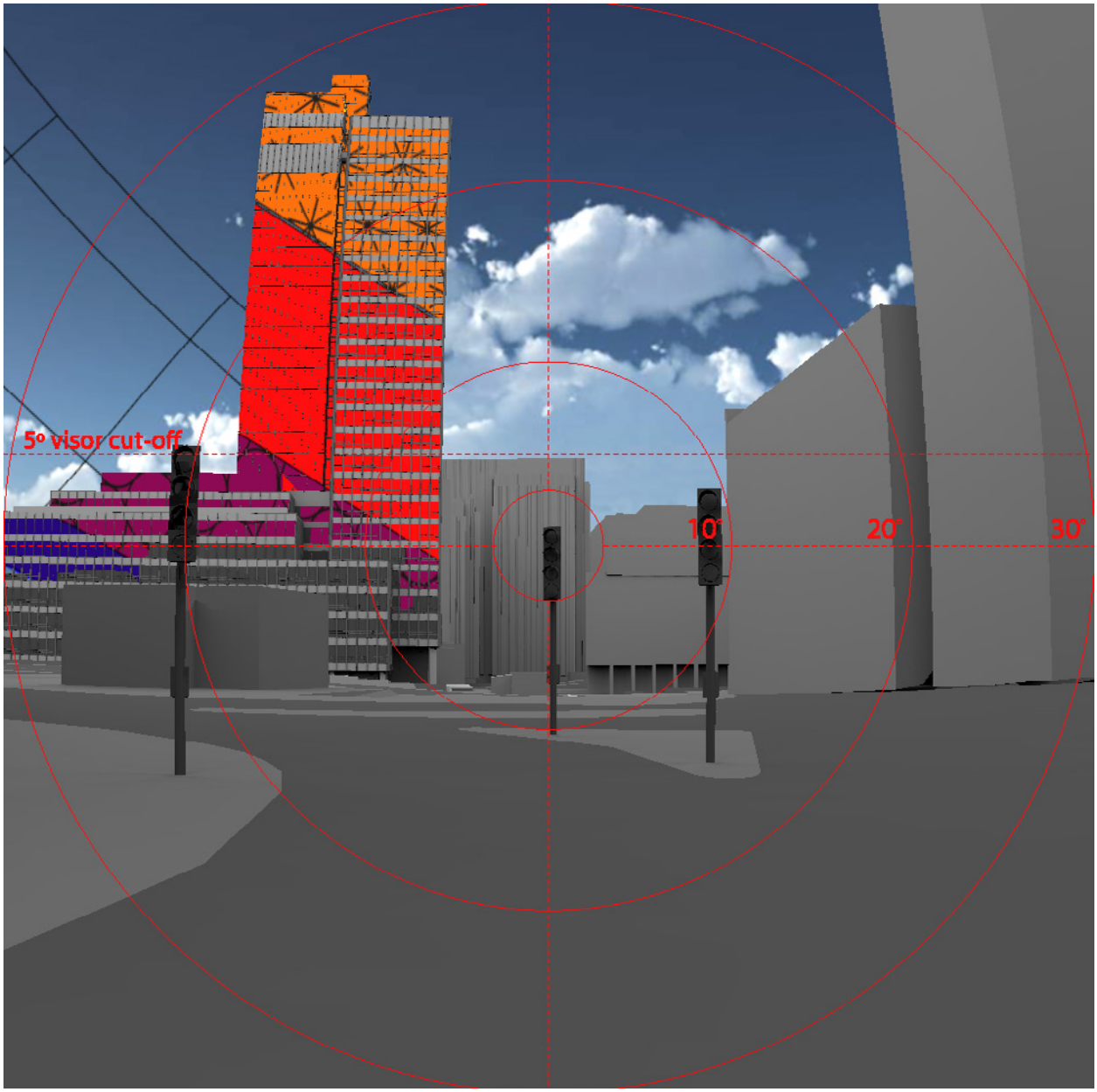
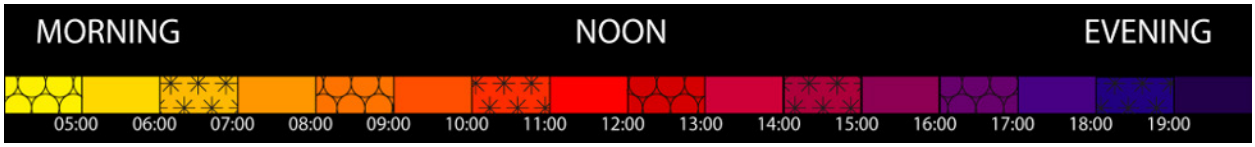


Fig. 22: Solar reflections



60° FIELD OF VIEW: SEASON
VIEWPOINT E2C - LOOKING AT RIGHT TRAFFIC LIGHT

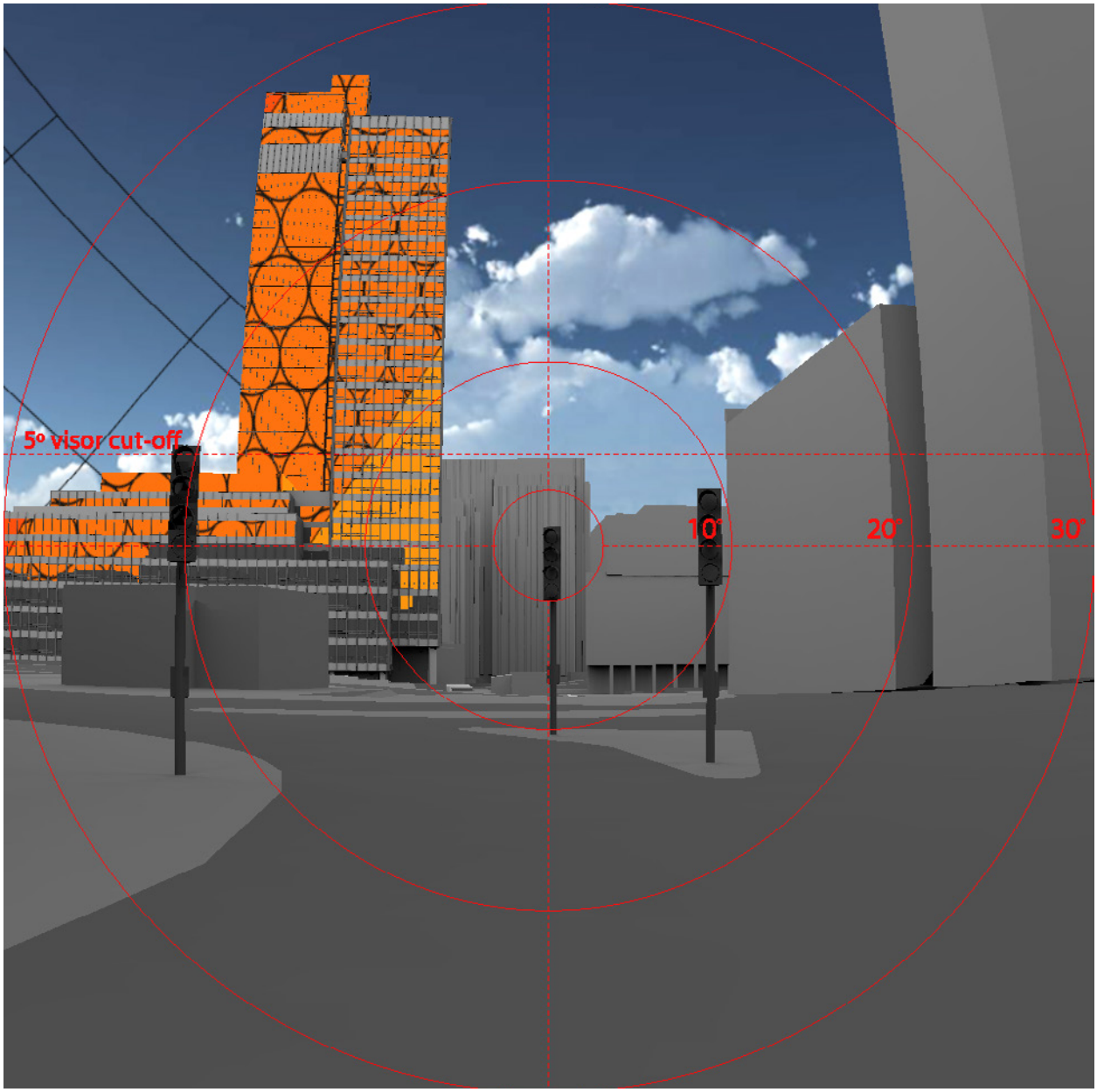


Fig. 23: Solar reflections



60° FIELD OF VIEW: TIME OF DAY
VIEWPOINT E3 - LOOKING FORWARD

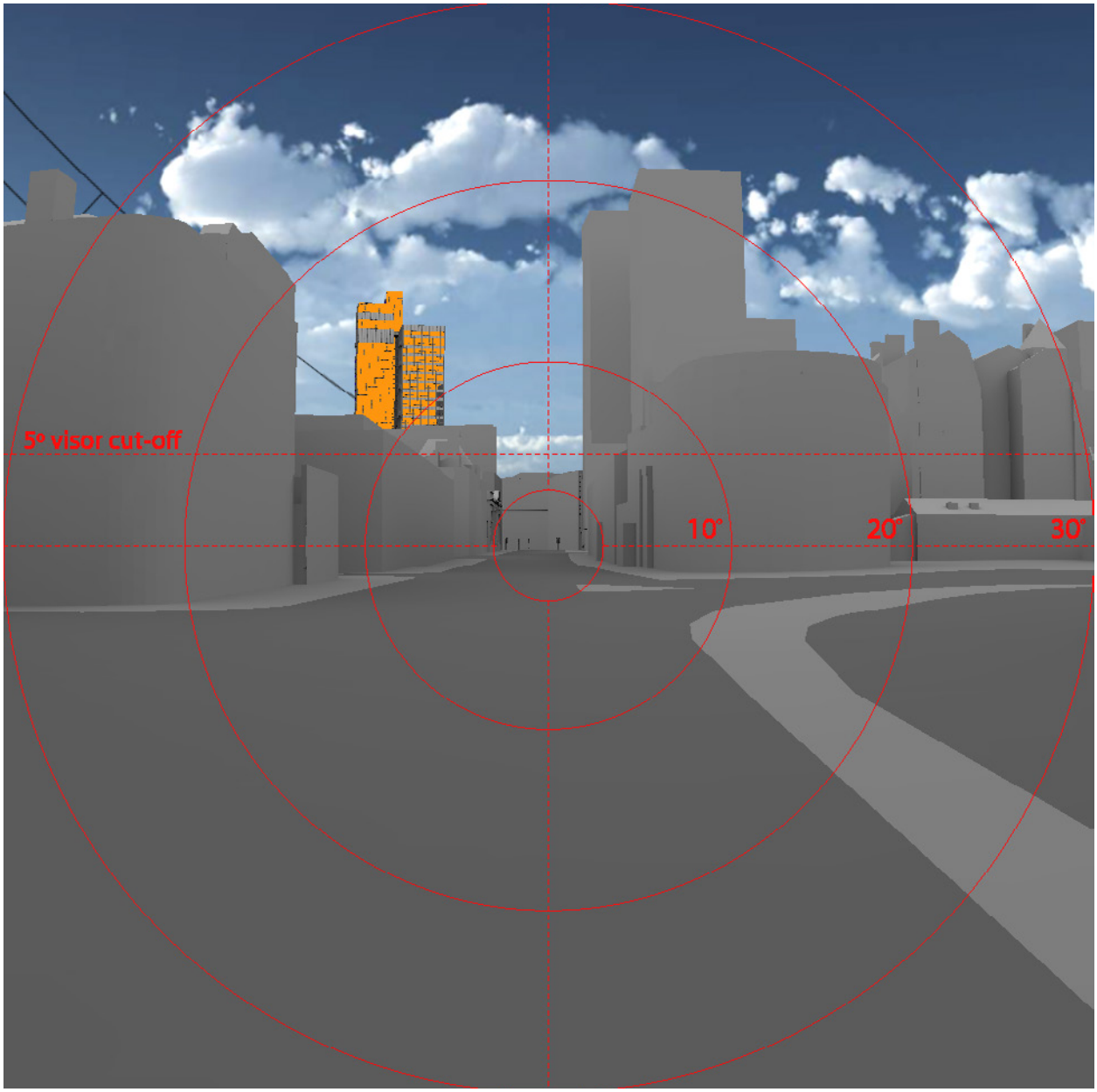
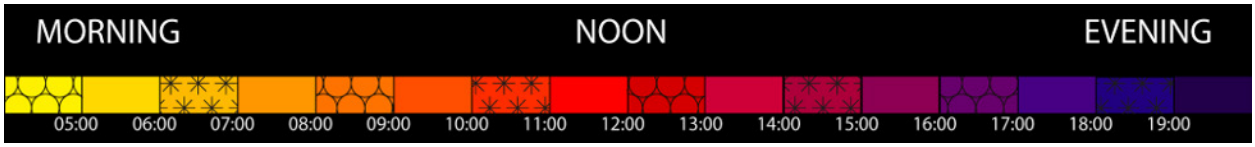


Fig. 24: Solar reflections



60° FIELD OF VIEW: SEASON
VIEWPOINT E3 - LOOKING FORWARD

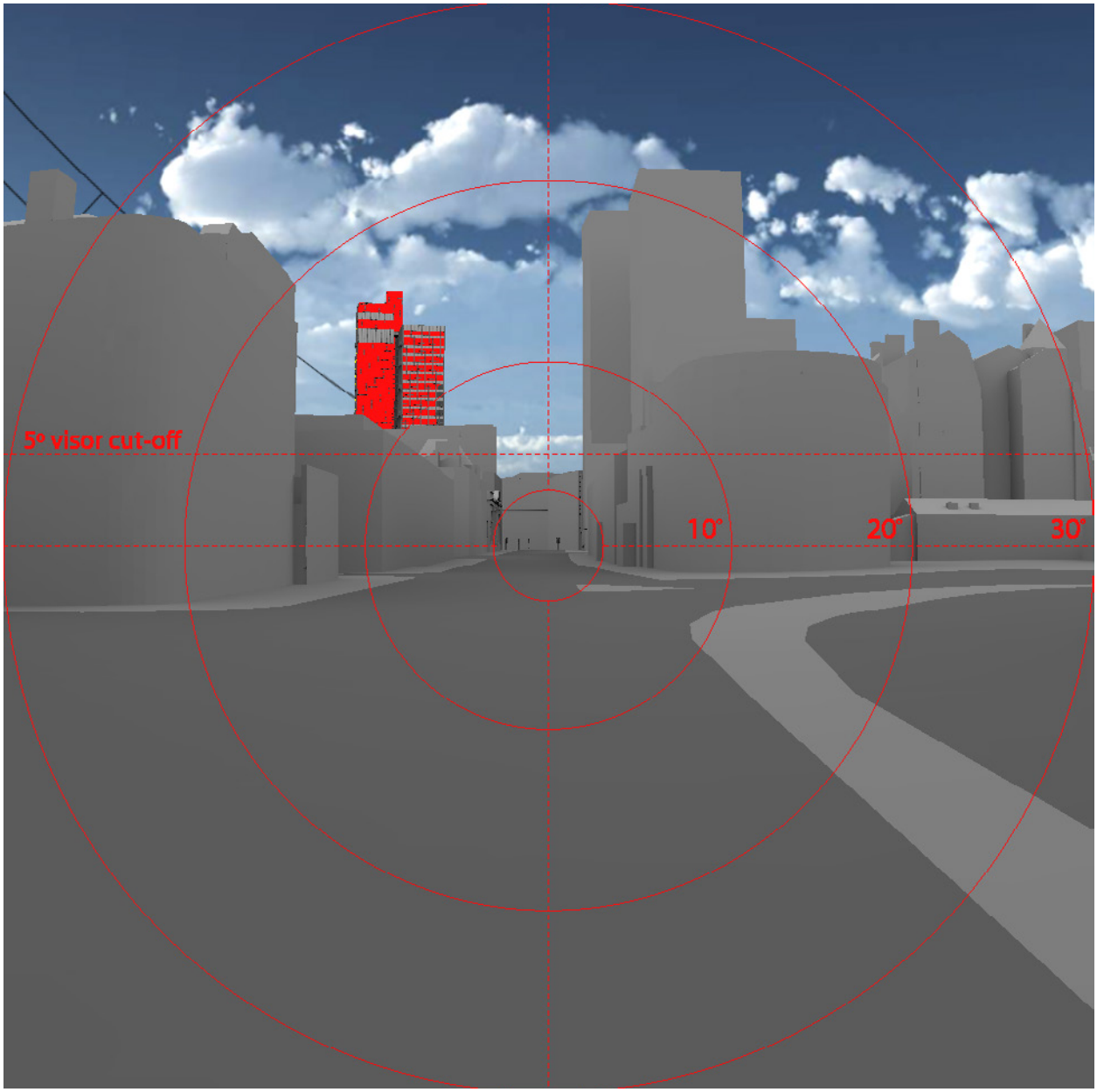


Fig. 25: Solar reflections

60° FIELD OF VIEW: TIME OF DAY
VIEWPOINT S1 - LOOKING FORWARD

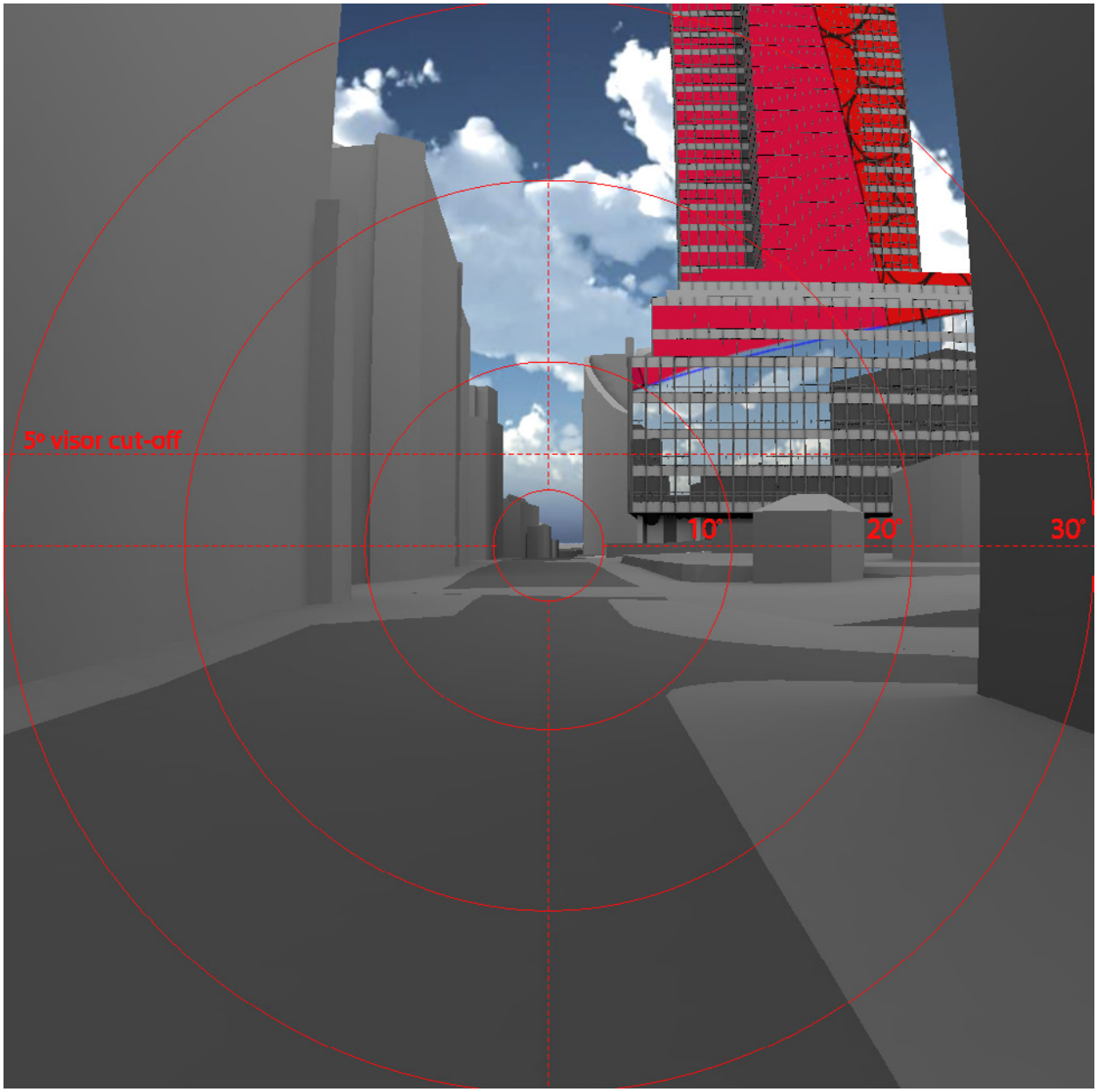
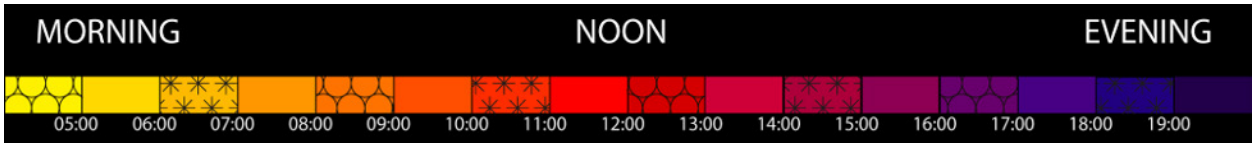


Fig. 26: Solar reflections



60° FIELD OF VIEW: SEASON
VIEWPOINT S1 - LOOKING FORWARD

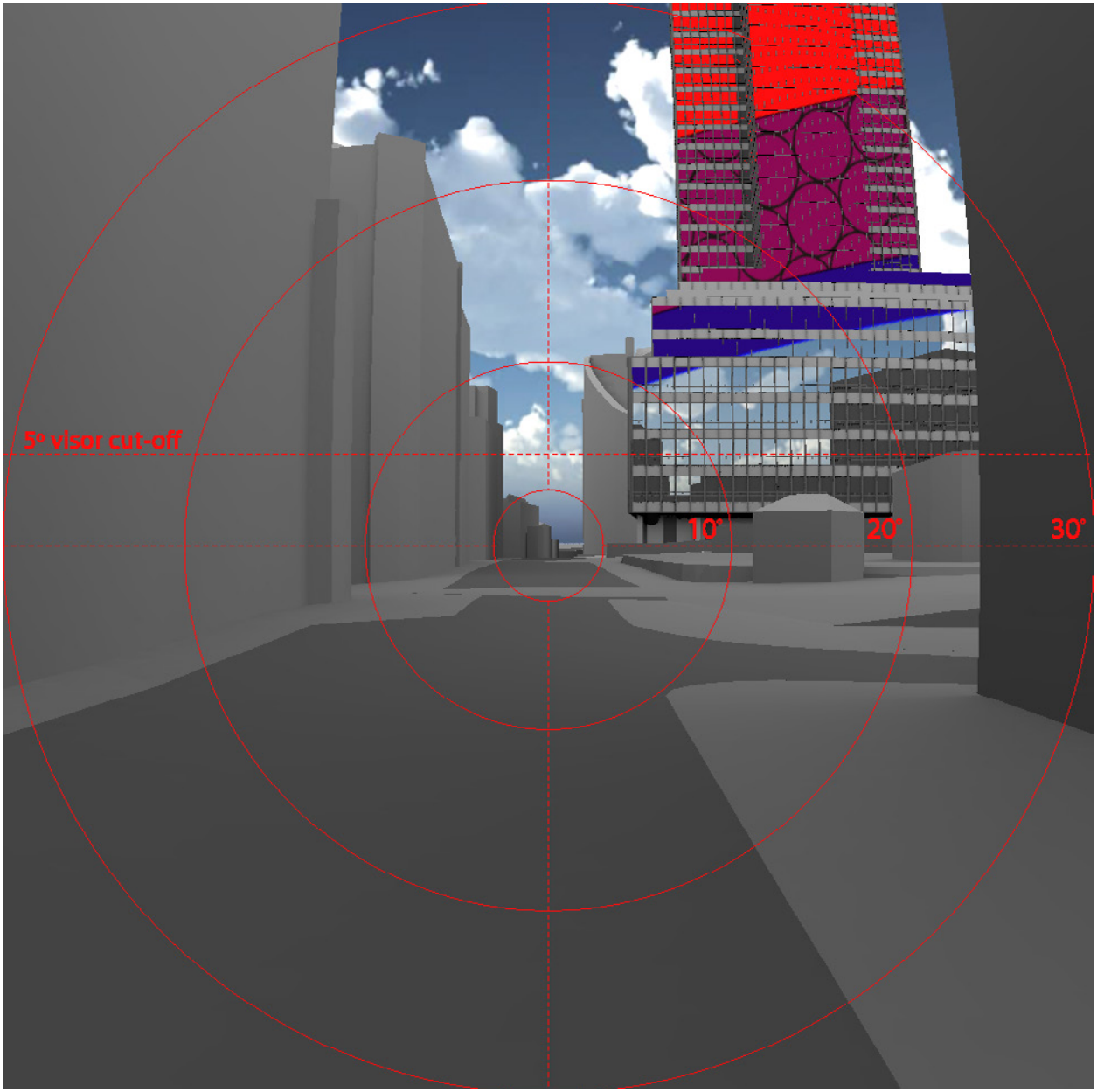


Fig. 27: Solar reflections



60° FIELD OF VIEW: TIME OF DAY
VIEWPOINT NW1 - LOOKING FORWARD

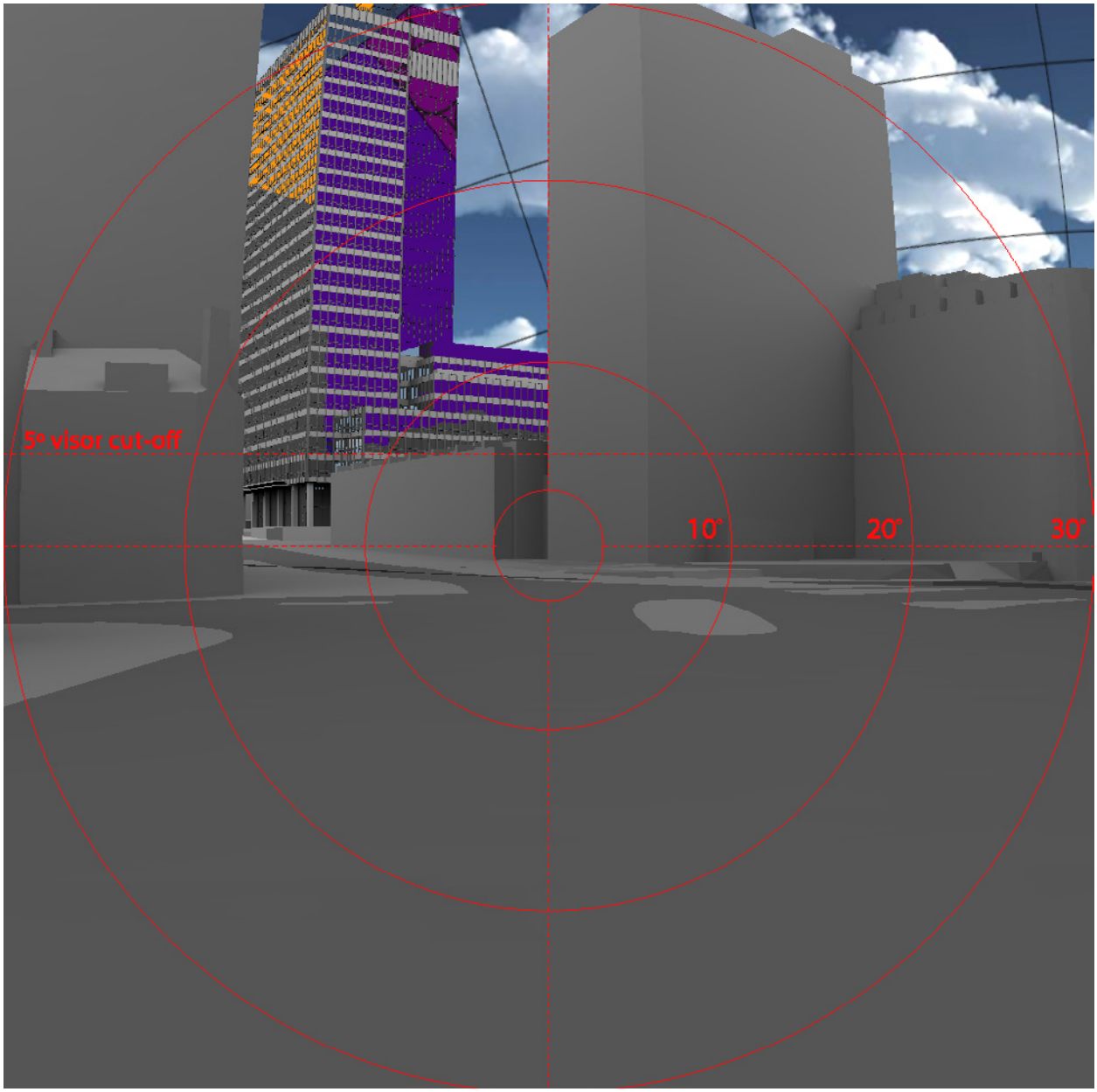
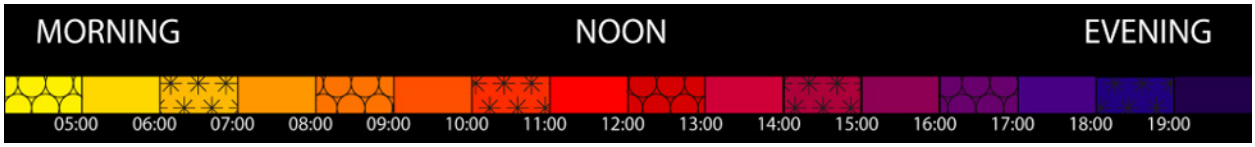


Fig. 28: Solar reflections



60° FIELD OF VIEW: SEASON
VIEWPOINT NW1 - LOOKING FORWARD

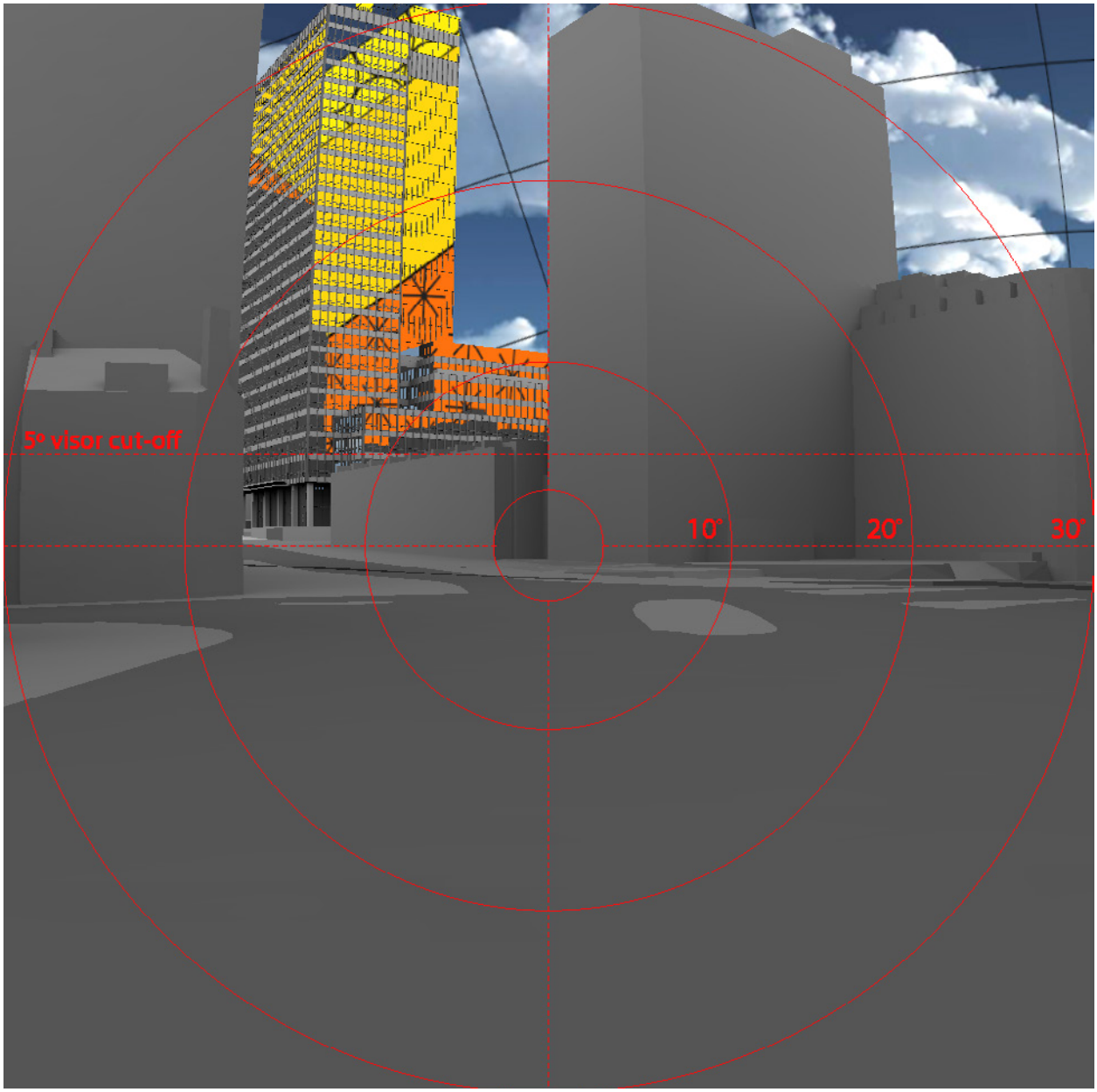


Fig. 29: Solar reflections



60° FIELD OF VIEW: TIME OF DAY
VIEWPOINT T2 - LOOKING FORWARD

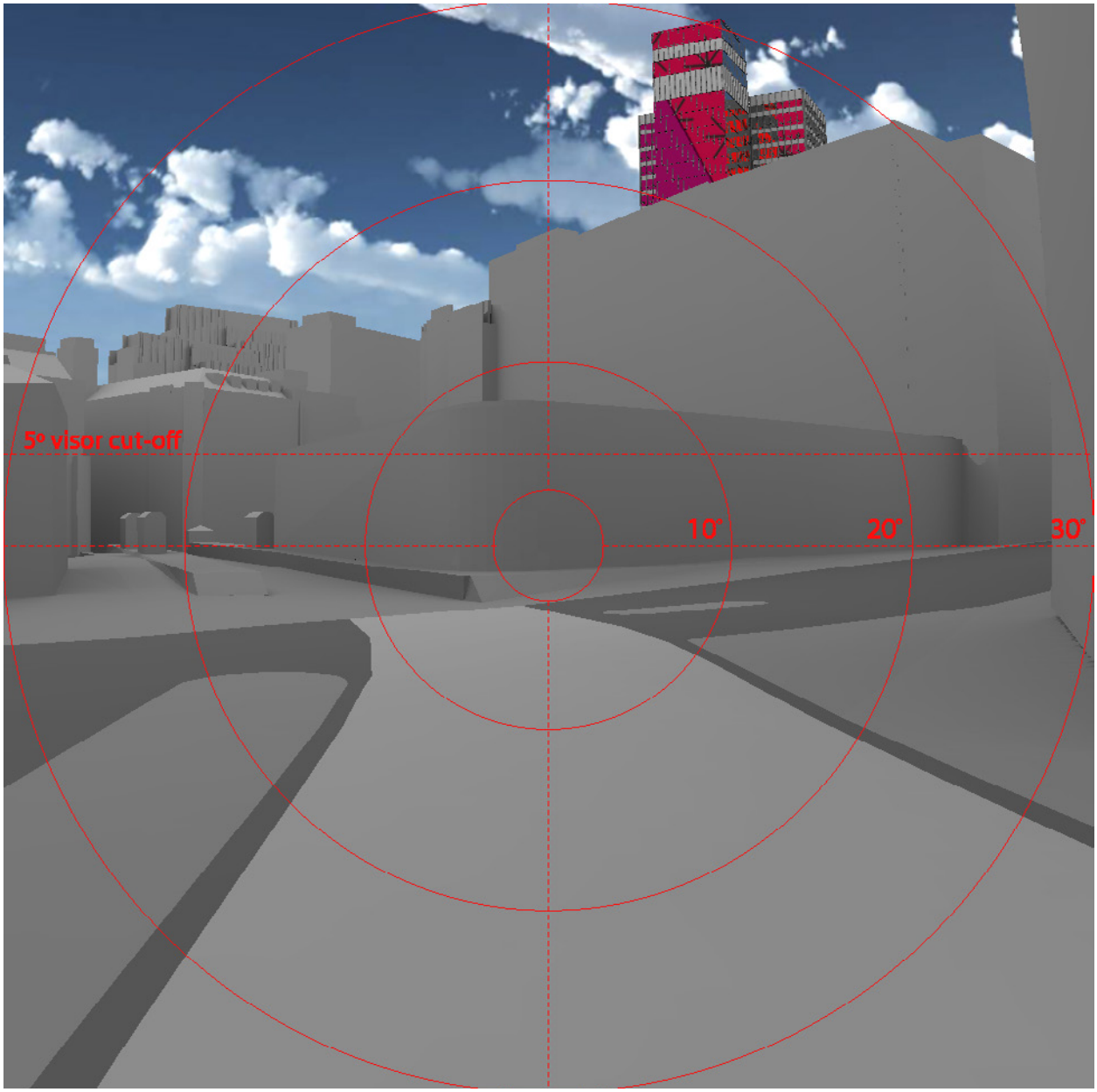
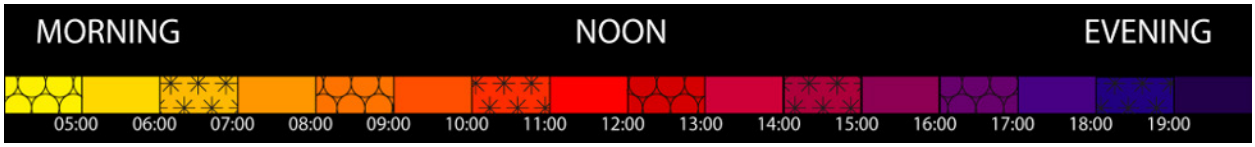


Fig. 30: Solar reflections



60° FIELD OF VIEW: SEASON
VIEWPOINT T2 - LOOKING FORWARD

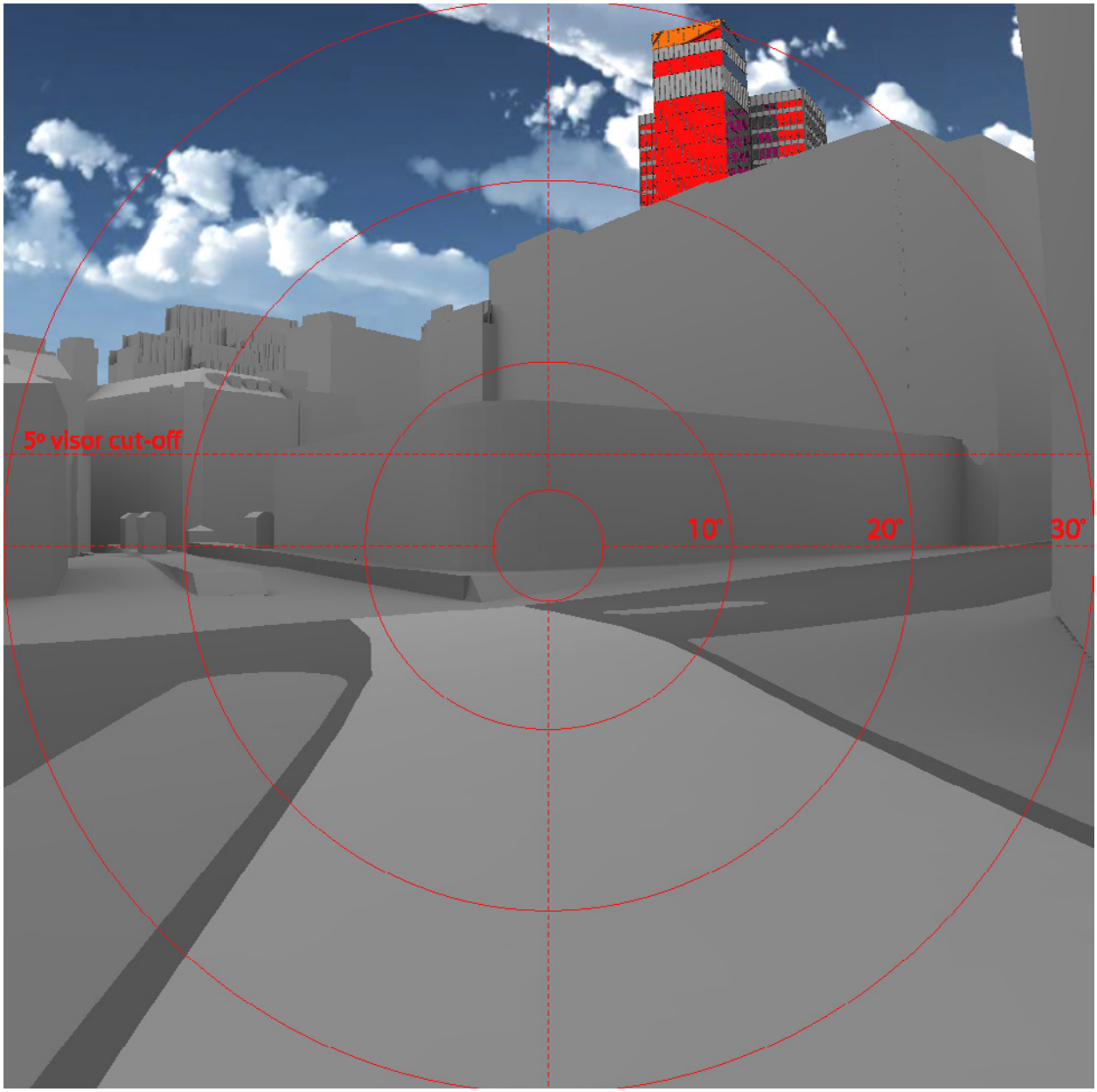


Fig. 31: Solar reflections



60° FIELD OF VIEW: TIME OF DAY
VIEWPOINT T3 - LOOKING FORWARD

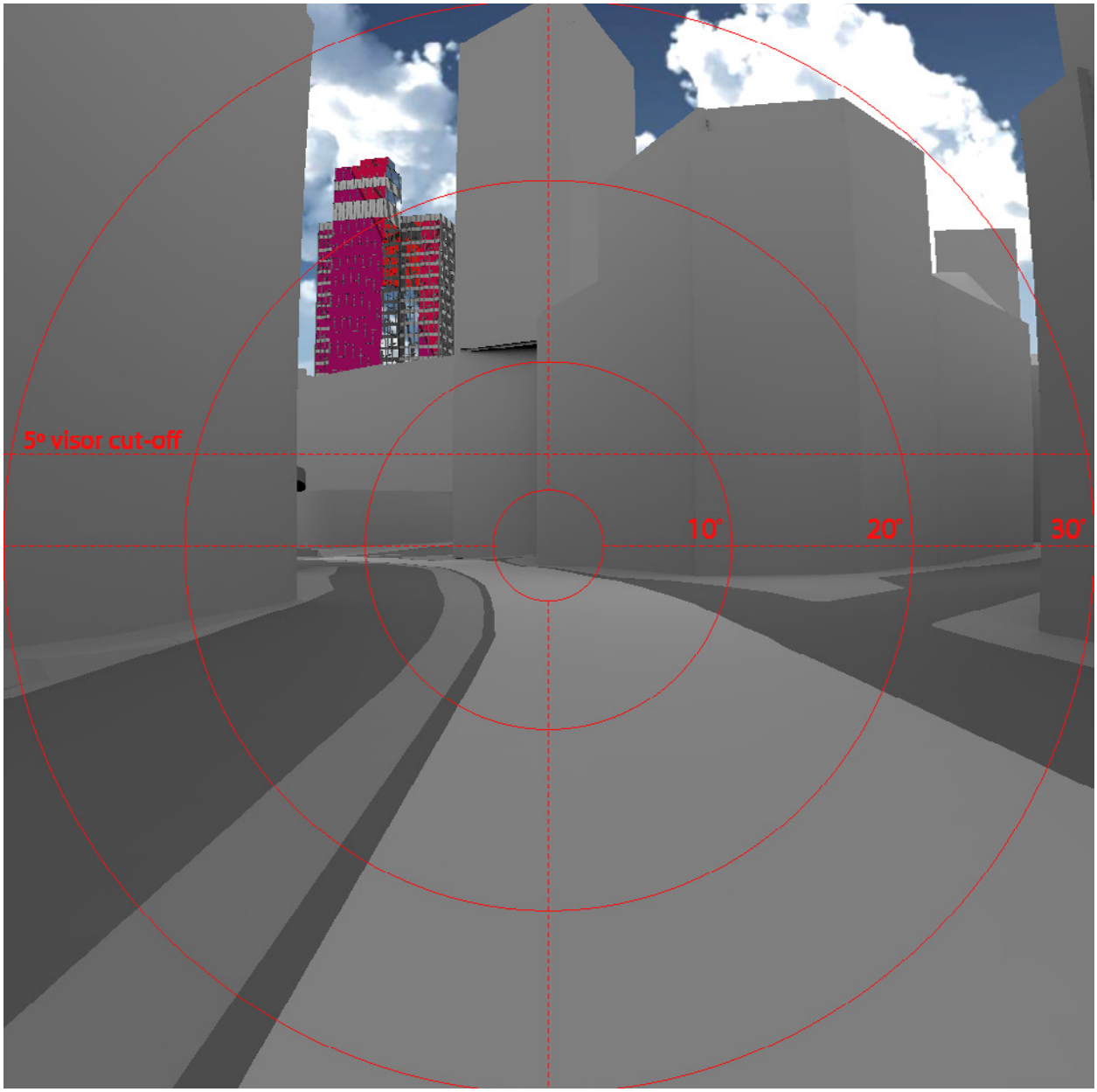
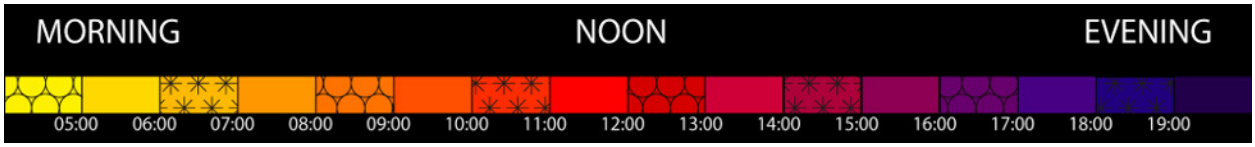


Fig. 32: Solar reflections



60° FIELD OF VIEW: SEASON
VIEWPOINT T3 - LOOKING FORWARD

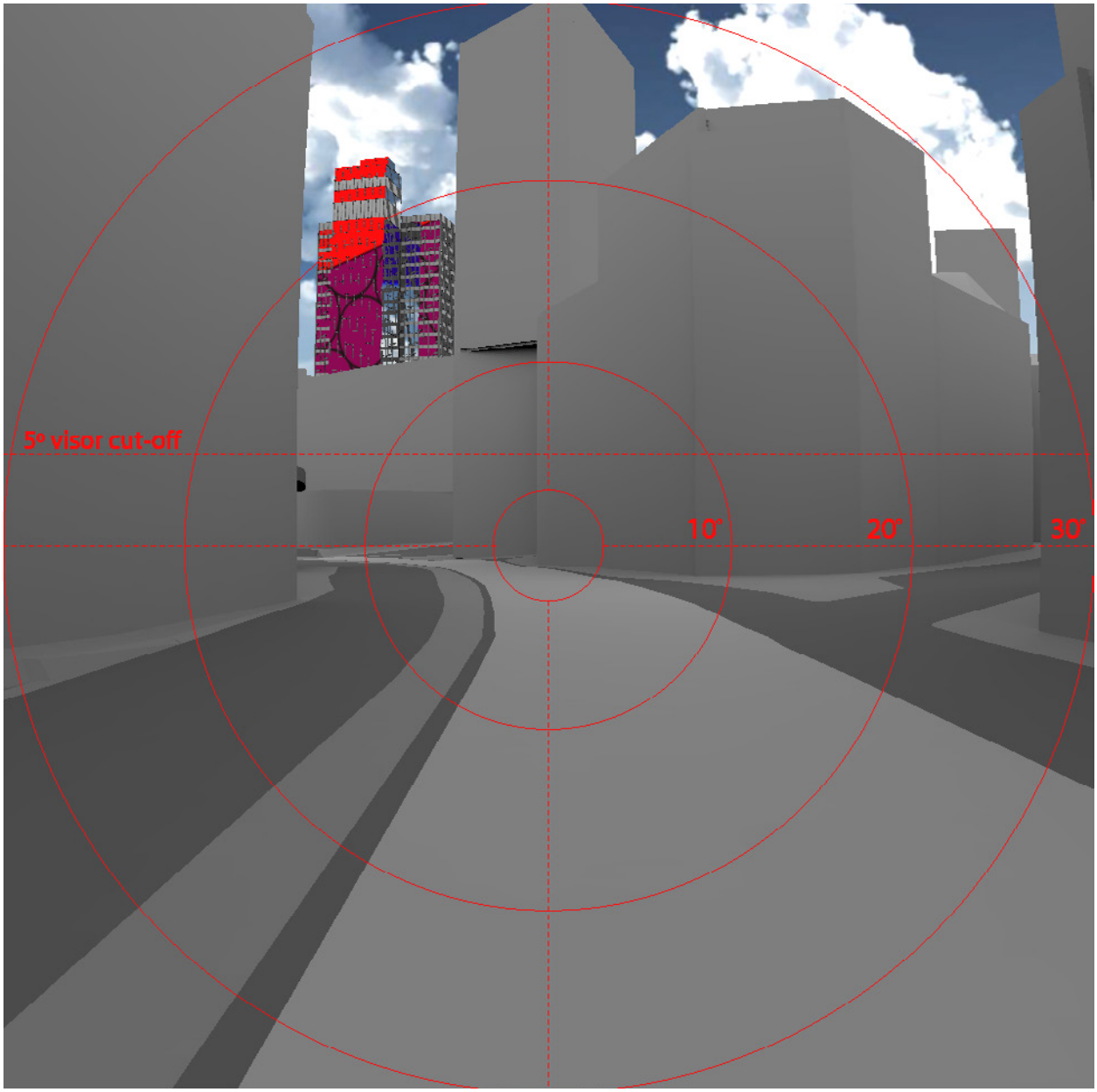


Fig. 33: Solar reflections



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What we do:

Building Surveying
Daylight & Sunlight
Light Obstruction Notices
Measured Surveys
Party Wall & Neighbourly Matters
Rights of Light
Solar PV
Wind Analysis

Where we are:

Belfast
Birmingham
Bristol
Dublin
London
Manchester

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