Appendix 12.1 – Solar Glare Assessment Methodology

Solar reflections off a building are particularly important at, road junctions including pedestrian crossings, and traffic signals as glare can cause temporary blinding of drivers. Typically, those elements of a Proposed Development considered reflective are either glazed elements or specular metal cladding. An assessment has been conducted to determine the time of day, period of year, duration and positioning of potential solar glare according to the driver's line of sight.

Solar Glare is not a comparative assessment; the fact it may occur in the baseline does not necessarily justify its occurrence as a result of a Proposed Development. Therefore, the assessment considers the effect of the Proposed Development in absolute terms.

Assumptions

For solar glare, the assessment undertaken is the worst-case scenario and has been undertaken assuming year-long clear skies. In reality, the probability of clear skies varies throughout the year, with the most cloud cover in the winter months and least in the summer months.

Assessment Methodology

The assessment considers potentially sensitive viewpoints for road and train/tram drivers surrounding the site. The viewpoints are generally be located at the minimum stopping distance for road users and at the driver's eye level with the focal point being a relevant traffic element, such as signals or incoming traffic. For train/tram drivers, viewpoints assessed is where signals are visible or at representative intervals where the Proposed Development would be visible close to the direct line of sight for a substantial stretch of track.

Viewpoints within 500m of the Site, where the Proposed Development is visible within the driver's field of view are assessed. At distances greater than 500m from the Proposed Development, instances of solar glare would be unlikely to occur.

The assessment of solar glare identifies the time of the day and year that solar reflections will be visible from the assessed viewpoints, as well as their relationship to a driver's line of sight. The assessment does not however, measure the intensity of the reflection but merely the occurrence and duration.

Drivers at each of the relevant road junctions are considered the sensitive receptors, where there are multiple directions of travel potentially affected, each direction of travel at the junction is considered a separate receptor as their effect significance may differ. For train/tram tracks, the train/tram drivers on the stretch of track are considered to be the sensitive receptor. The effect significance will be determined using professional judgement taking into consideration the duration of solar reflections, location of these in relation to a driver's line of sight, type of junction control and the probability of reflections occurring. The effect significance is given on a per junction basis considering all viewpoints assessed for that junction as well as any viewpoints that would not be affected by the Proposed Development.

Methodology for Determining Operational Effects

Owing to the evolving and changing nature of demolition and construction activities, the assessment of potential effects during demolition and construction of the Proposed Development on solar glare has not been modelled. Instead, a qualitative assessment has been undertaken using professional judgement and experience.

The potential solar glare effects relating to demolition and construction works will vary throughout the construction programme, starting from installation of the first glazed façade panels and gradually increasing to the potential effects identified for the completed Proposed Development once all cladding has been installed. It is therefore considered that the completed Proposed Development represents the worst-case assessment in terms of likely solar glare effects.

Methodology for Determining Operational Effects

The technical analyses carried out to inform the assessments and identify possible solar glare effects on road users and tram/train drivers have been undertaken by creating a digital three-dimensional (3D) model of the surrounding area, based on photogrammetry survey data, and insertion of a 3D model of the Proposed Development.

The potential for reflected solar glare or dazzle from the glazed or reflective façade cladding of the Proposed Development has been assessed using specialist lighting software. The assessment shows the path of the sun for the entire year around the Proposed Development. From this, two computer generated angular images have been produced for each selected viewpoint, indicating the area which sees the reflection of the sun-path at any point during the year. A modified diagram portraying a standardised extent of human vision is then overlaid onto the image.

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, driving, and any activity where visual detail is of primary importance. The macula corresponds to the central 13° of the visual field; the fovea to the central 3°.

Figure 12.1 highlights the degrees of vision corresponding to the foveal view, with a red circle of 3° of angle in order to identify the area most sensitive to reflected solar glare. Another red circle represents the incidence of the 30° radius of our typical field of view in order to identify a secondary area of sensitivity to potential reflected glare instances.

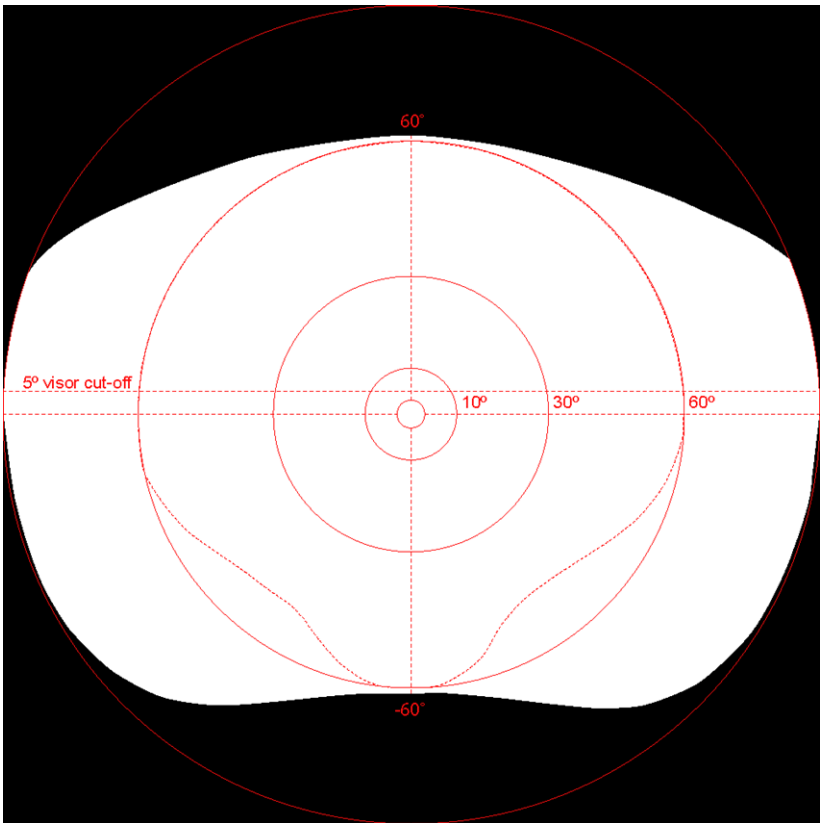


Figure 12.1 – Typical Human Field of View

The degrees of vision provide a reference from which potential concerns can be judged. At 3°, the potential for the reflected glare to cause a hazard is high and mitigation would be required. Between 3° and 30°, there is the potential that there could be an issue and mitigation may be necessary.

As stated in the CIE 146:2002, occurrences at angles beyond 30° would be of little significance in most situations, but may be relevant in exceptional circumstances. When seated in a driving seat of a typical car, for example, the limits of the windscreen would generally obstruct the driver's view at angles beyond 30° from the line of sight. Therefore, the risk of reflective solar glare causing a hazard is reduced.

Viewpoints for Road Users

The assessment considers potentially sensitive viewpoints for road users surrounding the Site. The viewpoints are generally located at the minimum stopping distance and at the driver's eye level. The focal point is a relevant traffic element, such as signals or incoming traffic.

Identifying the viewpoints based on the stopping distance is calculated as the combination of thinking and braking distances, using the following formula:

$D_{total} = D_{thinking} + D_{braking} = V*T + V^2/(2\mu*g)$

Where each component is:

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

T = Thinking time (0.67 sec)

μ = Braking effort (considered 0.65 for cars and 0.5 for buses)

g = Gravity acceleration.

The height of the viewpoint is considered to be 1.5m for cars and 2.0m for buses and trams. Figure 12.2 identifies the typical stopping distance range for a car travelling at different speeds. Therefore, a viewpoint for a car driving at 30 mph (i.e. speed limit for a dense urban location) would be placed at 23m from a traffic light and 1.5m above the ground.

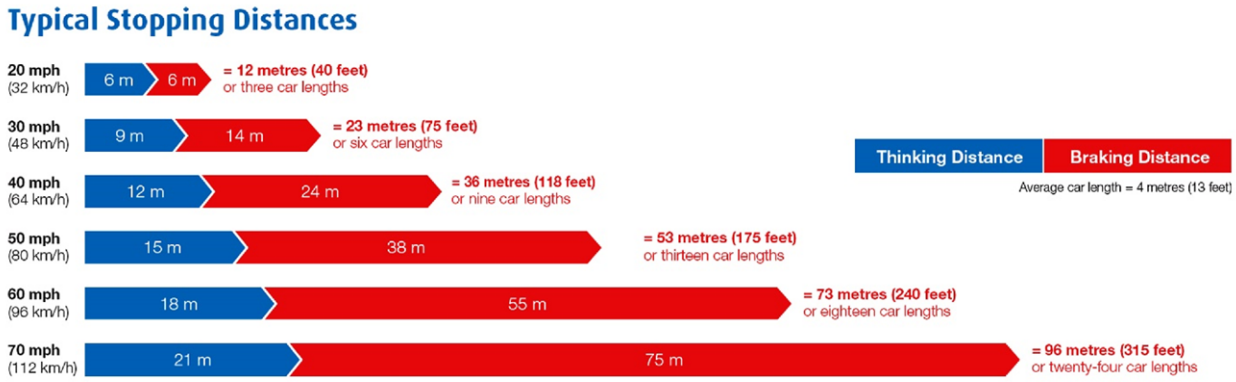


Figure 12.2 – Typical Car Stopping Distances for Various Speed Limits

Viewpoints for Train Drivers

The assessment considers potentially sensitive viewpoints for train drivers surrounding the Site. The viewpoints are assessed where signals are visible or at representative intervals where the Proposed Development would be visible close to the direct line of sight for a substantial stretch of track.

The height of the viewpoint is considered to be 2.75m above the rails.

For both receptor types, the assessment also considers a driver's field of vision which takes the angular extent seen at any given time, which for humans facing forwards is approximately 180 degrees.