



# SOLAR LIGHT REFLECTIVITY STUDY

461 CHAPEL ROAD, BANKSTOWN

WJ433-01F03(REV3)- SR REPORT

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Prepared for:

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# DOCUMENT CONTROL

| Date              | Revision History                               | Issued Revision | Prepared By (initials) | Instructed By (initials) | Reviewed & Authorised by (initials) |
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# 459-461 Chapel Road, Bankstown Saint Paul's Anglican Church (SSD-79709963)

## 1.1 Introduction

This Solar Reflectivity Report is submitted to the Department of Planning, Housing and Infrastructure (DPHI) on behalf of the Anglican Church Property Trust Diocese of Sydney under Sydney Anglican Property (SAP) in support of a State Significant Development Application (SSDA) (SSD-79709963) for a mixed-use development, comprising social and affordable housing at 459-461 Chapel Road, Bankstown (the site).

## 1.2 Project Background

SAP was formed on 1 January 2024 to provide a unified, co-ordinated approach to all diocesan property matters. A key objective of SAP is to put the Sydney Anglican Diocese's property on mission by delivering high-quality projects that provide much-needed community infrastructure, including upgraded ministry facilities, affordable housing and childcare.

As part of this mission, SAP, in partnership with Anglicare, is working with the Government to deliver a 23 storey 100% social and affordable housing development on its landholdings in the Bankstown City Centre. The affordable housing will be accompanied by community and renewed ministry facilities, childcare and retail and commercial uses within the podium.

### 1.3 The Site

The site is located at 459-461 Chapel Road, Bankstown within the Canterbury-Bankstown Local Government Area (LGA). It is located 500m of the Bankstown Station and City Centre and as such, is located within the Bankstown TOD Accelerated Precinct.

The site comprises three allotments, which are all owned by the Anglican Church Property Trust Diocese of Sydney and are legally described as Lots 26A, 27A and 28A in DP7058. Combined, the site has an approximate area of 2,179m<sup>2</sup>. It is located on a corner and has a street frontage of 52m to French Avenue to the north and 43m to Chapel Road to the west. Figure 1 below provides an aerial map of the site.

The site currently comprises an existing 350 capacity church building, known as Saint Paul's Anglican Church, as well as an associated ministry building and an additional building containing a range of community uses.



Figure 1: Site Aerial

## 1.4 The Proposed Development

This SSDA seeks approval for a new mixed-use affordable housing development. Specifically, the proposed development will comprise the following scope of works:

- Site preparation and excavation works, including demolition of all structures on the site.
- Construction of a new mixed-use 23 storey building, comprising the following:
  - Ground level retail and Level 1 commercial floor space located on the corner of Chapel Road and French Avenue.
  - 2 storey dual use community facility and place of public worship.
  - A childcare centre with outdoor open space, which will be shared with the community facility and place of public worship after hours and on weekends.
  - Approximately 186 dwellings from Level 2 and above, which will be used for the purpose of affordable housing, with the exception of one four-bedroom dwelling located on Level 2, which will be allocated to the church and therefore, is proposed to be ancillary to the place of public worship.
- One storey basement, comprising approximately carparking spaces, plant and loading facilities, which will be accessed via French Avenue. An at-grade shared carpark will be provided along the eastern boundary.
- Associated landscaping and public domain works.
- Extension and augmentation of physical infrastructure and utilities as required.

For a detailed project description, refer to the Environmental Impact Statement prepared by Beam Planning and the Architectural Drawings prepared by Plus.

## 1.5 Relevant SEARs

This Solar Reflectivity Report addresses the following relevant Secretary's Environmental Assessment Requirements (SEARs) set out in Table 1 below.

Table 1: SEARs Compliance Table

| SEARs Requirement Section of Report where response is provided. |                 |
|---|-----------------|
| SEARs Section 7 – Environmental Amenity                         | Sections 2 to 6 |

# EXECUTIVE SUMMARY

This report presents the results of a detailed study for the effect of potential solar glare from the subject development located at 461 Chapel Road, Bankstown. This study identifies any possible adverse reflected solar glare conditions affecting motorists, pedestrians, and to occupants of neighbouring buildings. If necessary, recommendations are made to mitigate any potentially adverse effects. This study assesses compliance with the controls for solar glare from the State Environmental Planning Policy (Housing) 2021 Chapter 4 Design, which contains the Apartment Design Guide (ADG), and the City of Canterbury Bankstown Development Control Plan 2023.

The results of the study indicate that, to avoid any adverse glare to motorists and pedestrians on the surrounding streets, occupants of neighbouring buildings, and to comply with the abovementioned planning control requirements, the following limitations to the maximum normal specular reflectance of visible light of the external façade glazing is recommended:

- Northern aspect (009°) main building façade and balustrades on Level 01: 9%.
- Western aspect (279°) main building façade and balustrades on Levels 06 to 20: 9%.
- All other glazing on the external façade should have a maximum normal specular reflectance of visible light of 20%.

It should be noted that the most reflective surface on the façade of a building is the glazing. Reflected solar glare from concrete, brickwork, timber, etc. is negligible (i.e. less than 1% normal specular reflectance) and hence will not cause any adverse solar glare effects. Note also that, for any painted or powder-coated metallic surfaces on the exterior façade of the development, the maximum normal specular reflectance of visible light for those types of surfaces is in the range of 1% to 5%, which is well within the abovementioned limit.

Hence, with the incorporation of the abovementioned recommendations, the results of this study indicate that the subject development will not cause adverse solar glare to motorists or pedestrians in the surrounding area, or to occupants of neighbouring buildings, and will comply with the planning controls regarding reflectivity from Chapter 4 of the SEPP (Housing) 2021 and the City of Canterbury Bankstown Development Control Plan 2023.

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## GLARE OBSERVED BY MOTORISTS

### 2.1 Methodology

The reflectivity analysis of the subject development has been carried out using the technique published by Hassall (1991). The limiting veiling luminance of 500 cd/m<sup>2</sup> for the comfort of motorists, as suggested in Hassall (1991), has been adopted as a basis of assessing the glare impact from the subject development.

The various critical glazed aspects of the development were determined and are shown in Figure 1. Solar charts for each of these critical glazed aspects are presented in Appendix B, and these are used to derive the check zones which are shown in Figure 2. The solar chart of each critical aspect is determined from the standard sun chart of the region, provided in Appendix C (Phillips, 1992), using the method detailed in Hassall (1991). The check zones highlight the areas that are potentially affected by solar reflections from each critical glazed aspect. It should be noted that the check zones shown in Figure 2 do not take into account the effect of overshadowing by neighbouring buildings or the shielding effect of any existing trees or other obstructions. These effects are examined in the detailed analysis described in Section 1.3 of this report.

Study point locations are selected within the check zone areas where motorists are facing the general direction of the subject development (within  $\pm 16^\circ$  of the direct sight-line). These are shown in Figure 2, and summarised in Table 3. Photographs have been taken from the viewpoint of motorists at each study point location using a calibrated camera, and a scaled glare protractor has been superimposed over each viewpoint image (these are presented in Appendix A).

The glare protractor is used to assess the amount of glare likely to be caused and to provide a direct comparison with the criterion of 500 cd/m<sup>2</sup>. Alternatively, the glare protractor can be used to determine the maximum acceptable reflectivity index of the façade material of the development for the glare to be within the criterion of 500 cd/m<sup>2</sup>, to ensure that solar glare will not cause discomfort or threaten the safety of motorists and hence to enable the subject development to comply with the relevant planning control requirements regarding solar light reflectivity.

The list of the architectural drawings relied on for this assessment are presented in Table 1 below.

Table 2: List of Architectural Drawings Referenced

| Drawing Title                       | Revision Number | Date       |
|-------------------------------------|-----------------|------------|
| PLA-DA-1000 - GROUND                | 11              | 26/03/2025 |
| PLA-DA-1001 - LEVEL 01              | 11              | 26/03/2025 |
| PLA-DA-1002 - LEVEL 02              | 11              | 26/03/2025 |
| PLA-DA-1003 - LEVEL 03 - LEVEL 07   | 11              | 26/03/2025 |
| PLA-DA-1008 - LEVEL 08              | 11              | 26/03/2025 |
| PLA-DA-1009 - LEVEL 09              | 11              | 26/03/2025 |
| PLA-DA-1010 - LEVEL 10              | 11              | 26/03/2025 |
| PLA-DA-1011 - LEVEL 11 - LEVEL 22   | 11              | 26/03/2025 |
| PLA-DA-1023 - ROOF                  | 11              | 26/03/2025 |
| PLA-DA-2000 - ELEVATIONS - SHEET 01 | 11              | 26/03/2025 |
| PLA-DA-2001 - ELEVATIONS - SHEET 02 | 11              | 26/03/2025 |
| PLA-DA-2002 - ELEVATIONS - SHEET 03 | 11              | 26/03/2025 |
| PLA-DA-2003 - ELEVATIONS - SHEET 04 | 11              | 26/03/2025 |
| PLA-DA-3000 - SECTIONS - SHEET 01   | 11              | 26/03/2025 |
| PLA-DA-3001 - SECTIONS - SHEET 02   | 11              | 26/03/2025 |



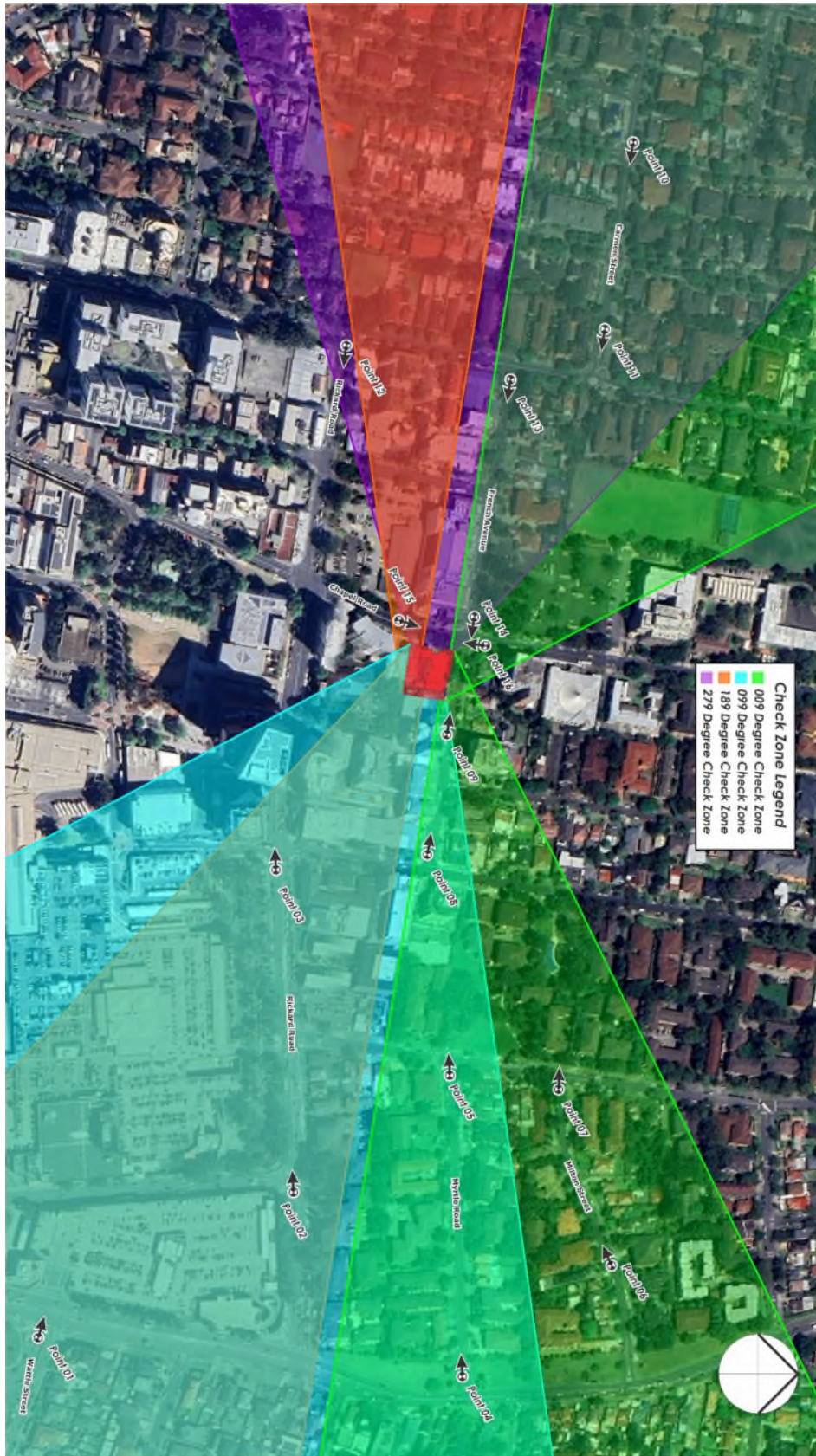


Figure 3: Check Zones and Study Point Locations  
 (the check zones are the areas where glare could potentially be observed)

## 2.2 Veiling Luminance

As described in Section 1.1, a limiting veiling luminance of 500 cd/m<sup>2</sup> is utilised in this assessment of glare from the façade of the subject development for the comfort and safety of motorists or train driver. The veiling luminance, measured in units of Candelas per square metre, can be determined using the Holladay Formula as follows:

$$L_v = \frac{10ER\cos\theta}{\theta^2} \quad (1.1)$$

Where:

$E$  Is the solar illumination (solar power) of the sun ray on the façade, measured in lux.

$\theta$  Is the angle between the line normal to the centre of the glare source and the line of sight of the observer.

$R$  Is the inherent visual light reflectance value of the glazing as a percentage.

$L_v$  Is the Veiling Luminance in cd/m<sup>2</sup>. The limit to which solar glare is assessed is 500 cd/m<sup>2</sup>.

The veiling luminance is a function of solar illumination ( $E$ ), the reflective value of a surface ( $R$ ) and theta, which is the angle between the glare source and the line of site of the observer. The solar illumination ( $E$ ) is calculated as a product of the solar power (W/m<sup>2</sup>) and luminous efficiency (lumens/W). Solar power and luminous efficiency are both a function of the sun elevation (as shown in Figure 3a, from Hassall, 1991).

The glare protractor, as described in Section 1.1 and shown overlaid onto the viewpoint images in Appendix A, represents the visual acuity of the eye; specifically, the eye's perception to luminance. The centre of the circle on the glare protractor, known as the zone of distinct vision, represents the line of sight of the observer. As the glare source approaches the zone of distinct vision, theta tends to 0 and the veiling luminance increases drastically. Hence, the critical locations on the building façade with regards to glare intensity are (in most cases) locations where the glare source is near the zone of distinct vision (i.e., in the direct sightline of the motorist or train driver). As such, where necessary, the critical locations selected for the calculation of veiling luminance are chosen based on this reasoning.

Further to the above, it should be noted that glass will reflect more than its nominal percentage of reflection if the angle of incidence is greater than approximately 45 degrees. If the angle of incidence is greater than approximately 45 degrees the solar illumination ( $E$ ) increases exponentially, and hence the intensity of the glare observed also increases exponentially. The relationship between reflected light and angle of incidence is illustrated in Figure 3b. For locations affected by this type of high angle of incidence glare condition, physical obstructions are required to be used to mitigate adverse solar glare, unless the calculated veiling luminance is less than the limiting veiling luminance of 500 cd/m<sup>2</sup>.

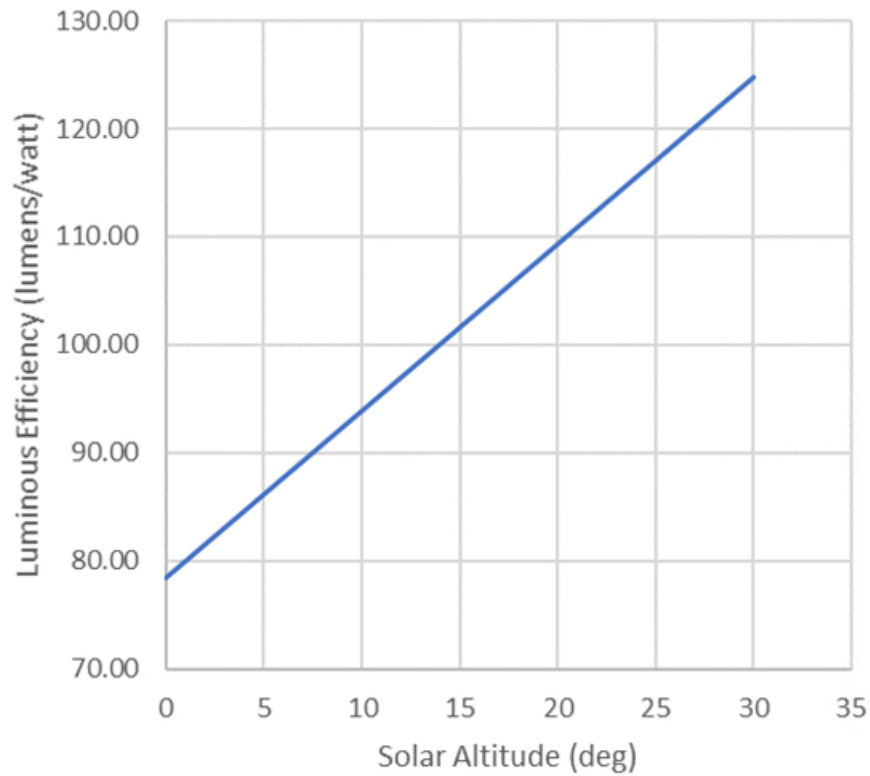
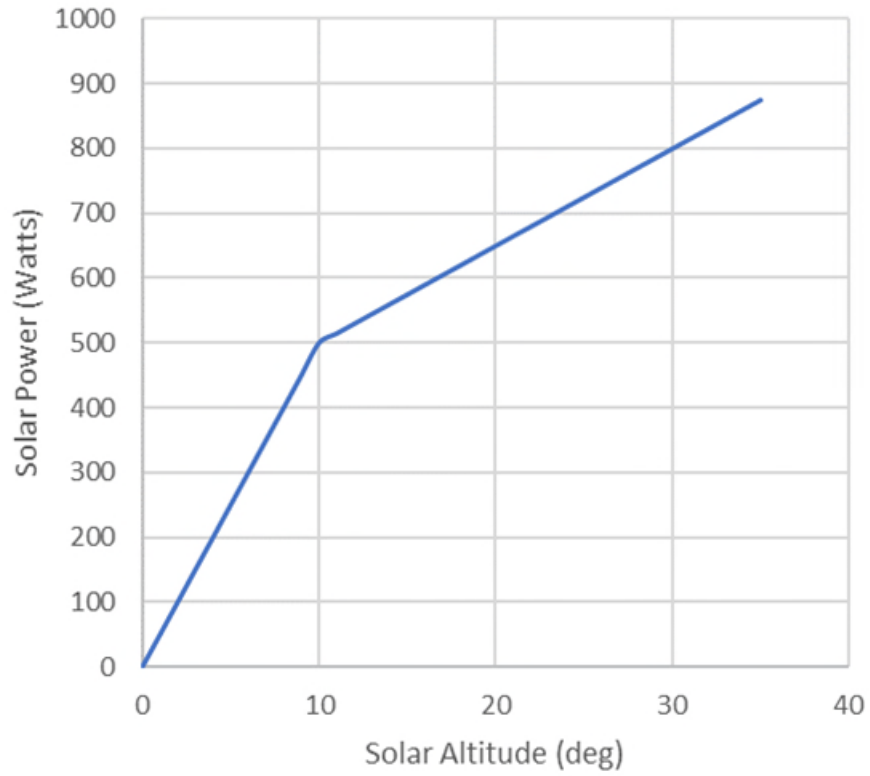
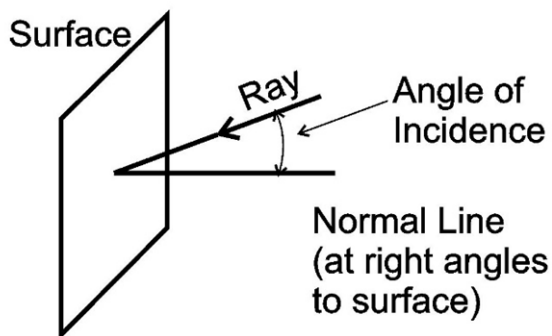
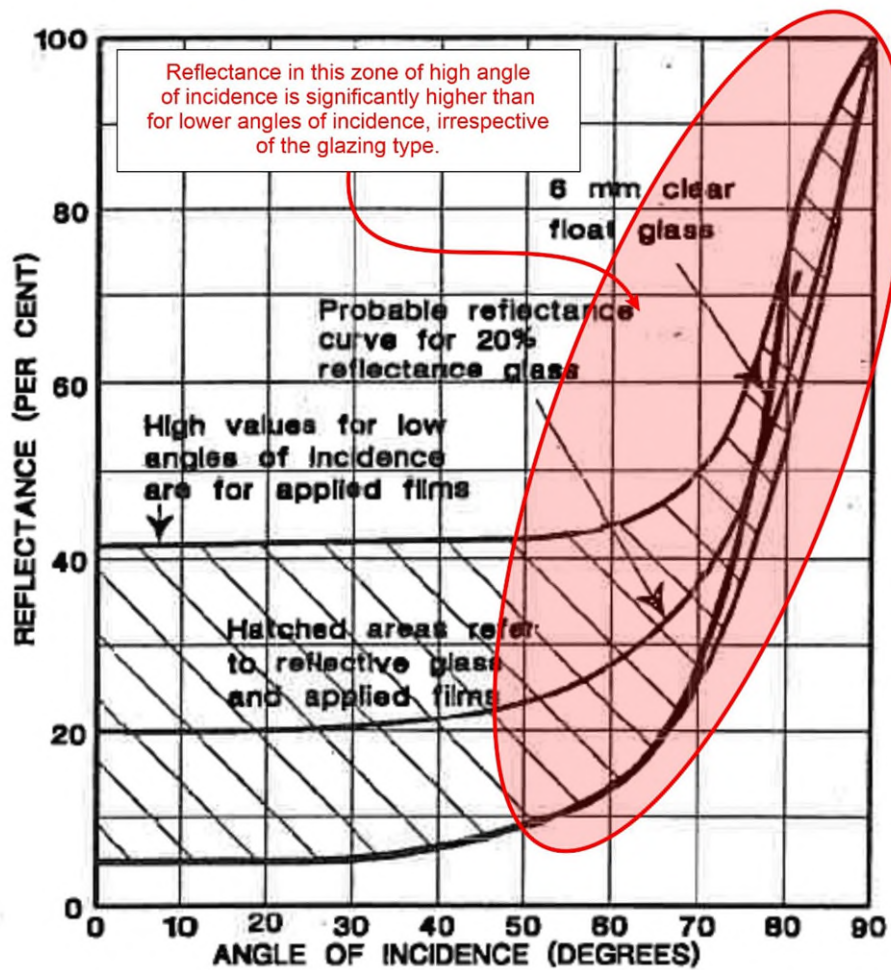


Figure 4a: Relationship between Solar Power, Luminous Efficiency and Solar Altitude (from Hassall, 1991)



Definition of Angle of Incidence

Figure 4b: Reflectance of Different Glazing Types for Varying Angles of Incidence of Light (from Hassall, 1991)

## 2.3 Analysis and Discussion

The amount of solar glare observed by motorists from the façade of the development at each study point location is presented in this section. Treatment options are provided if excessive solar glare conditions are observed.

Table 3: Viewpoint Assessment from Each Study Point

| Study Point | Location and Viewpoint            | Development Visibility  |
|-------------|-----------------------------------|---|
| Point 01    | Wattle Street, heading west       | Visible, refer to the following sub-section for further analysis. |
| Point 02    | Rickard Road, heading west        | Visible, refer to the following sub-section for further analysis. |
| Point 03    | Rickard Road, heading west        | Not visible, no further assessment required.                      |
| Point 04    | Myrtle Road, heading west         | Visible, refer to the following sub-section for further analysis. |
| Point 05    | Myrtle Road, heading west         | Not visible, no further assessment required.                      |
| Point 06    | Milton Street, heading south-west | Not visible, no further assessment required.                      |
| Point 07    | Milton Street, heading west       | Not visible, no further assessment required.                      |
| Point 08    | French Avenue, heading west       | Visible, refer to the following sub-section for further analysis. |
| Point 09    | French Avenue, heading west       | Visible, refer to the following sub-section for further analysis. |
| Point 10    | Carmen Street, heading east       | Not visible, no further assessment required.                      |
| Point 11    | Carmen Street, heading east       | Visible, refer to the following sub-section for further analysis. |
| Point 12    | Rickard Road, heading east        | Not visible, no further assessment required.                      |
| Point 13    | French Avenue, heading east       | Visible, refer to the following sub-section for further analysis. |
| Point 14    | French Avenue, heading east       | Visible, refer to the following sub-section for further analysis. |
| Point 15    | Chapel Road, heading north        | Visible, refer to the following sub-section for further analysis. |
| Point 16    | Chapel Road, heading south        | Visible, refer to the following sub-section for further analysis. |

Table 4: Aspects of the Development that could reflect Solar Glare to Each Study Point for Motorists

| Study Point | Location and Viewpoint      | Aspect(s) of the Development                     |
|-------------|-----------------------------|--|
| Point 01    | Wattle Street, heading west | Eastern and southern aspects of the development. |
| Point 02    | Rickard Road, heading west  | Eastern and southern aspects of the development. |
| Point 04    | Myrtle Road, heading west   | Eastern and northern aspects of the development. |
| Point 08    | French Avenue, heading west | Eastern and northern aspects of the development. |
| Point 09    | French Avenue, heading west | Eastern and northern aspects of the development. |
| Point 11    | Carmen Street, heading east | Northern and western aspects of the development. |
| Point 13    | French Avenue, heading east | Northern and western aspects of the development. |
| Point 14    | French Avenue, heading east | Northern and western aspects of the development. |
| Point 15    | Chapel Road, heading north  | Southern and western aspects of the development. |
| Point 16    | Chapel Road, heading south  | Northern and western aspects of the development. |

### 2.3.1 Motorists heading west along Wattle Street at Point 01

An analysis of the glare meters overlaid onto the viewpoint at Point 01 indicates that portions of the eastern aspect (099°) and southern aspect (189°) are visible and within the zone of sensitive vision. A further analysis indicates Point 01 is located within the check zones for the visible eastern aspect (099°) and southern aspect (189°). Hence there is potential for solar glare to be observed by motorists heading west along Wattle Street at Point 01 during the early morning and late afternoon period.

To ensure that the intensity of that adverse glare is not observed by motorists heading west along Wattle Street at Point 01, it is recommended that the glazing/façade element used on the eastern aspect (099°) and southern aspect (189°) has a maximum normal reflectance of visible light of 20%.

### 2.3.2 Motorists heading west along Rickard Road at Point 02

An analysis of the glare meter overlaid onto the viewpoint image at Point 02 indicates that the view of the development will not be visible within the zone of sensitive vision. Hence there will be no adverse solar glare observed by motorists heading west along Rickard Road at Point 02.

### 2.3.3 Motorists heading west along Myrtle Road at Point 04

An analysis of the glare meter overlaid onto the viewpoint image at Point 04 indicates that a portion of the northern aspect (009°) is visible and within the zone of sensitive vision. Point 04 is located within the check zones for the visible northern aspect (009°) and hence there is potential for solar glare to be observed at this location during the late afternoon period. A review of the architectural drawings indicate that the visible portion of the façade is comprised of rendered façade. Rendered façade typically has a negligible specular reflectance value of less than 1% and as such reflected solar glare from rendered facade is not expected to have an adverse impact on the motorists. Hence there will be no adverse solar glare observed by motorists heading west along Myrtle Road at Point 04 from the visible northern aspect (009°).

An analysis of the glare meters overlaid onto the viewpoint at Point 04 indicates that portions of the eastern aspect (099°) is visible and within the zone of sensitive vision. Point 04 is located within the check zones for the visible eastern aspect (099°). Hence there is potential for solar glare to be observed at this location during the early morning period. A review of the architectural drawings indicate that the visible portion of the façade is approximately 20% comprised of glazing, and the non-glazed portion will have a negligible reflectance. Further analysis of the visible eastern aspect (099°) indicates that solar glare will cause only a very narrow vertical strip of the glazed façade with an angular width of less than 0.5° arc, to be capable of causing glare at this point at any single point in time. As the sun subtends an angular width of 0.5°, the possibility of the full intensity of the solar glare from being observed off the visible façade is minimised. As a general recommendation maximum normal specular reflectance of visible light of 20% is recommended to be used along the eastern aspect (099°) of the development.

### 2.3.4 Motorists heading west along French Avenue at Point 08

An analysis of the glare meter overlaid onto the viewpoint image at Point 08 indicates that a portion of the northern aspect is visible and within the zone of sensitive vision. Point 08 is located within the check zones for the visible northern aspect (009°) and hence there is potential for solar glare to be observed at this location during the late afternoon period. A review of the architectural drawings indicate that the visible portion of the façade is comprised of rendered façade. Rendered façade typically has a negligible specular reflectance value of less than 1% and as such reflected solar glare from rendered facade is not expected to have an adverse impact on the motorists. Hence there will be no adverse solar glare observed by motorists heading west along French Avenue at Point 08 from the visible northern aspect (009°).

An analysis of the glare meters overlaid onto the viewpoint at Point 08 indicates that portions of the eastern aspect (099°) is visible and within the zone of sensitive vision. Point 08 is located within the check zones for the visible eastern aspect (099°). Hence there is potential for solar glare to be observed at this location during the early morning period. A review of the architectural drawings indicate that the visible portion of the façade is approximately 15% comprised of glazing, and the non-glazed portion will have a negligible reflectance. To ensure that the intensity of that adverse glare is not observed by motorists heading west along Wattle Street at Point 01, it is recommended that the glazing/façade element used on the eastern aspect (099°) has a maximum normal reflectance of visible light of 20%.

### 2.3.5 Motorists heading west along French Avenue at Point 09

An analysis of the glare meter overlaid onto the viewpoint image at Point 09 indicates that a portion of the eastern aspect is visible and within the zone of sensitive vision. Point 09 is located within the check zones for the visible eastern aspect (099°) and hence there is potential for solar glare to be observed at this location during the early morning period. A review of the architectural drawings indicate that the visible portion of the façade is comprised of rendered façade. Rendered façade typically has a negligible specular reflectance value of less than 1% and as such reflected solar glare from rendered facade is not expected to have an adverse impact on the motorists. Hence there will be no adverse solar glare observed by motorists heading west along French Avenue at Point 09 from the visible eastern aspect (099°).

An analysis of the glare meter overlaid onto the viewpoint image at Point 09 indicates that a portion of the northern aspect is visible and within the zone of sensitive vision. Point 09 is located within the check zones for the visible northern aspect (009°) and hence there is potential for solar glare to be observed at this location during the late afternoon period. A review of the architectural drawings indicate that the visible portion of the façade is comprised of rendered façade. Rendered façade typically has a negligible specular reflectance value of less than 1% and as such reflected solar glare from rendered facade is not expected to have an adverse impact on the motorists. Hence there will be no adverse solar glare observed by motorists heading west along French Avenue at Point 09 from the visible northern aspect (009°).

### 2.3.6 Motorists heading east along Carmen Street at Point 11

An analysis of the glare meter overlaid onto the viewpoint image at Point 11 indicates that the view of the development will not be visible within the zone of sensitive vision. Hence there will be no adverse solar glare observed by motorists heading east along Carmen Street at Point 11.

### 2.3.7 Motorists heading east along French Avenue at Point 13

An analysis of the glare meter overlaid onto the viewpoint image at Point 13 indicates that a portion of the northern aspect (009°) is visible and within the zone of sensitive vision. Point 13 is located within the check zones for the visible northern aspect (009°) and hence there is potential for solar glare to be observed at this location during the early morning period. A review of the architectural drawings indicate that the visible portion of the façade is comprised of rendered façade. Rendered façade typically has a negligible specular reflectance value of less than 1% and as such reflected solar glare from rendered facade is not expected to have an adverse impact on the motorists. Hence there will be no adverse solar glare observed by motorists heading east along French Avenue at Point 13 from the visible northern aspect (009°).

An analysis of the glare meter overlaid onto the viewpoint image at Point 13 indicates that a portion of the western aspect (279°) is visible and within the zone of sensitive vision. Point 13 is located within the check zones for the visible western aspect (279°) and hence there is potential for solar glare to be observed at this location during the late afternoon period. To ensure that the intensity of that adverse glare is not observed by motorists heading east along French Avenue at Point 13, it is recommended that the glazing/façade element used on the western aspect (279°) has a maximum normal reflectance of visible light of 9%, which is to be applied from Level 06 to Level 20.

### 2.3.8 Motorists heading east along French Avenue at Point 14

An analysis of the glare meter overlaid onto the viewpoint image at Point 14 indicates that a portion of the western aspect (279°) is visible and within the zone of sensitive vision. Point 14 is located within the check zones for the visible western aspect (279°) and hence there is potential for solar glare to be observed at this location during the late afternoon period. A review of the architectural drawings indicate that the visible portion of the façade is comprised of rendered façade. Rendered façade typically has a negligible specular reflectance value of less than 1% and as such reflected solar glare from rendered facade is not expected to have an adverse impact on the motorists. Hence there will be no adverse solar glare observed by motorists heading east along French Avenue at Point 14 from the visible western aspect (279°).

An analysis of the glare meter overlaid onto the viewpoint image at Point 14 indicates that a portion of the northern aspect (009°) is visible and within the zone of sensitive vision. Point 14 is located within the check zones for the visible northern aspect (009°) and hence there is potential for solar glare to be observed at this location during the early morning period. A review of the architectural drawings indicate that the visible portion of the façade is comprised of rendered façade, from Level 02 onwards. Rendered façade typically has a negligible specular reflectance value of less than 1% and as such reflected solar glare from rendered facade is not expected to have an adverse impact on the motorists. Additionally, to ensure that the intensity of that adverse glare is not observed by motorists heading east along French Avenue at Point 14, it is recommended that the glazing elements used on Level 01 northern aspect (009°) has a maximum normal reflectance of visible light of 9%.

### 2.3.9 Motorists heading north along Chapel Road at Point 15

An analysis of the glare meter overlaid onto the viewpoint image at Point 15 indicates that portions of the western aspect (279°) is visible and within the zone of sensitive vision. However, further analysis indicates that Point 15 does not lie within the check zone for the portions of the western aspect. Hence there will be no adverse solar glare observed by motorists heading north along Chapel Road at Point 15 from the visible western aspect (279°).

Additionally, an analysis of the glare meters overlaid onto the viewpoint at Point 15 indicates that portions of the southern aspect (189°) is visible and within the zone of sensitive vision. Point 15 is located within the check zones for the visible southern aspect (189°). Hence there is potential for solar glare to be observed at this location during the late afternoon period. A review of the sun chart for the Sydney region indicates that the sun will not operate at the angular position required for sunlight to be reflected off the aspect (with the sun located at an acute azimuth angle from the south). Hence there will be no adverse solar glare observed by motorists heading north along Chapel Road at Point 15 from the visible southern aspect (189°).

### 2.3.10 Motorists heading south along Chapel Road at Point 16

An analysis of the glare meter overlaid onto the viewpoint image at Point 16 indicates that portions of the western aspect (279°) is visible and within the zone of sensitive vision. However, further analysis indicates that Point 15 does not lie within the check zone for the portions of the western aspect. Hence there will be no adverse solar glare observed by motorists heading south along Chapel Road at Point 16 from the visible western aspect (279°).

Additionally, an analysis of the glare meters overlaid onto the viewpoint at Point 15 indicates that portions of the northern aspect (009°) is visible and within the zone of sensitive vision. Point 15 is located within the check zones for the visible northern aspect (009°). Hence there is potential for solar glare to be observed at this location during the early morning period. A review of the sun chart for the Sydney region indicates that the sun will not operate at the angular position required for sunlight to be reflected off the aspect (with the sun located at an acute azimuth angle from the north). Hence there will be no adverse solar glare observed by motorists heading south along Chapel Road at Point 16 from the visible northern aspect (009°).

## GLARE OBSERVED BY PEDESTRIANS AND OCCUPANTS OF NEIGHBOURING BUILDINGS

Our past experience involving more than 250 projects, and also research by Rofail and Dowdle (2004), tends to indicate that buildings which cause a nuisance to pedestrians and occupants of neighbouring buildings are those that have a normal specular reflectivity of visible light greater than 20%. This seems to justify the suggested limit of 20% reflectivity by many local government authorities and state planning bodies. Hence a general recommendation is made that all glazing and other reflective materials used on the façade of the subject development have a maximum normal specular reflectivity of visible light of 20% to avoid adverse solar glare to pedestrians and occupants of neighbouring buildings.

## 4 TYPICAL REFLECTANCES OF FAÇADE MATERIALS

It should be noted that the most reflective surface on the façade of a building is the glazing. Reflected solar glare from concrete, brickwork, timber, etc, is negligible (ie: less than 1% normal specular reflectance) and hence will not cause any adverse solar glare effects. The following sub-sections provide some general reflectance values of more reflective materials used on building facades.

### 4.1 Glazed Surfaces

A glazing supplier will be able to provide information on the maximum normal specular reflectance of visible light of different types of glazing. Some typical reflectivity values of different types of glazing are listed as follows:

- Low reflectance glazing, such as Guardian Clarity – less than 5%
- Clear float glass – typically 5% to 8%
- Low-e solar control glazing – typically 8% to 12%
- Other types of compliant performance glazing – up to 20%

### 4.2 Painted and/or Powder-Coated Metallic Surfaces

In the event that some portions of the external façade of the development feature powder-coated or painted metallic surfaces, it is not expected that adverse glare will be observed from those surfaces since the maximum normal specular reflectance of visible light of these types of façade materials range from 1% to 5%. This is well within the maximum limits specified in previous sections of this report.

### 4.3 Glare from Convex Curved Surfaces

It is noted that convex curved façades are proposed at several locations of the proposed development. Glare from these types of façade elements is dispersed by the convex curvature, which reduces the intensity of glare observed. Furthermore, any glare that is observed will appear very small at any given point in time, since it is not possible for glare from the entire curved surface to be observed at once. Hence there will not be any adverse solar glare observed from the curved façade surfaces of the subject development.

## SUGGESTED TREATMENTS

The suggested treatments described in this report for ensuring the development does not cause adverse glare conditions are summarised as follows:

- Northern aspect (009°) main building façade and balustrades on Level 01: 9%.
- Western aspect (279°) main building façade and balustrades on Levels 06 to 20: 9%.
- All other glazing on the external façade should have a maximum normal specular reflectance of visible light of 20%.

The abovementioned suggested treatment involving the location of the vertical fins are also indicated in the following marked-up elevation figures.

## Treatments Legend


 The proposed glazing along the Level 01 northern aspect (009 Degree), as indicated in the architectural drawings, is to have a maximum normal reflectance of visible light of 9%.



Figure 5a: Suggested Treatment – North Elevation

### Treatments Legend

The proposed glazing along the Level 06 to Level 20 western aspect (279 Degree), as indicated in the architectural drawings, is to have a maximum normal reflectance of visible light of 9%.

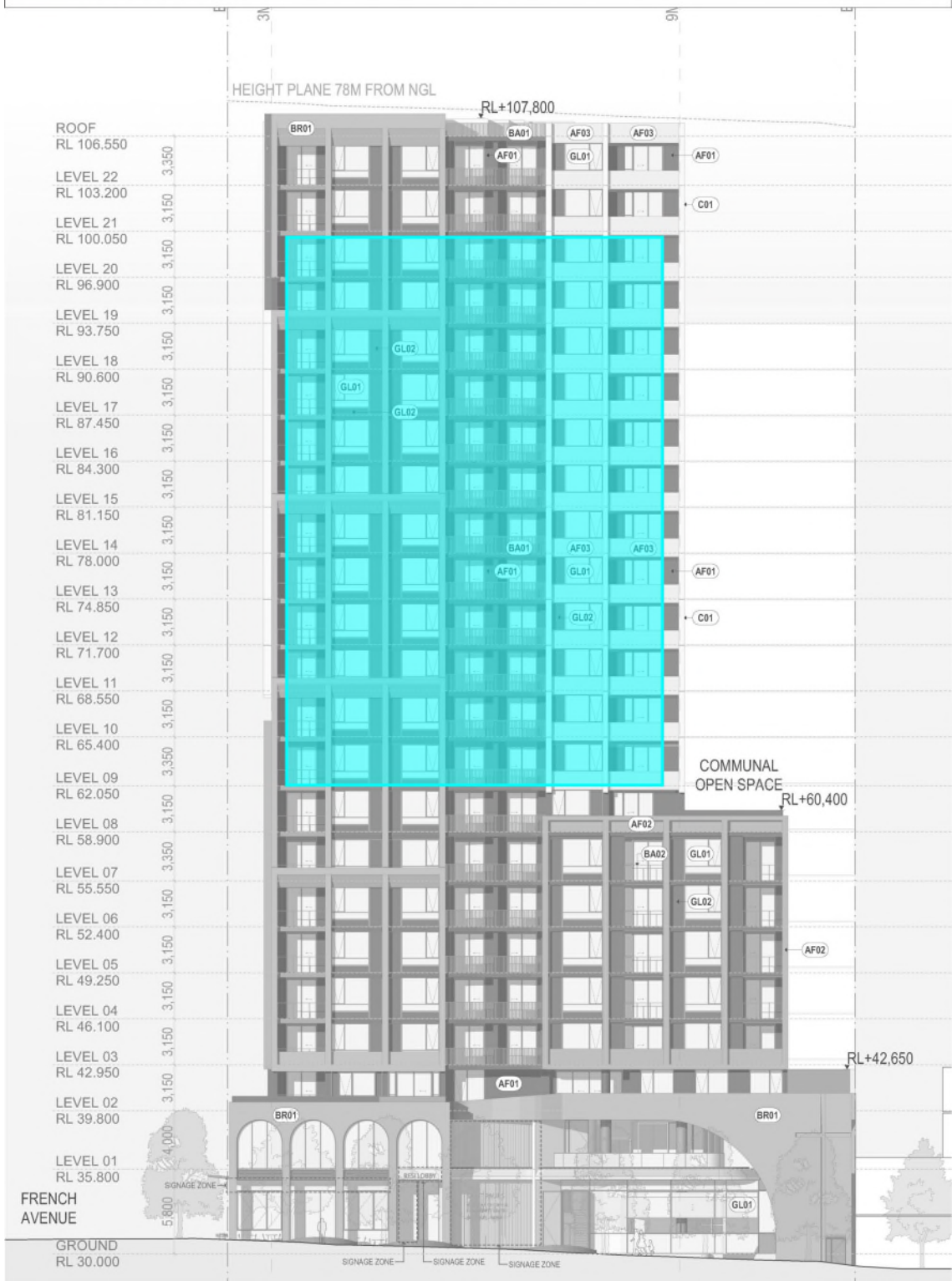


Figure 5b: Suggested Treatment – West Elevation

## CONCLUSION

A detailed study has been undertaken for the effect of potential solar glare from the 461 Chapel Road development, located in Bankstown. This study identifies any possible adverse reflected solar glare conditions affecting motorists, pedestrians, and to occupants of neighbouring buildings. If necessary, recommendations are made to mitigate any potentially adverse effects. This study assesses compliance with the controls for solar glare from the State Environmental Planning Policy (Housing) 2021 Chapter 4 Design, which contains the Apartment Design Guide (ADG), and the City of Canterbury Bankstown Development Control Plan 2023.

The results of the study indicate that, to avoid any adverse glare to motorists and pedestrians on the surrounding streets, occupants of neighbouring buildings, and to comply with the abovementioned planning control requirements, the following limitations to the maximum normal specular reflectance of visible light of the external façade glazing is recommended:

- Northern aspect (009°) main building façade and balustrades on Level 01: 9%.
- Western aspect (279°) main building façade and balustrades on Levels 06 to 20: 9%.
- All other glazing on the external façade should have a maximum normal specular reflectance of visible light of 20%.

It should be noted that the most reflective surface on the façade of a building is the glazing. Reflected solar glare from concrete, brickwork, timber, etc. is negligible (i.e. less than 1% normal specular reflectance) and hence will not cause any adverse solar glare effects. Note also that, for any painted or powder-coated metallic surfaces on the exterior façade of the development, the maximum normal specular reflectance of visible light for those types of surfaces is in the range of 1% to 5%, which is well within the abovementioned limit.

Hence, with the incorporation of the abovementioned recommendations, the results of this study indicate that the subject development will not cause adverse solar glare to motorists or pedestrians in the surrounding area, or to occupants of neighbouring buildings, and will comply with the planning controls regarding reflectivity from Chapter 4 of the SEPP (Housing) 2021 and the City of Canterbury Bankstown Development Control Plan 2023.

City of Canterbury Bankstown Council, 2023 "City of Canterbury Bankstown Development Control Plan 2023".

Hassall, D.N., 1991, "Reflectivity, Dealing with Rogue Solar Reflections", (published by author).

Phillips, R.O., 1992, "Sunshine and Shade in Australasia", Sixth Edition, CSIRO Publishing.

Rofail, A.W., and Dowdle, B., 2004, "Reflectivity Impact on Occupants of Neighbouring Properties", International Conf. on Building Envelope Systems & Technologies, Sydney.

State Environmental Planning Policy (Housing) 2021 Chapter 4 Design, "Apartment Design Guide", NSW Department of Planning and Environment.



# APPENDIX A SIGHT-LINES WITH GLARE OVERLAYS

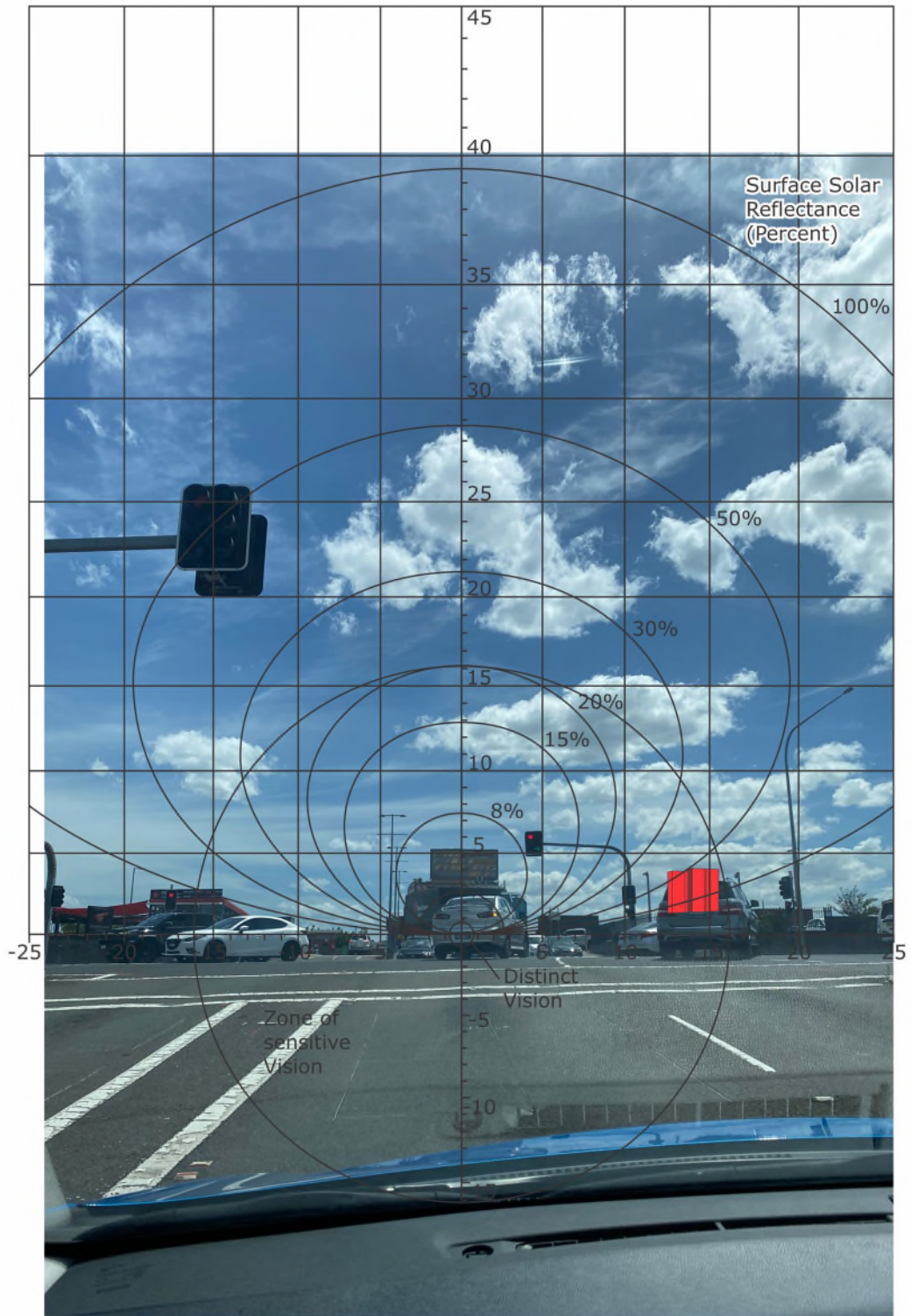


Figure A.1: Glare Overlay of the Viewpoint at Point 01

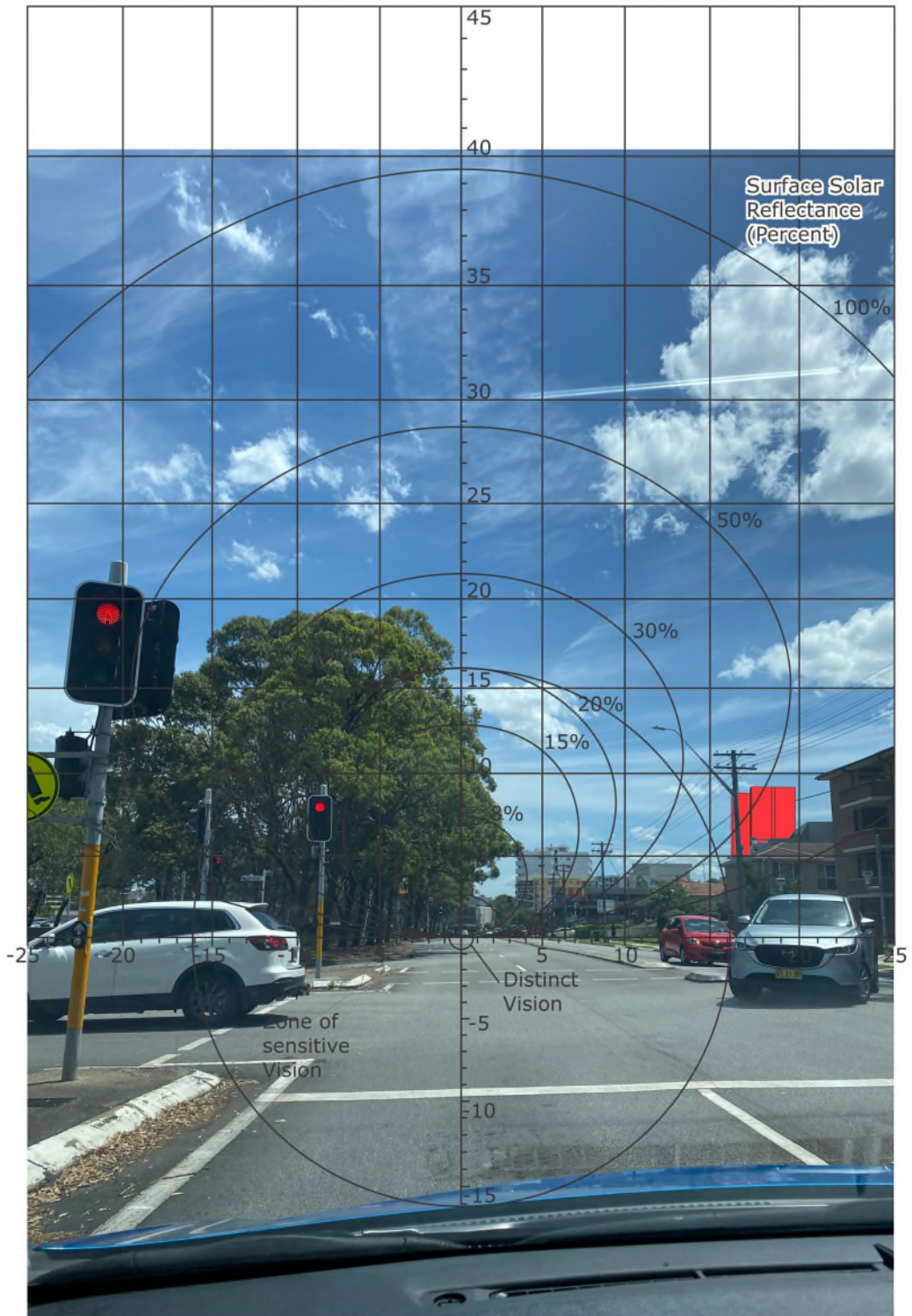


Figure A.2: Glare Overlay of the Viewpoint at Point 02

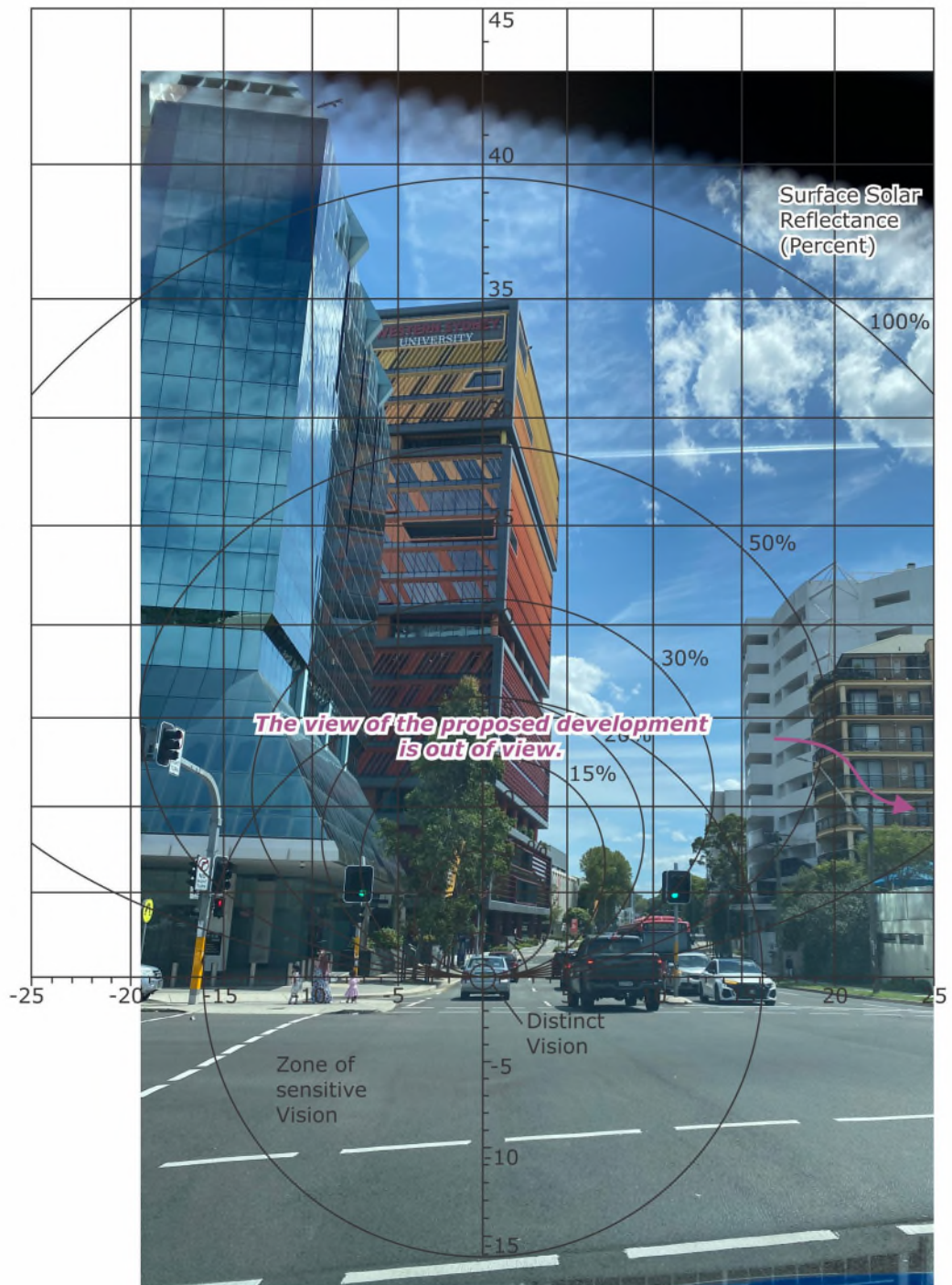


Figure A.3: Glare Overlay of the Viewpoint at Point 03

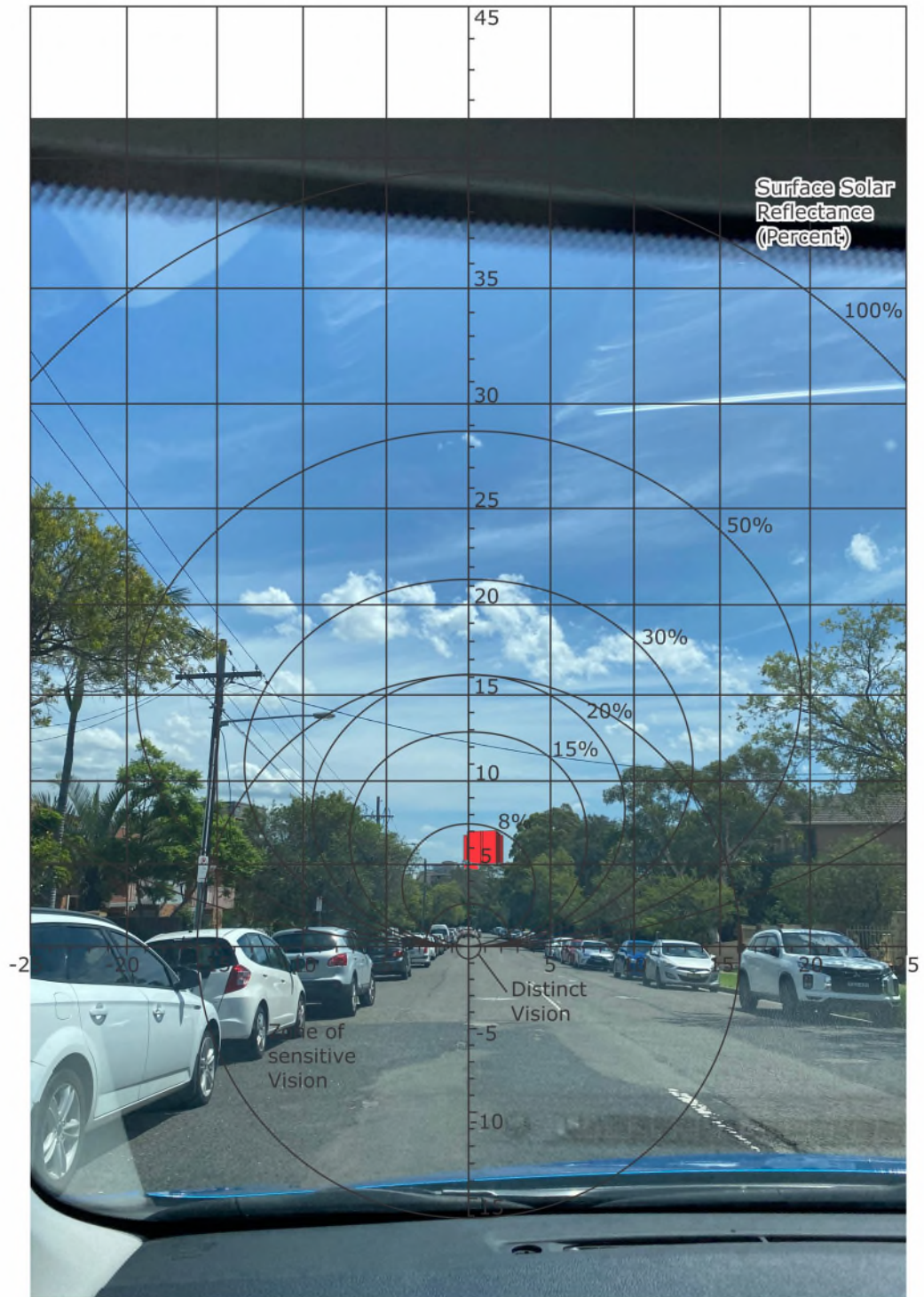


Figure A.4: Glare Overlay of the Viewpoint at Point 04

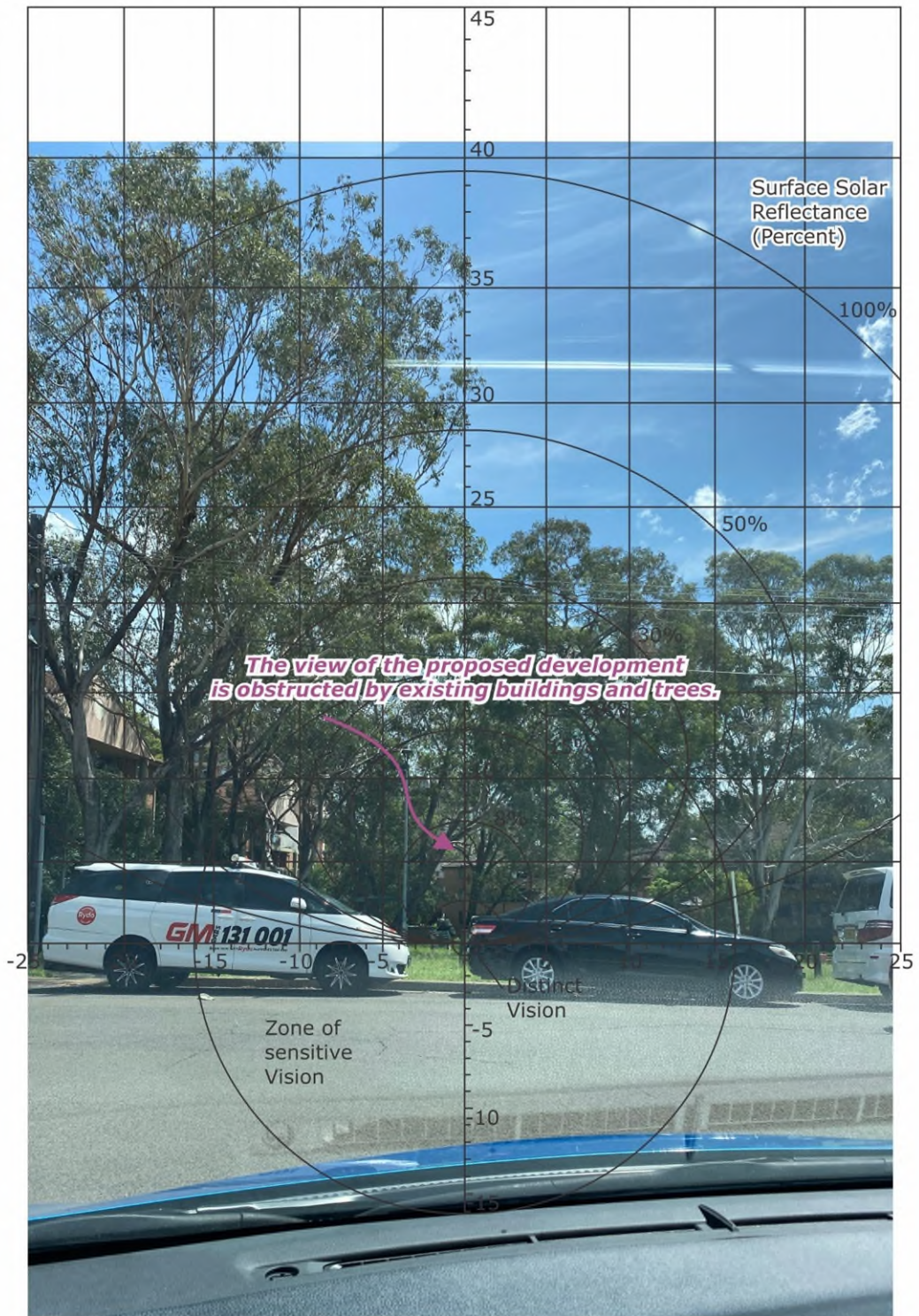


Figure A.5: Glare Overlay of the Viewpoint at Point 05

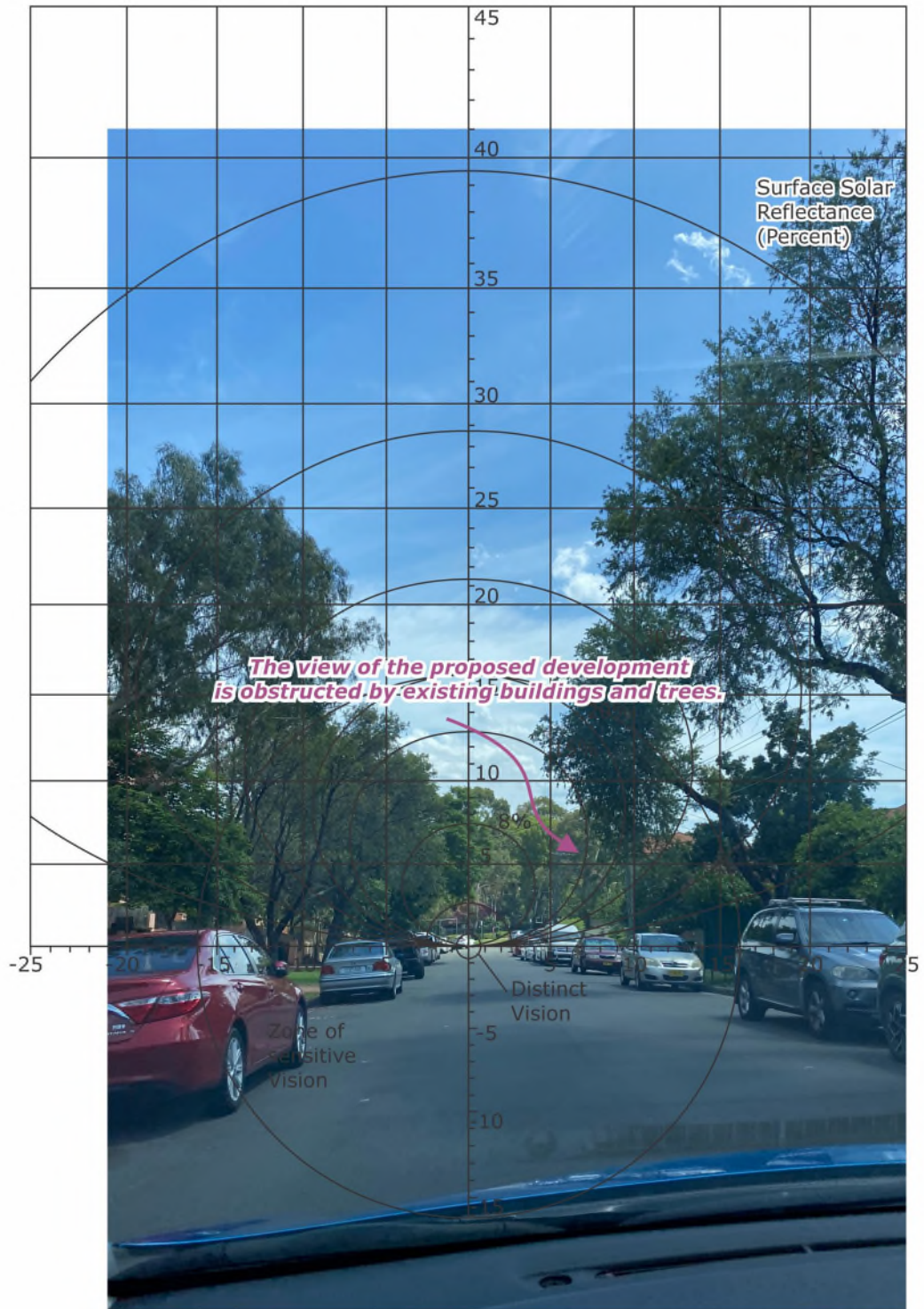


Figure A.6: Glare Overlay of the Viewpoint at Point 06

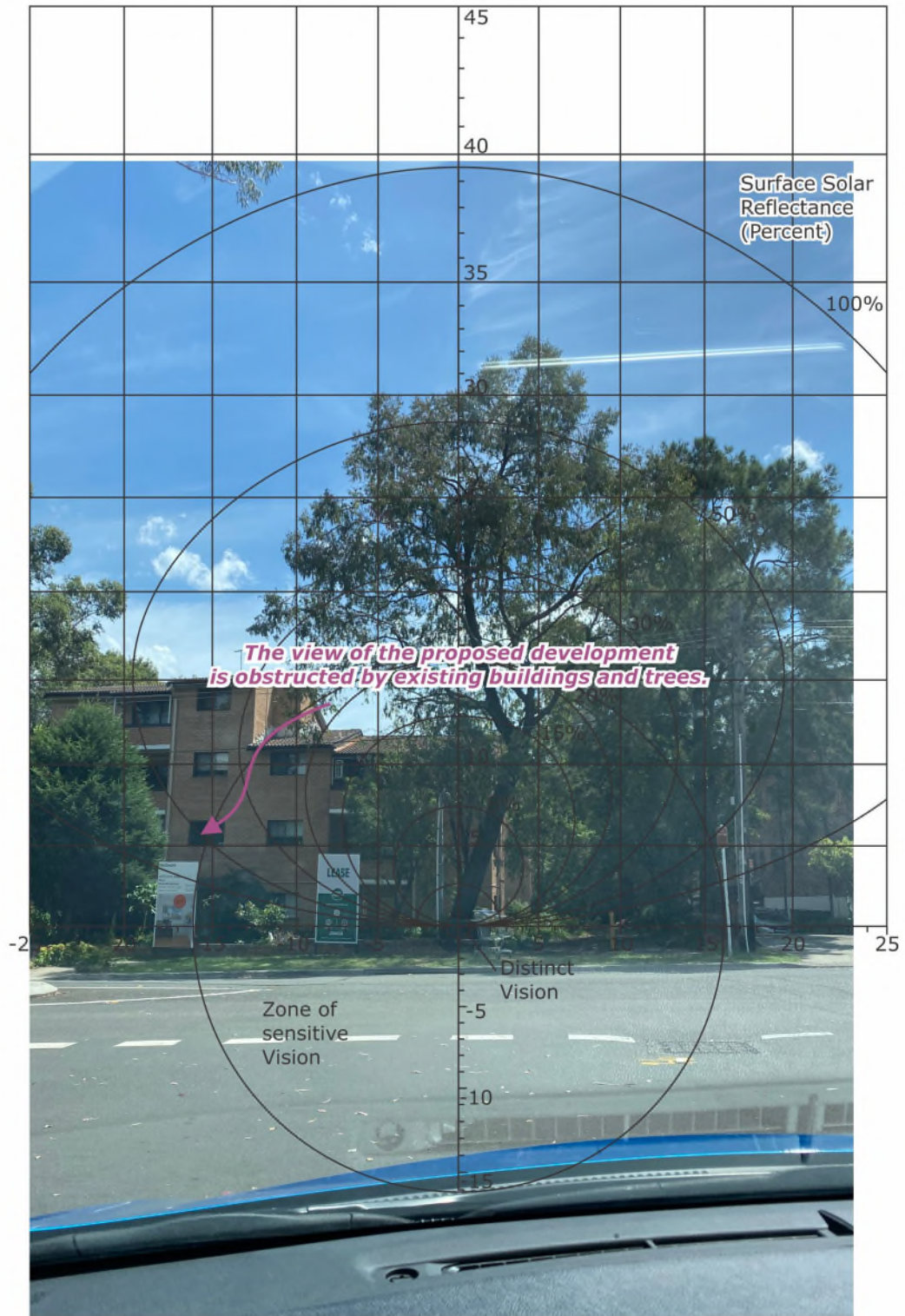


Figure A.7: Glare Overlay of the Viewpoint at Point 07

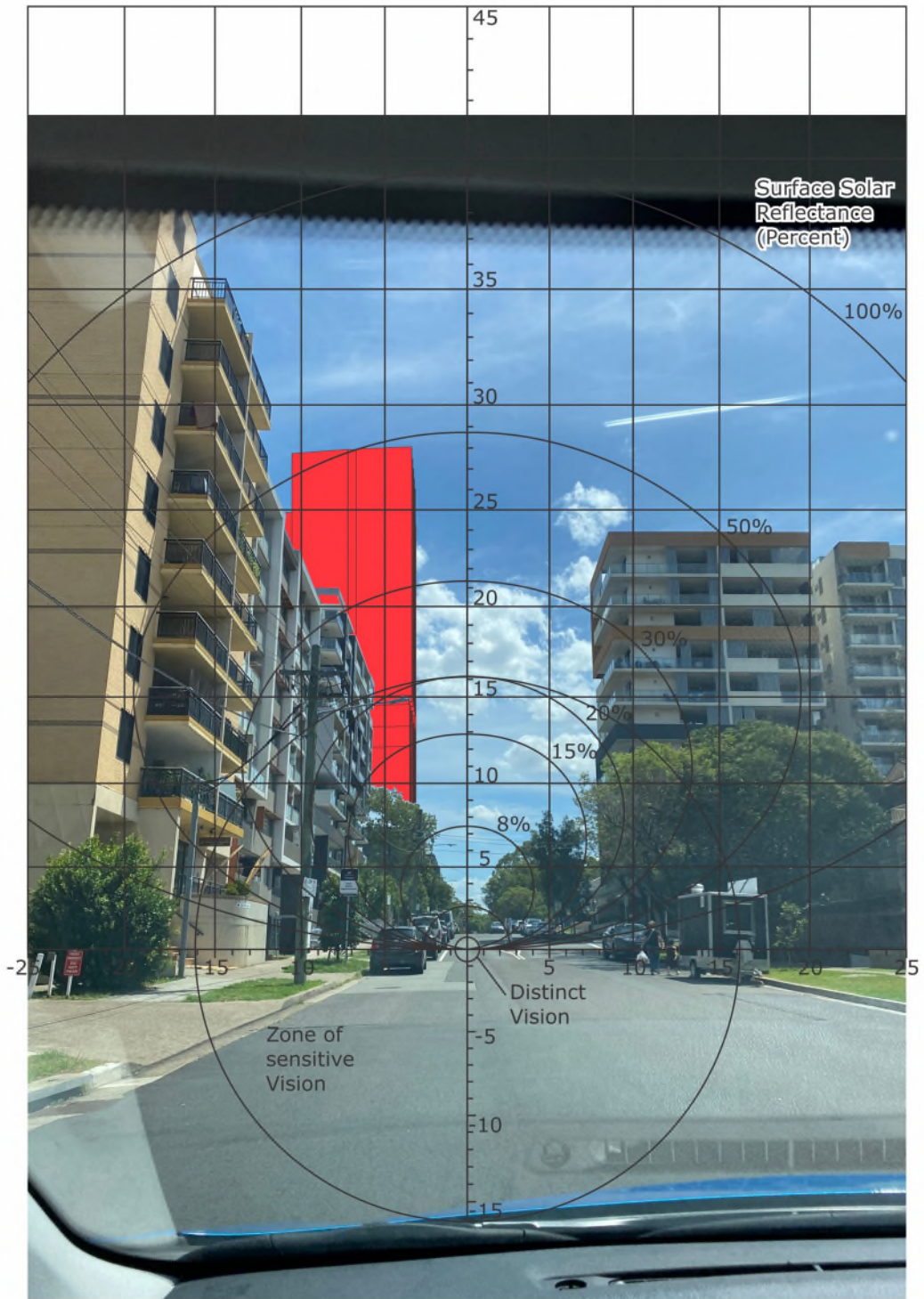


Figure A.8: Glare Overlay of the Viewpoint at Point 08

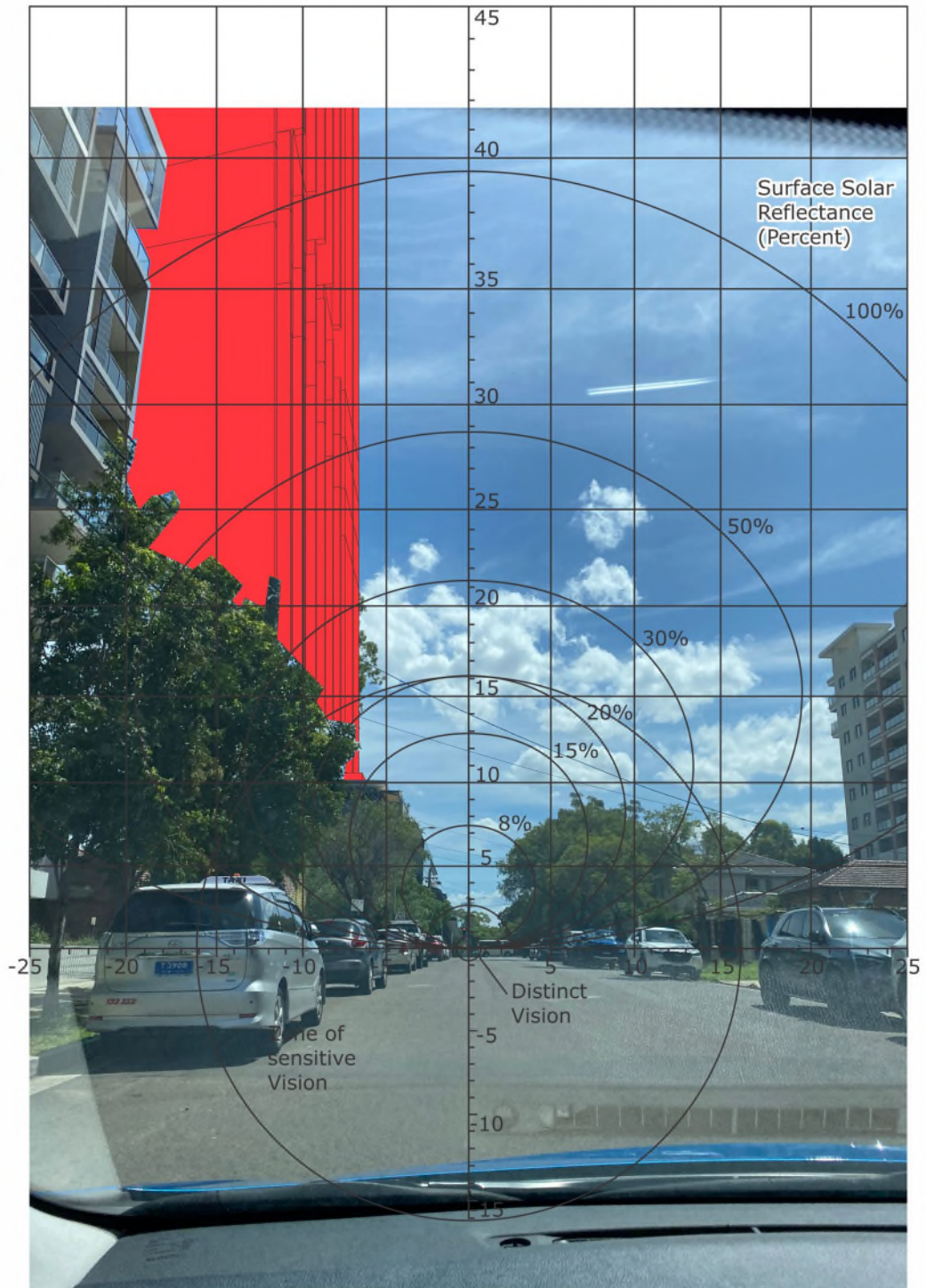


Figure A.9: Glare Overlay of the Viewpoint at Point 09



Figure A.10: Glare Overlay of the Viewpoint at Point 10

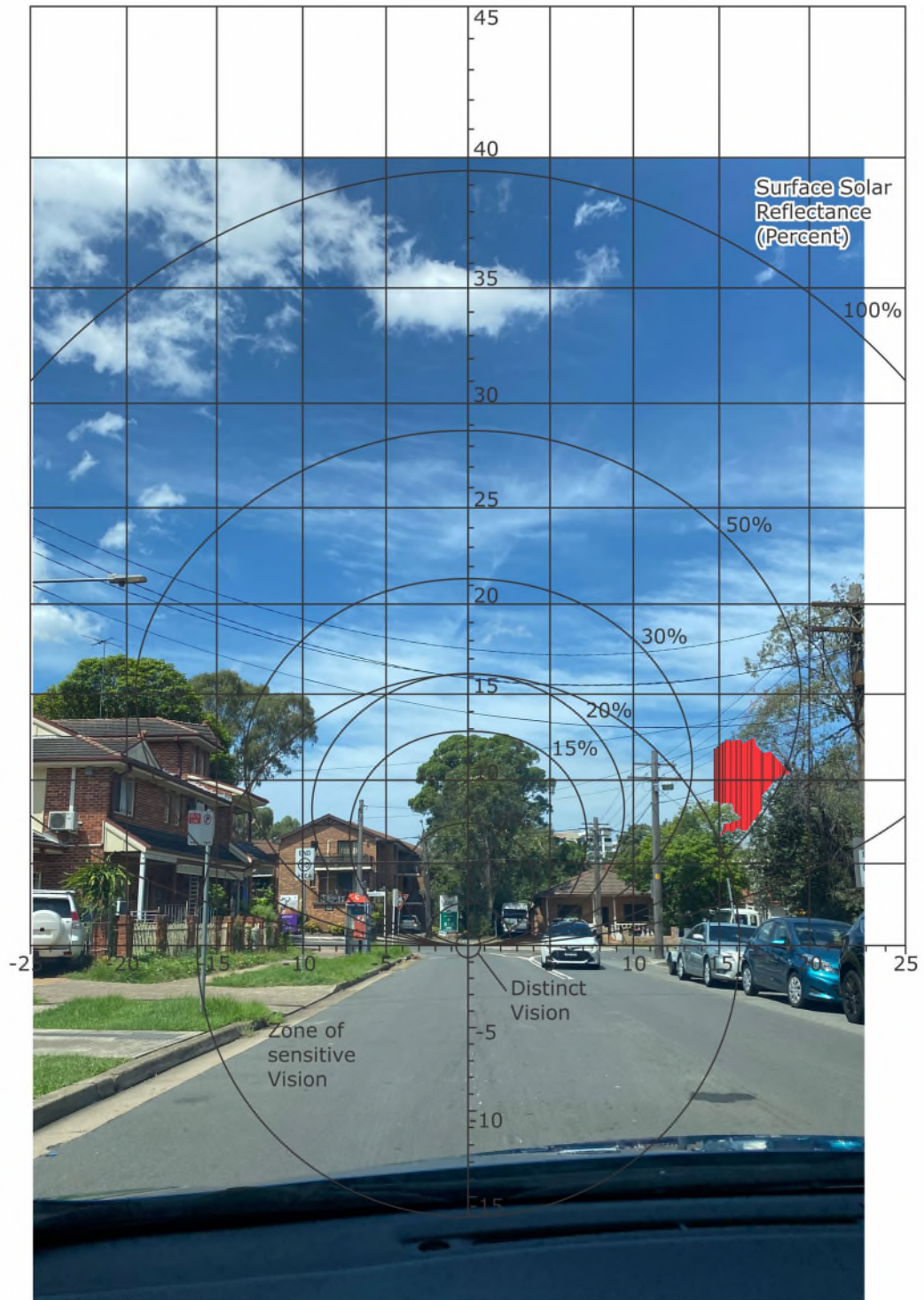


Figure A.11: Glare Overlay of the Viewpoint at Point 11

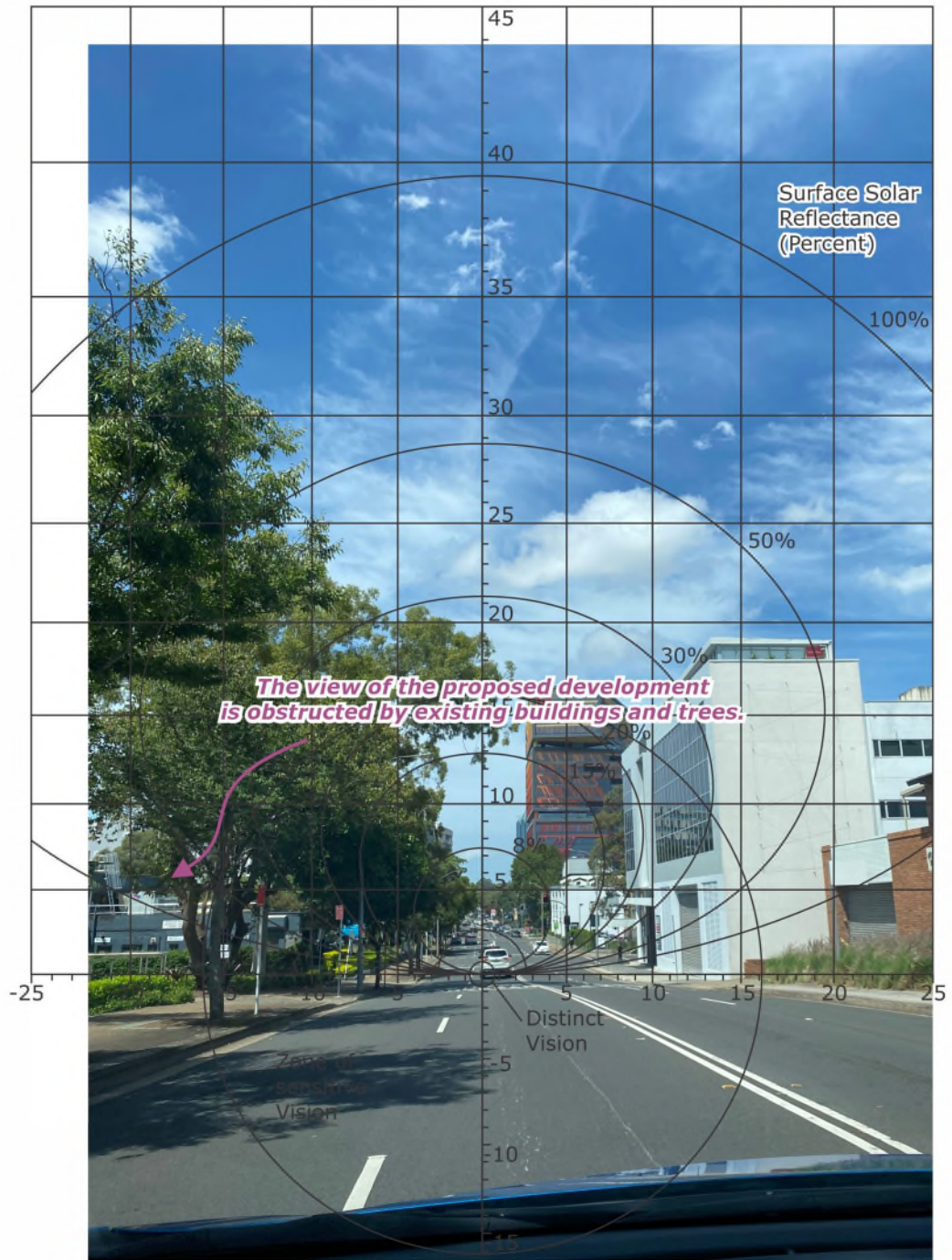


Figure A.12: Glare Overlay of the Viewpoint at Point 12

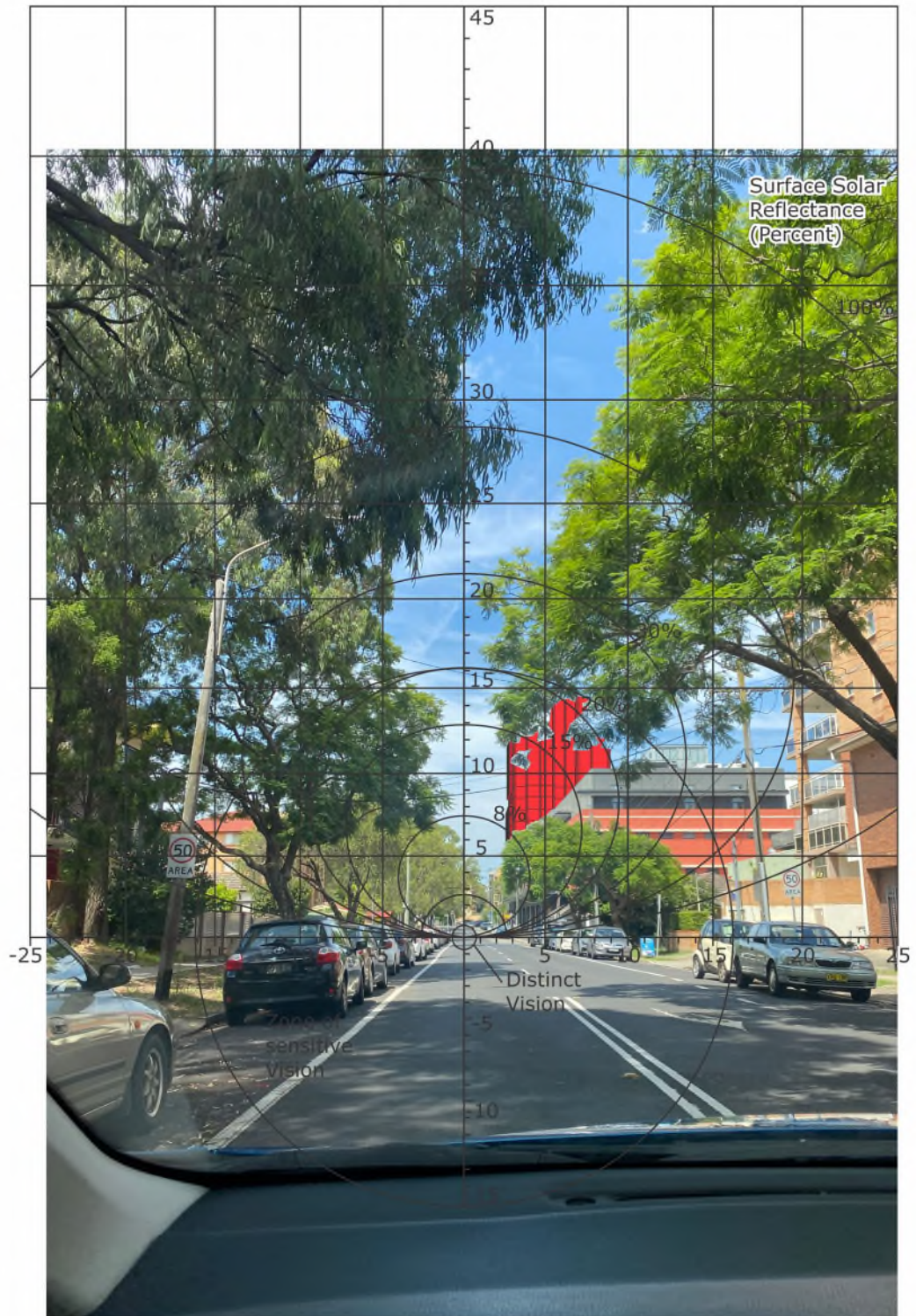


Figure A.13: Glare Overlay of the Viewpoint at Point 13

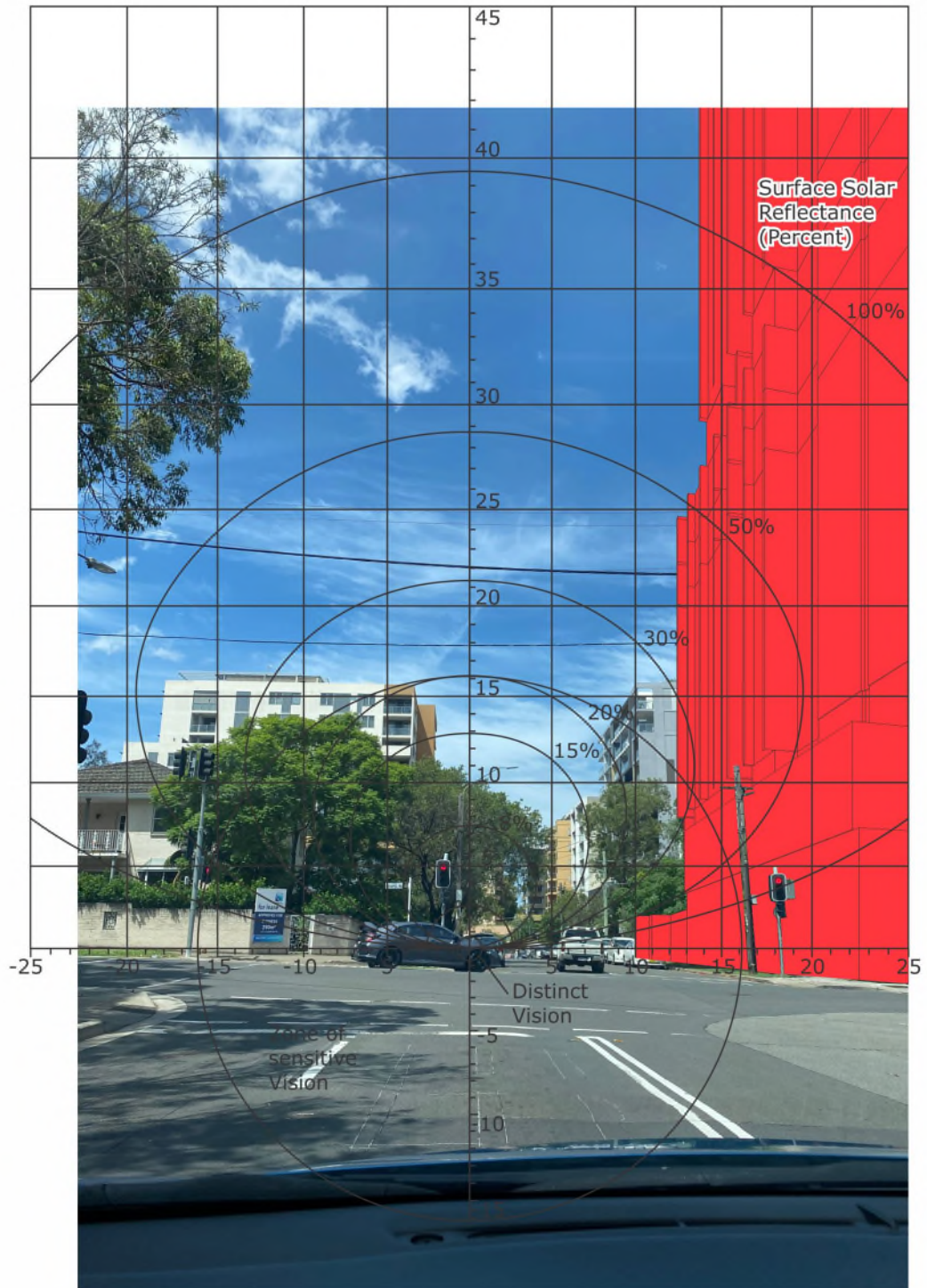


Figure A.14: Glare Overlay of the Viewpoint at Point 14

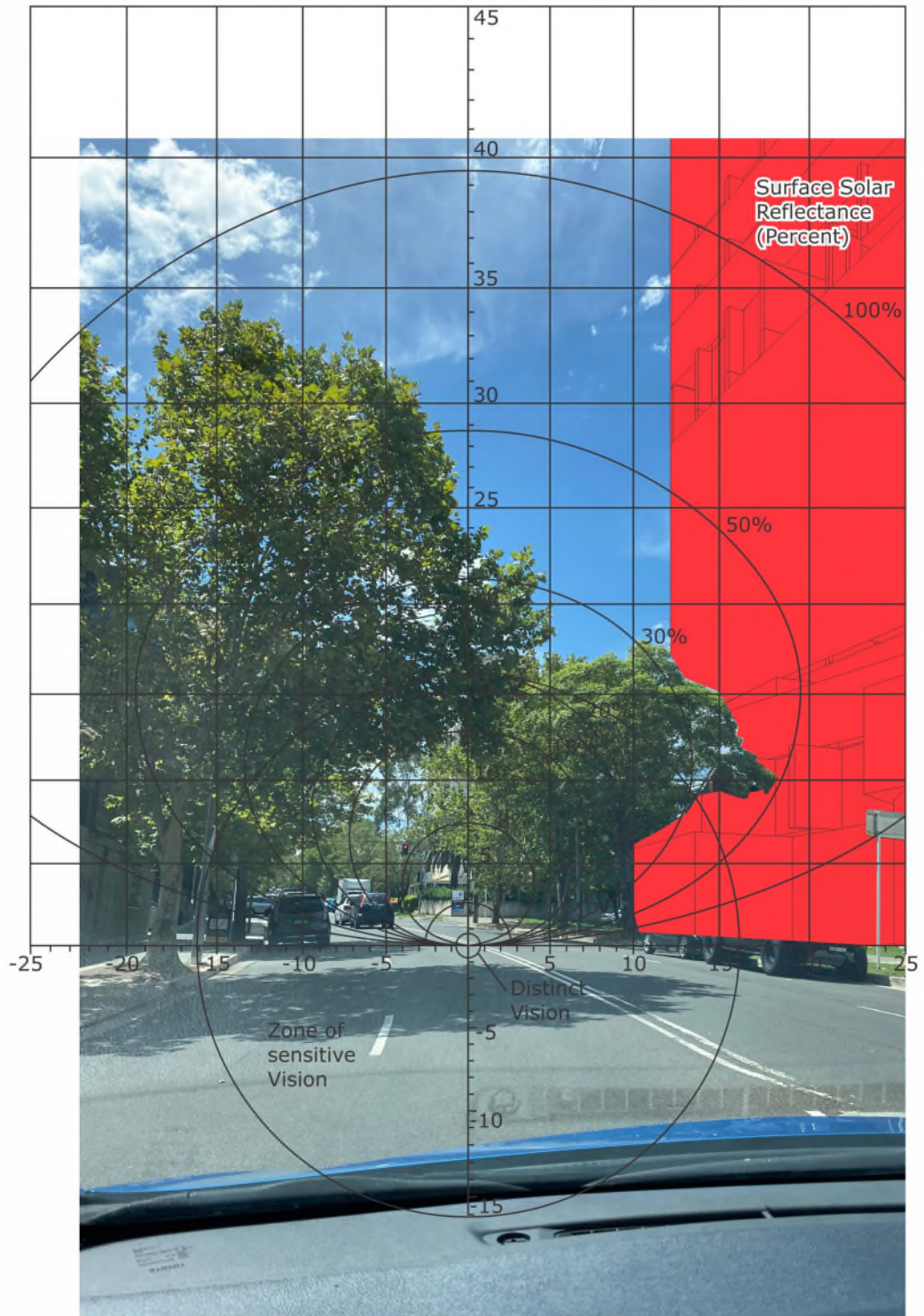


Figure A.15: Glare Overlay of the Viewpoint at Point 15



Figure A.16: Glare Overlay of the Viewpoint at Point 16



## APPENDIX B CRITICAL ASPECT SOLAR CHARTS

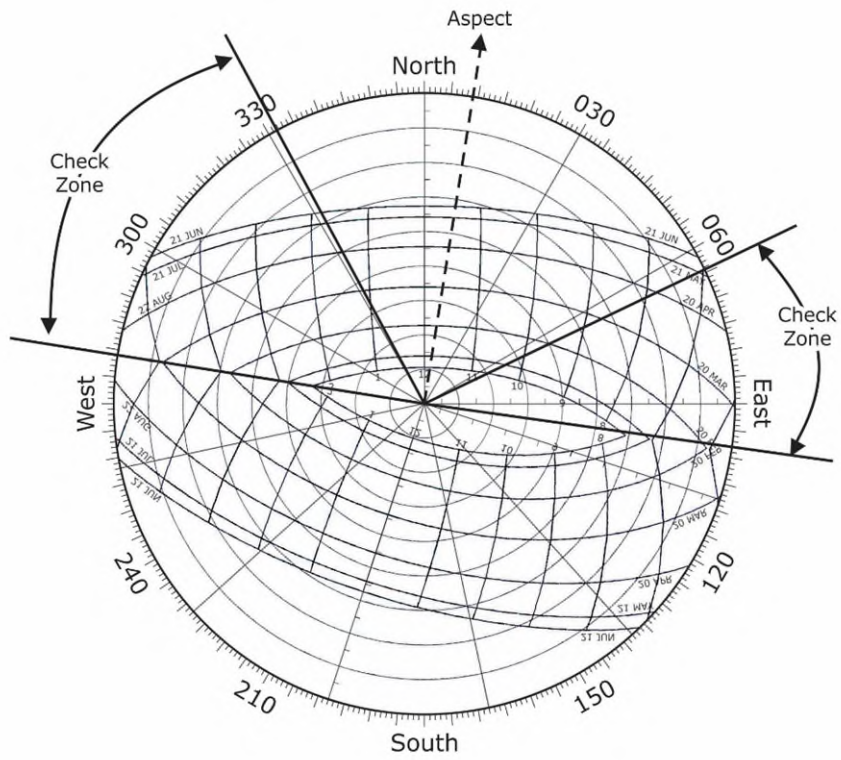


Figure B.1: Sun Chart for the 009° Aspect

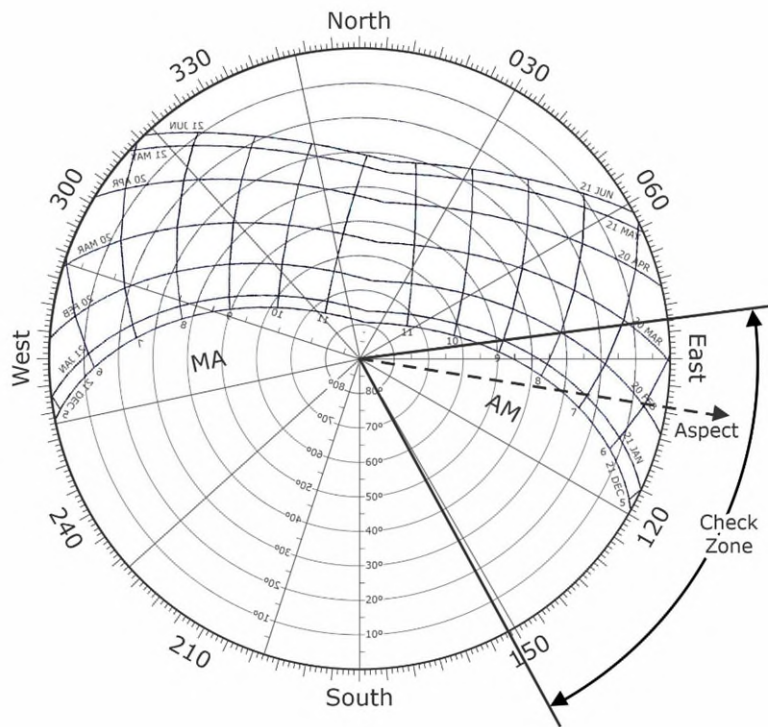


Figure B.2: Sun Chart for the 099° Aspect





# APPENDIX C STANDARD SUN CHART FOR THE REGION

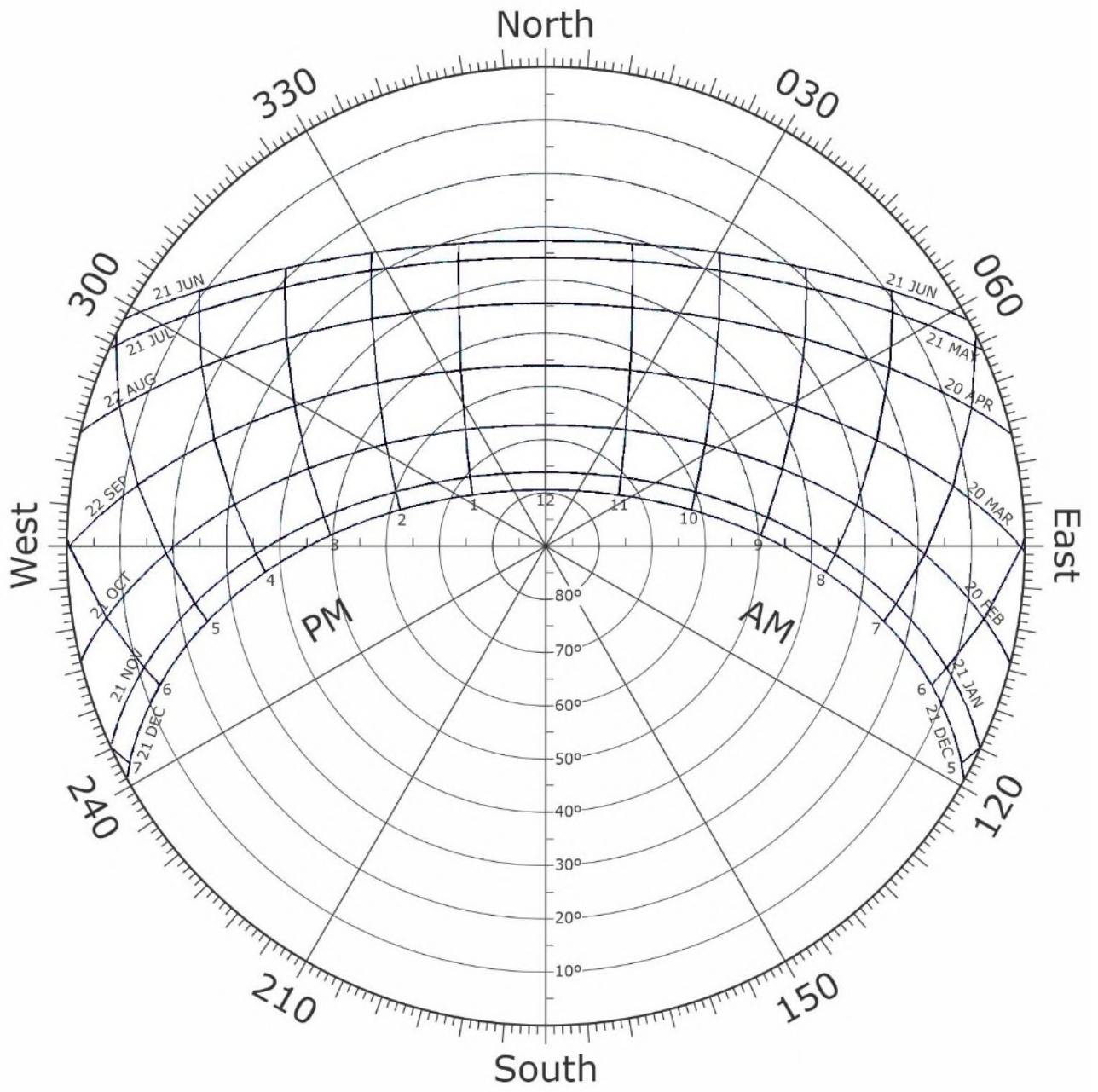


Figure C.1: Standard Sun Chart for the Sydney Region