# SOLAR LIGHT REFLECTIVITY STUDY

## SSD-78669234, LOT 11 AND 12 IN DP1188210, 27-29 TRYON ROAD, LINDFIELD

WJ421-03F03(REV0)- SR REPORT

DECEMBER 4, 2025

Prepared for:

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# DOCUMENT CONTROL

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# EXECUTIVE SUMMARY

This Solar Reflectivity Report accompanies an Environmental Impact Statement (EIS) pursuant to Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), in support of a State Significant Development Application (SSDA) for the construction of the proposed residential flat building, reference SSD-78669234.

This report addresses the Secretary's Environmental Assessment Requirements (SEARs) issued for the project, notably as indicated in Table 1:

Table 1: SEARs Requirement Section of Report where response is provided

| SEARs Requirement Section of Report where response is provided. | |
|---|---|
| SEARs Section 7 – Environmental Amenity<br>Assess amenity impacts on the surrounding locality, including solar access, visual privacy, view loss and view sharing, as well as wind lighting and reflectivity impacts. A high level of environmental amenity for any surrounding residential or other sensitive land uses must be demonstrated. | Solar Reflectivity Report as shown in Sections 2 to 4. |

This report presents the results of a detailed study for the effect of potential solar glare from the Lot 11 and 12 in DP1188210, 27-29 Tryon Road development, located in Lindfield. 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 Ku-ring-gai Development Control Plan 2024.

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:

- Eastern aspect of the development on Levels 4 to 8: 11%.
- All other glazing (windows and balustrades) 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, train drivers or pedestrians in the surrounding area, or to occupants of neighbouring buildings, and will comply with the planning controls regarding reflectivity from SEPP Housing 2021, Chapter 4, and the Ku-ring-gai Development Control Plan 2024.

Windtech Consultants, confirm this Solar Reflectivity Report addresses the requirement of SEAR No. 5 and relevant State and local legislation, policies, and guidelines. I further confirm that none of the information contained in the Solar Reflectivity Report is false or misleading.

Windtech Consultants Pty Ltd.

# CONTENTS

# 1 GLARE OBSERVED BY MOTORISTS

## 1.1 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$^2$ 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 ±16° of the direct sight-line). These are shown in Figure 2, and summarised in Table

The list of the architectural drawings relied on for this assessment are presented in Table 2 below.

Table 2: List of Architectural Drawings Referenced

| Drawing Title | Revision Number | Date |
|---|---|---|
| PTW-DA-B1GRD10 – GROUND FLOOR PLAN | E | 28/11/2025 |
| PTW-DA-B1L0110 – LEVEL 01 PLAN | D | 28/11/2025 |
| PTW-DA-B1L0210 – LEVEL 02 PLAN | E | 28/11/2025 |
| PTW-DA-B1L0310 – LEVEL 03 PLAN | D | 28/11/2025 |
| PTW-DA-B1L0410 – LEVEL 04-06 PLAN | D | 28/11/2025 |
| PTW-DA-B1L0710 – LEVEL 07 PLAN | D | 28/11/2025 |
| PTW-DA-B1L0810 – LEVEL 08 PLAN | E | 28/11/2025 |
| PTW-DA-B1ROF10 – ROOF PLAN | E | 28/11/2025 |
| PTW-DA-C110010 – NORTH & SOUTH ELEVATIONS | E | 28/11/2025 |
| PTW-DA-C120010 – EAST, WEST & COURTYARD ELEVATIONS | E | 28/11/2025 |
| PTW-DA-D110010 – SECTION 1,2 | E | 28/11/2025 |


Figure 1: Critical Glazed Aspects of the Development (Ground Level plan shown)


Figure 2: Check Zones and Study Point Locations
(the check zones are the areas where glare could potentially be observed)

## 1.2 Veiling Luminance

As described in Section 1.1, a limiting veiling luminance of 500 cd/m$^2$ 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:

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

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$^2$. The limit to which solar glare is assessed is 500 cd/m$^2$.

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$^2$) 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 1.1and 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$^2$.

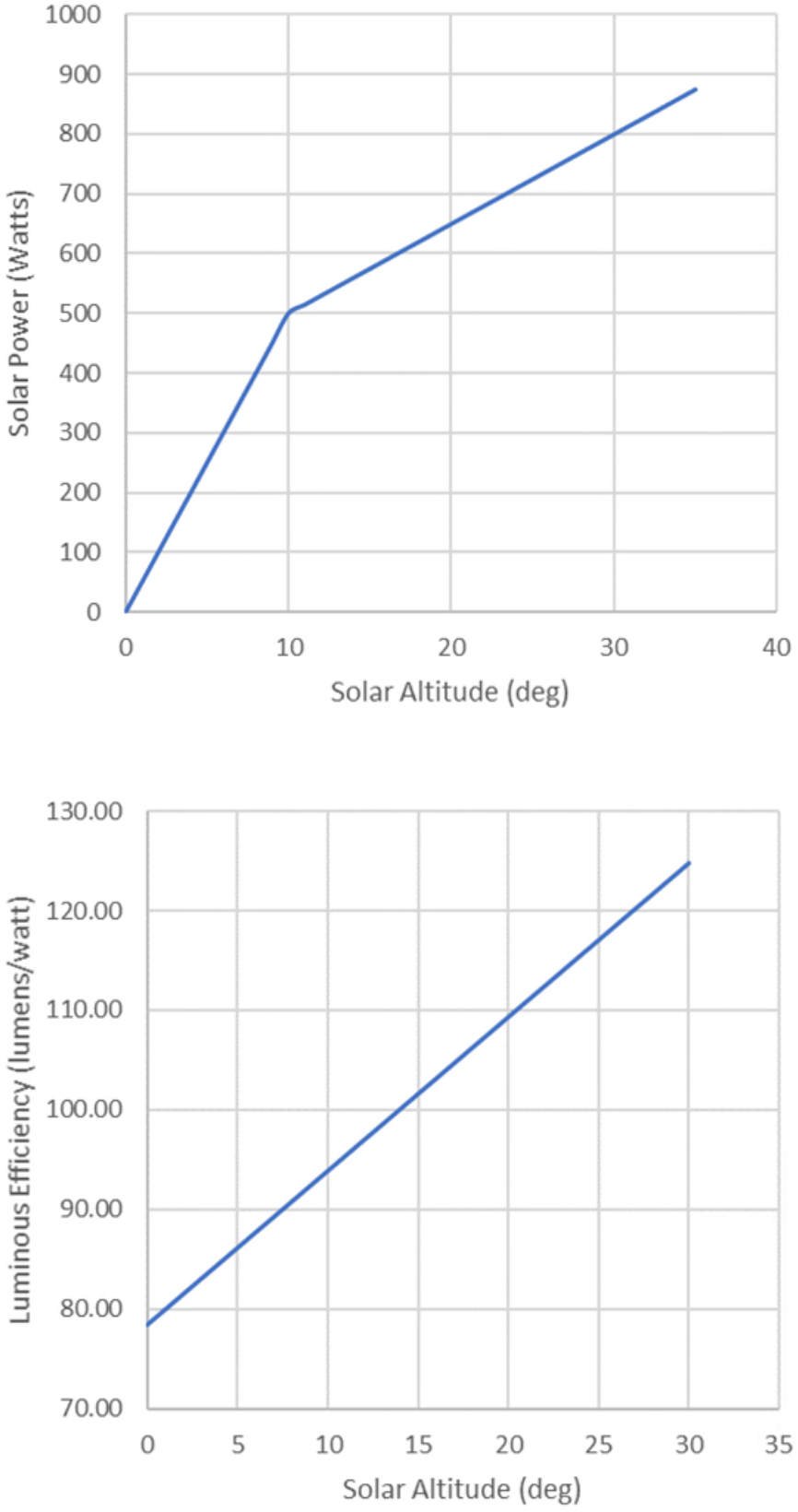
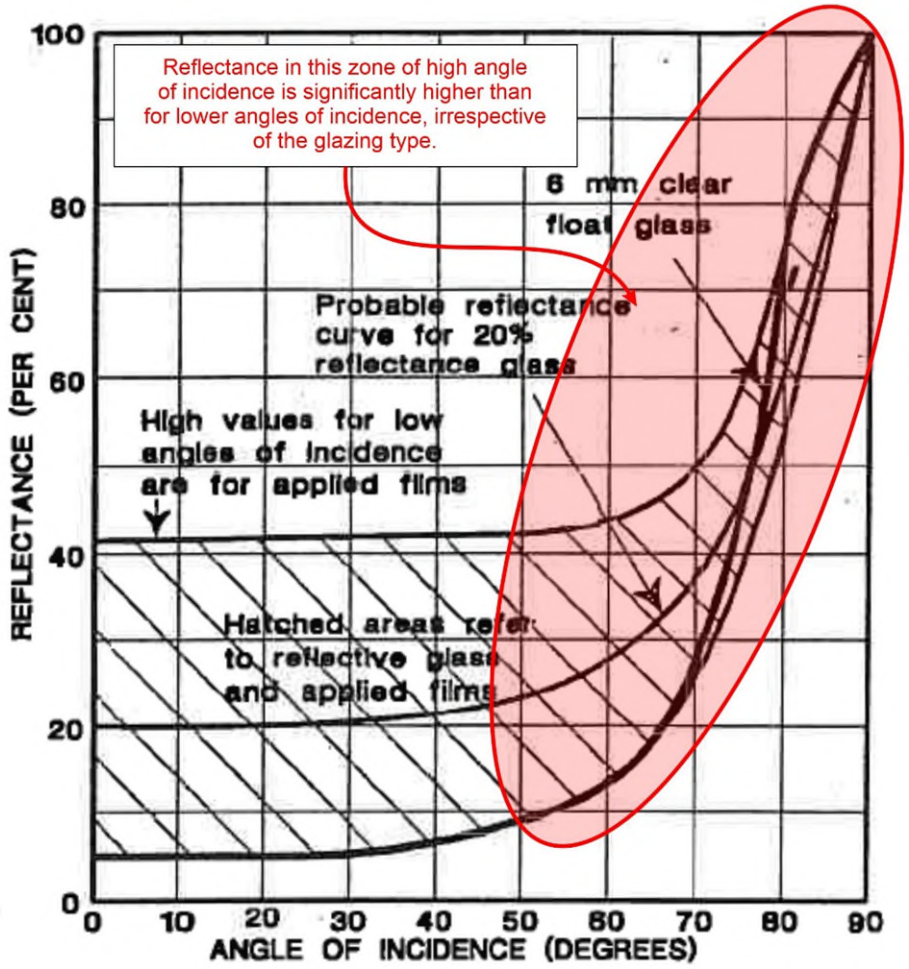
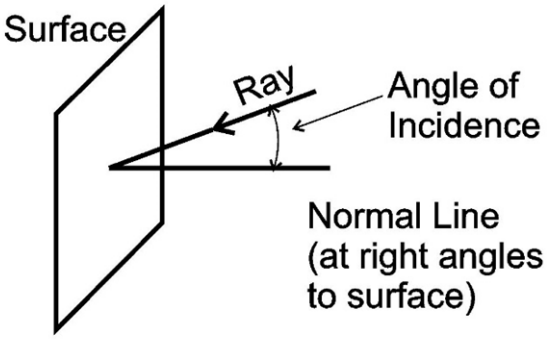



Figure 3a: Relationship between Solar Power, Luminous Efficiency and Solar Altitude (from Hassall, 1991)




Definition of Angle of Incidence

Figure 3b: Reflectance of Different Glazing Types for Varying Angles of Incidence of Light (from Hassall, 1991)

## 1.3 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 |
|---|---|---|
| 01 | Tryon Road, heading south-west | Not visible, no further assessment required. |
| 02 | Tryon Road, heading south-west | Visible, refer to the following sub-section for further analysis. |
| 03 | Tryon Road, heading south-west | Visible, refer to the following sub-section for further analysis. |
| 04 | Tryon Road, heading north-east | Not visible, no further assessment required. |
| 05 | Tryon Road, heading north-east | Not visible, no further assessment required. |
| 06 | Valley Lane, heading south-west | Visible, refer to the following sub-section for further analysis. |
| 07 | Valley Lane, heading south-west | Visible, refer to the following sub-section for further analysis. |
| 08 | Valley Road, heading south-west | Not visible, no further assessment required. |
| 09 | Valley Road, heading south-west | Not visible, no further assessment required. |
| 10 | Middle Harbour Road, heading south-west | Not visible, no further assessment required. |
| 11 | Lowana Avenue, heading north | Not visible, no further assessment required. |
| 12 | Trafalgar Avenue, heading north | Visible, refer to the following sub-section for further analysis. |
| 13 | Trafalgar Avenue, heading north | Visible, refer to the following sub-section for further analysis. |
| 14 | Strickland Avenue, heading north (above Sydney trainline) | Not visible, no further assessment required. |
| 15 | Strickland Avenue, heading north-east | Not visible, no further assessment required. |
| 16 | Pacific Highway, heading north | Not visible, no further assessment required. |
| 17 | Russell Avenue, heading north-east | Not visible, no further assessment required. |
| 18 | Tryon Lane, heading north-east | Not visible, no further assessment required. |
| 19 | Tryon Lane, heading north-east | Visible, refer to the following sub-section for further analysis. |
| 20 | Tryon Place, heading east | Not visible, no further assessment required. |
| 21 | Russell Lane, heading north | Visible, refer to the following sub-section for further analysis. |
| 22 | Nelson Road, heading south-east | Not visible, no further assessment required. |

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 |
|---|---|---|
| 02 | Tryon Road, heading south-west | Northern and Eastern aspects of the development. |
| 03 | Tryon Road, heading south-west | Northern aspect of the development. |
| 06 | Valley Lane, heading south-west | Eastern aspect of the development. |
| 07 | Valley Lane, heading south-west | Eastern aspect of the development. |
| 12 | Trafalgar Avenue, heading north | Southern aspect of the development. |
| 13 | Trafalgar Avenue, heading north | Southern aspect of the development. |
| 19 | Tryon Lane, heading north-east | Southern and Western aspects of the development. |
| 21 | Russell Lane, heading north | Southern aspect of the development. |

### 1.3.1 Motorists heading south-west along Tryon Road at Point 02

An analysis of the glare meter overlaid onto the viewpoint image at Point 02 indicates a portion of the northern and eastern aspects are visible and within the zone of sensitive vision. Point 02 is located within the check zones for the visible northern aspect (331°) and eastern aspect (061°), and hence there is potential for solar glare to be observed at this location during the early morning and late afternoon periods.

Upon further analysis, the glazing along the northern aspect of the development, that can be seen within the zone of sensitive vision, will be overshadowed by the proposed solid intertenancy screens and overall recessed design of the building aspect at times when solar glare would have otherwise been observed. Additionally, a review of the architectural drawings indicates that the eastern aspect of the development, that can be seen within the zone of sensitive vision, is comprised of non-glazed materials that will have a negligible reflectance. Hence, there will be no adverse solar glare observed by motorists from the development's northern and eastern aspects heading south-west along Tryon Road at this location.

### 1.3.2 Motorists heading south-west along Tryon Road at Point 03

An analysis of the glare meter overlaid onto the viewpoint image at Point 03 indicates that the view of the northern aspect of the development (331°) will not be visible within the zone of sensitive vision. Hence there will be no adverse solar glare observed by motorists from the development's eastern aspect heading south-west along Tryon Road at this location.

### 1.3.3 Motorists heading south-west along Valley Lane at Point 06

An analysis of the glare meter overlaid onto the viewpoint image at Point 06 indicates a portion of the eastern aspect are visible and within the zone of sensitive vision. Point 06 is located within the check zones for the visible eastern aspect (061°), and hence there is potential for solar glare to be observed at this location during the early morning and late afternoon periods. It is recommended that the glazing elements used on this eastern aspect of the subject development has a maximum normal reflectance of visible light of 11% from Level 04 to Level 08.

### 1.3.4 Motorists heading south-west along Valley Lane at Point 07

An analysis of the glare meter overlaid onto the viewpoint image at Point 07 indicates that the view of the eastern aspect of the development (061°) will not be visible within the zone of sensitive vision. Hence there will be no adverse solar glare observed by motorists from the development's eastern aspect heading south-west along Valley Lane at this location.

### 1.3.5 Motorists heading north along Trafalgar Avenue at Point 12

An analysis of the glare meters overlaid onto the viewpoint at Point 12 indicates that portions of the southern aspect are visible and within the zone of sensitive vision. Point 12 is located within the check zones for the visible southern aspects (241°). 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 Trafalgar Avenue at this location.

### 1.3.6 Motorists heading north along Trafalgar Avenue at Point 13

An analysis of the glare meters overlaid onto the viewpoint at Point 13 indicates that portions of the southern aspect are visible and within the zone of sensitive vision. Point 13 is located within the check zones for the visible southern aspects (241°). 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 Trafalgar Avenue at this location.

### 1.3.7 Motorists heading north-east along Tryon Lane at Point 19

An analysis of the glare meter overlaid onto the viewpoint image at Point 19 indicates a portion of the southern and western aspects are visible and within the zone of sensitive vision. Point 19 is located within the check zones for the visible southern aspects (151°) and western aspect (241°), and hence there is potential for solar glare to be observed at this location during the early morning and late afternoon periods.

Upon further analysis of the architectural drawings, the western aspect (241°) of the development, that can be seen within the zone of sensitive vision, is comprised of non-glazed materials that will have a negligible reflectance. Hence, there will be no adverse solar glare observed by motorists heading north-east along Tryon Lane at this location from the visible the western aspect (241°) of the development.

Secondly, glazing along the southern aspect (151°) of the development, that can be seen within the zone of sensitive vision, will be overshadowed by the proposed building articulations at times when solar glare would have otherwise been observed. In addition, the visible portions of the southern aspect (151°) cause only a very narrow vertical strip of the façade; with an angular width of less than 0.5º arc, to be capable of causing glare at this point at any single point in time. As the sun subtends an angular width of 0.5º, 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 southern aspect (151°) of the development.

### 1.3.8 Motorists heading north along Russell Lane at Point 21

An analysis of the glare meters overlaid onto the viewpoint at Point 21 indicates that portions of the southern aspect are visible and within the zone of sensitive vision. Point 21 is located within the check zones for the visible southern aspects (241°). Hence there is potential for solar glare to be observed at this location during the early morning and 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 Russell Lane at this location.

# 2 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.

# 3 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.

## 3.1 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%

## 3.2 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.

## 3.3 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.

# 4 SUGGESTED RECOMMENDATIONS AND MITIGATION MEASURES

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

- Glazing on the external façade of eastern aspect (061°) of the development, on Levels 4 to 8, should have a maximum normal specular reflectance of visible light of 11%.
- All other glazing on the external façade should have a maximum normal specular reflectance of visible light of 20%.

# 5 CONCLUSION

A detailed study has been undertaken for the effect of potential solar glare from the Lot 11 and 12 in DP1188210, 27-29 Tryon Road development, located in Lindfield. 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 and the Ku-ring-gai Development Control Plan 2024.

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:

- Eastern aspect of the development on Levels 4 to 8: 11%.
- All other glazing (windows and balustrades) 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, train drivers or pedestrians in the surrounding area, or to occupants of neighbouring buildings, and will comply with the planning controls regarding reflectivity from SEPP Housing 2021, Chapter 4 and the Ku-ring-gai Development Control Plan 2024.

# 6 REFERENCES

Ku-ring-gai Council, 2015 "Ku-ring-gai Development Control Plan 2024".

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

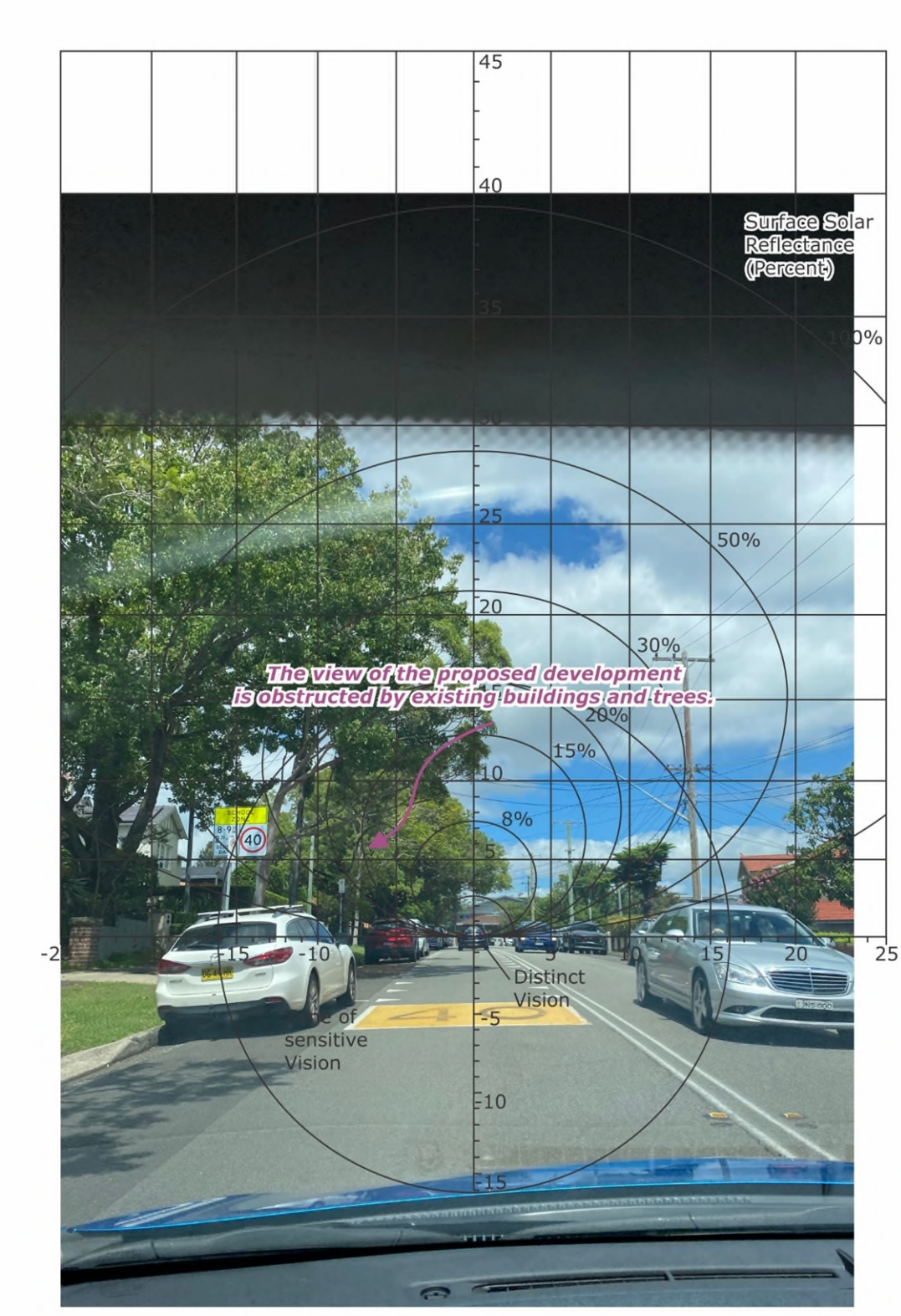



Figure A.1: Glare Overlay of the Viewpoint at Point 01

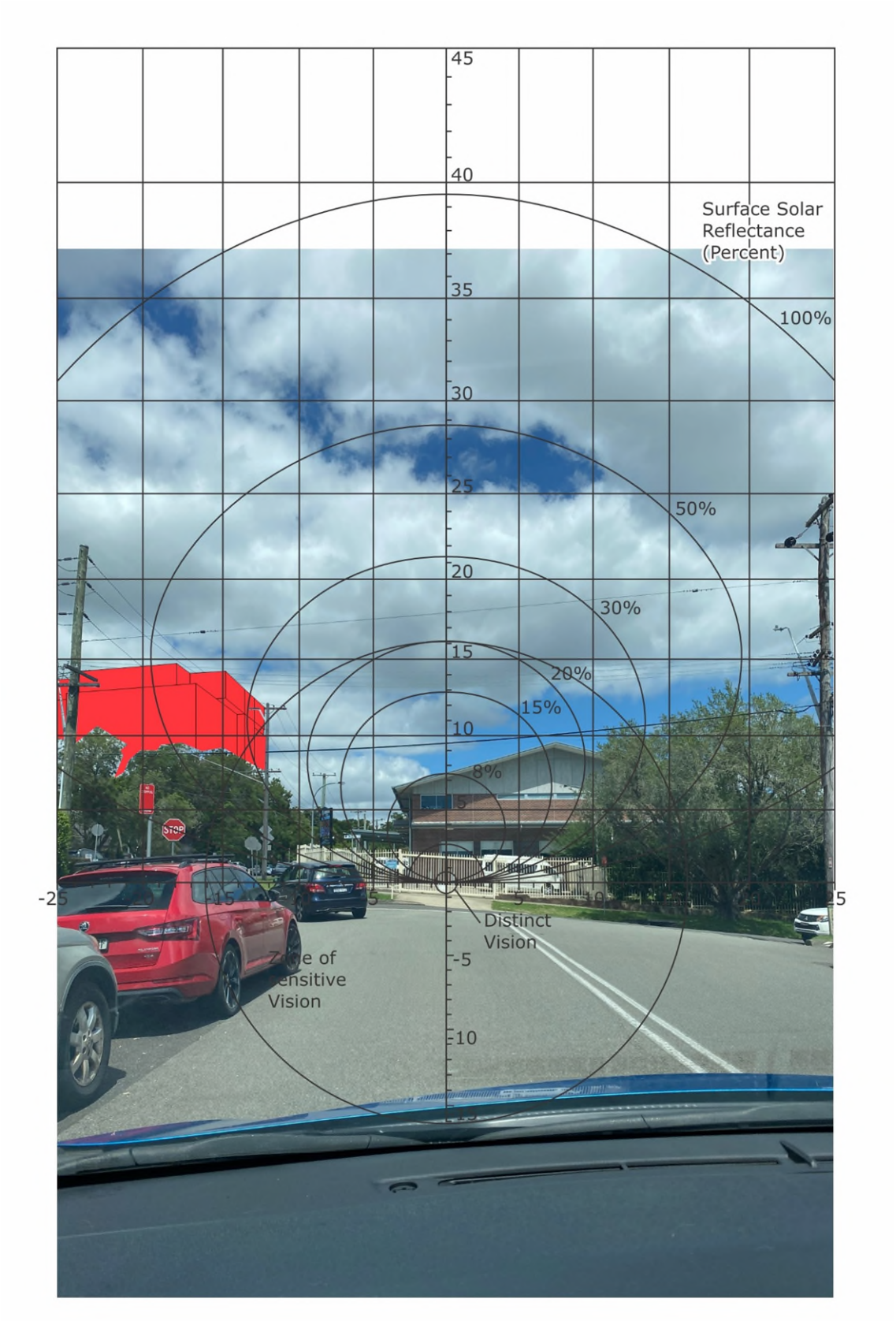



Figure A.2: Glare Overlay of the Viewpoint at Point 02

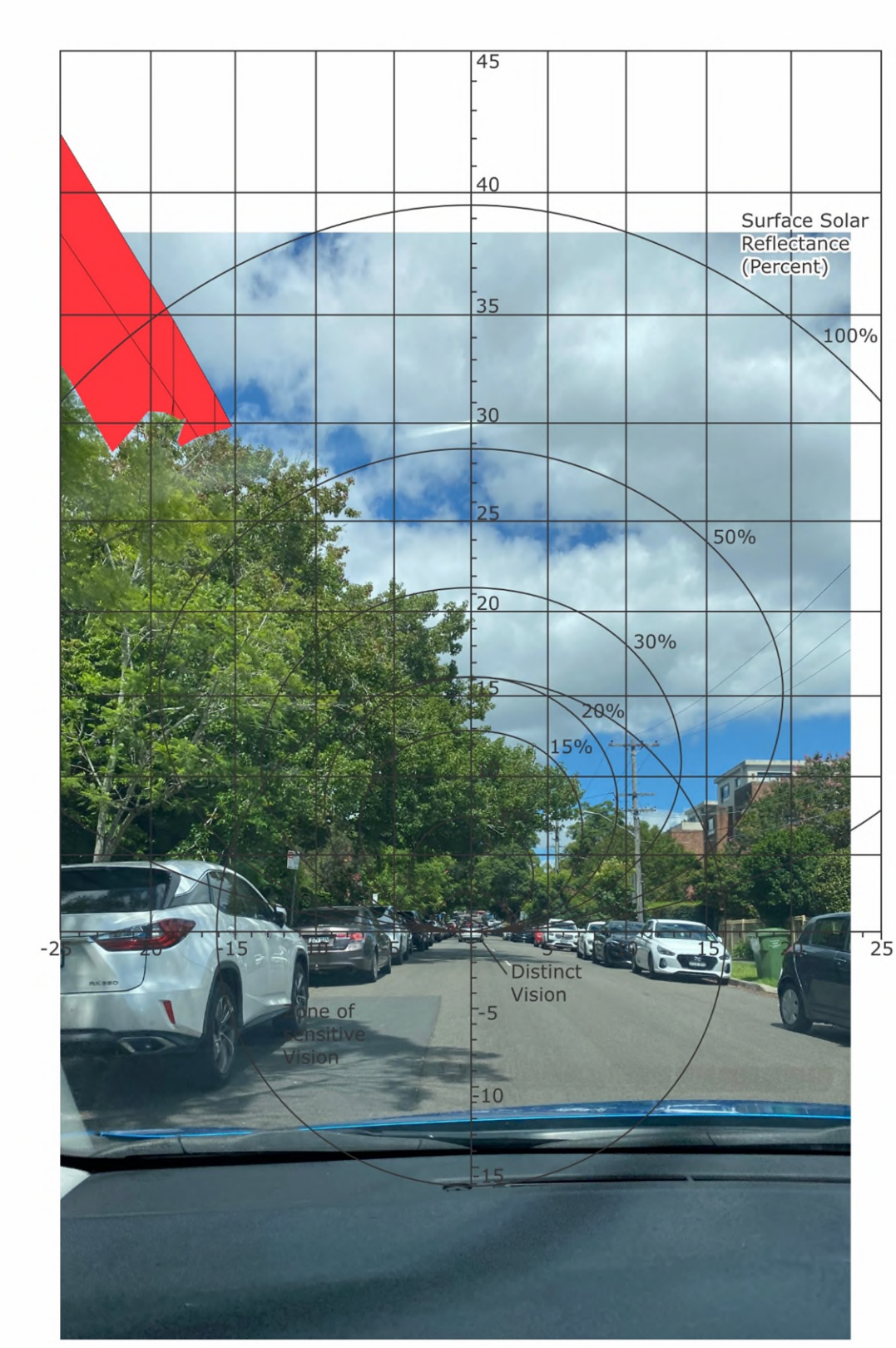



Figure A.3: Glare Overlay of the Viewpoint at Point 03

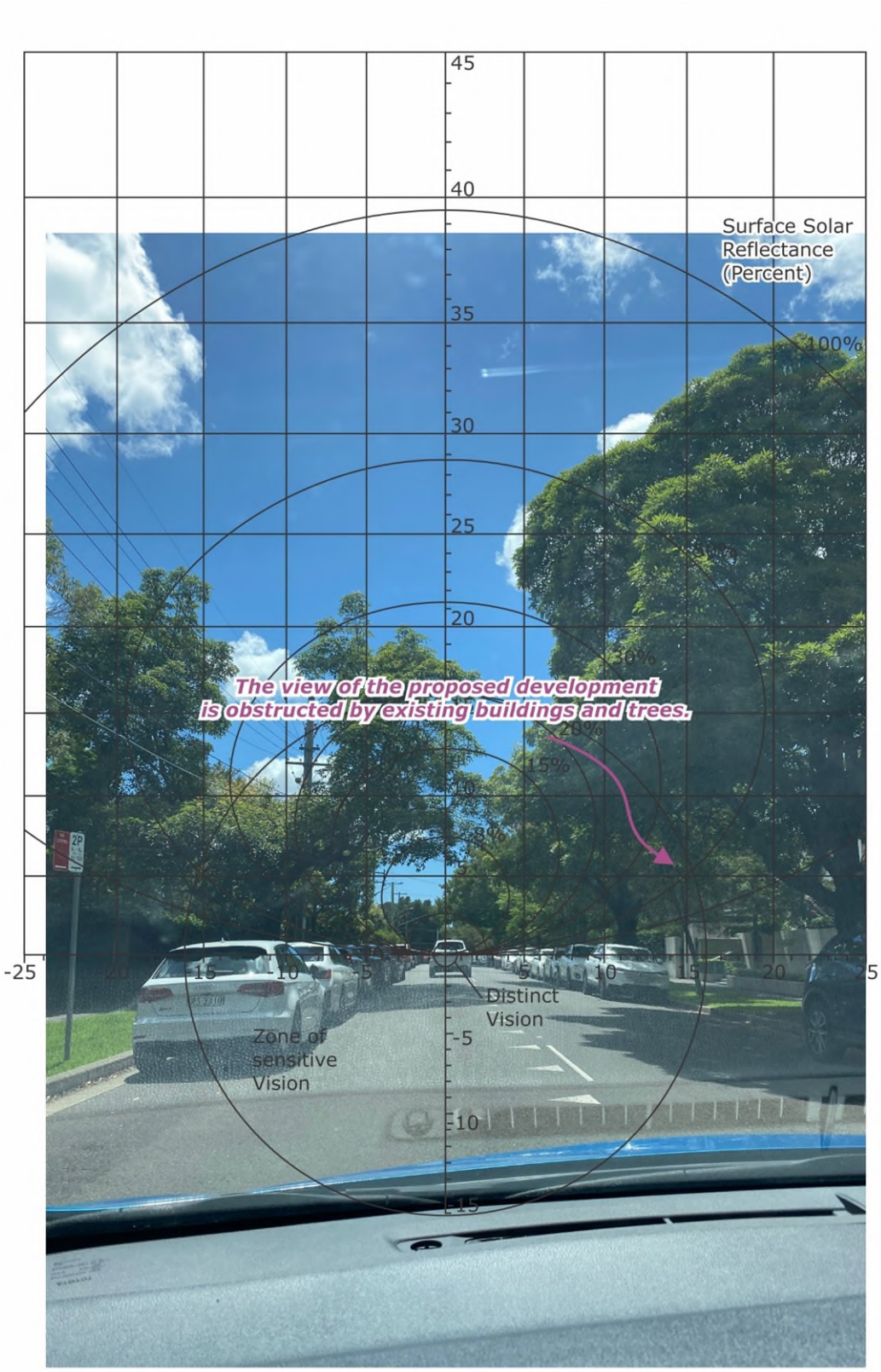



Figure A.4: Glare Overlay of the Viewpoint at Point 04

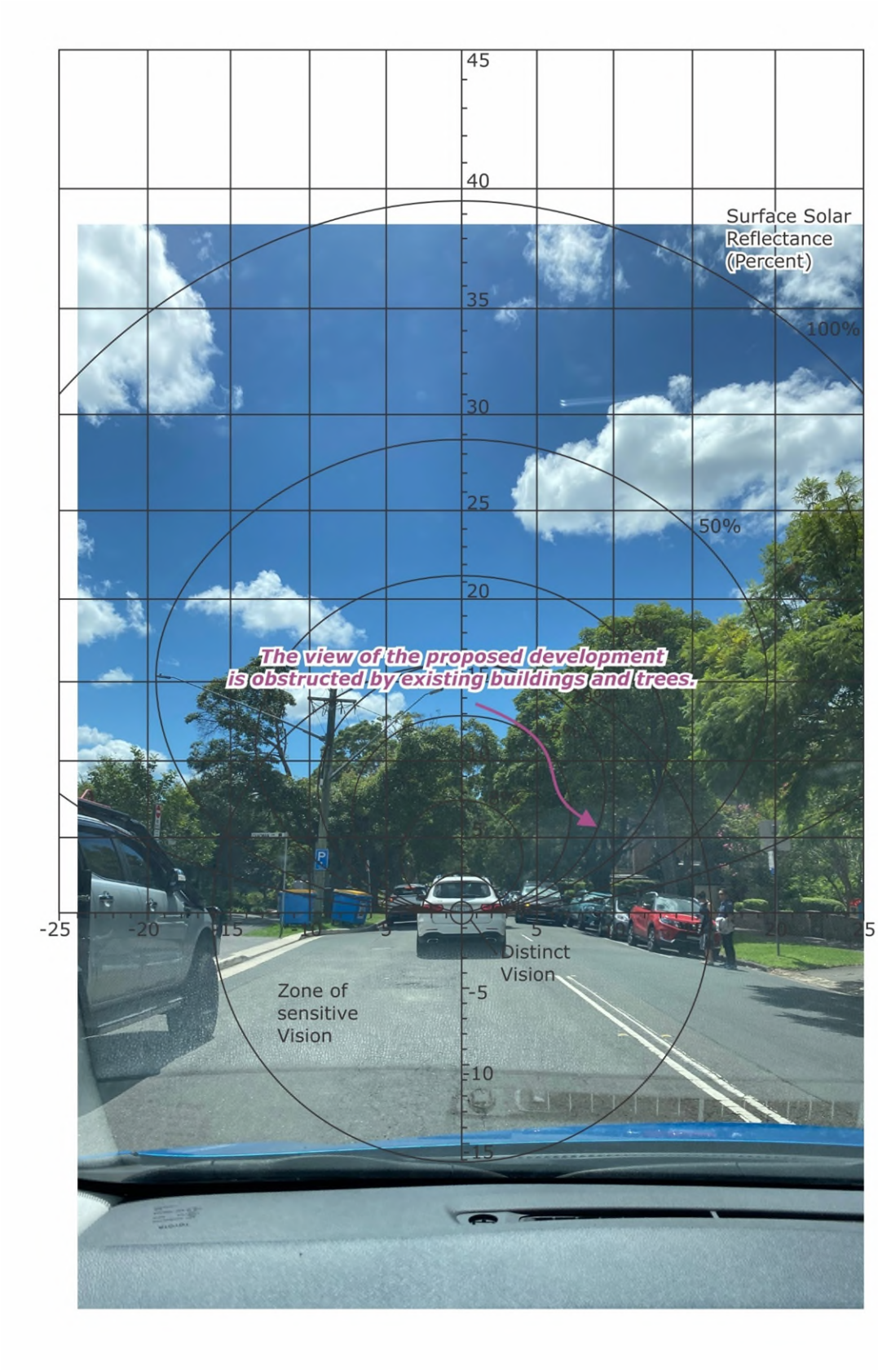



Figure A.5: Glare Overlay of the Viewpoint at Point 05

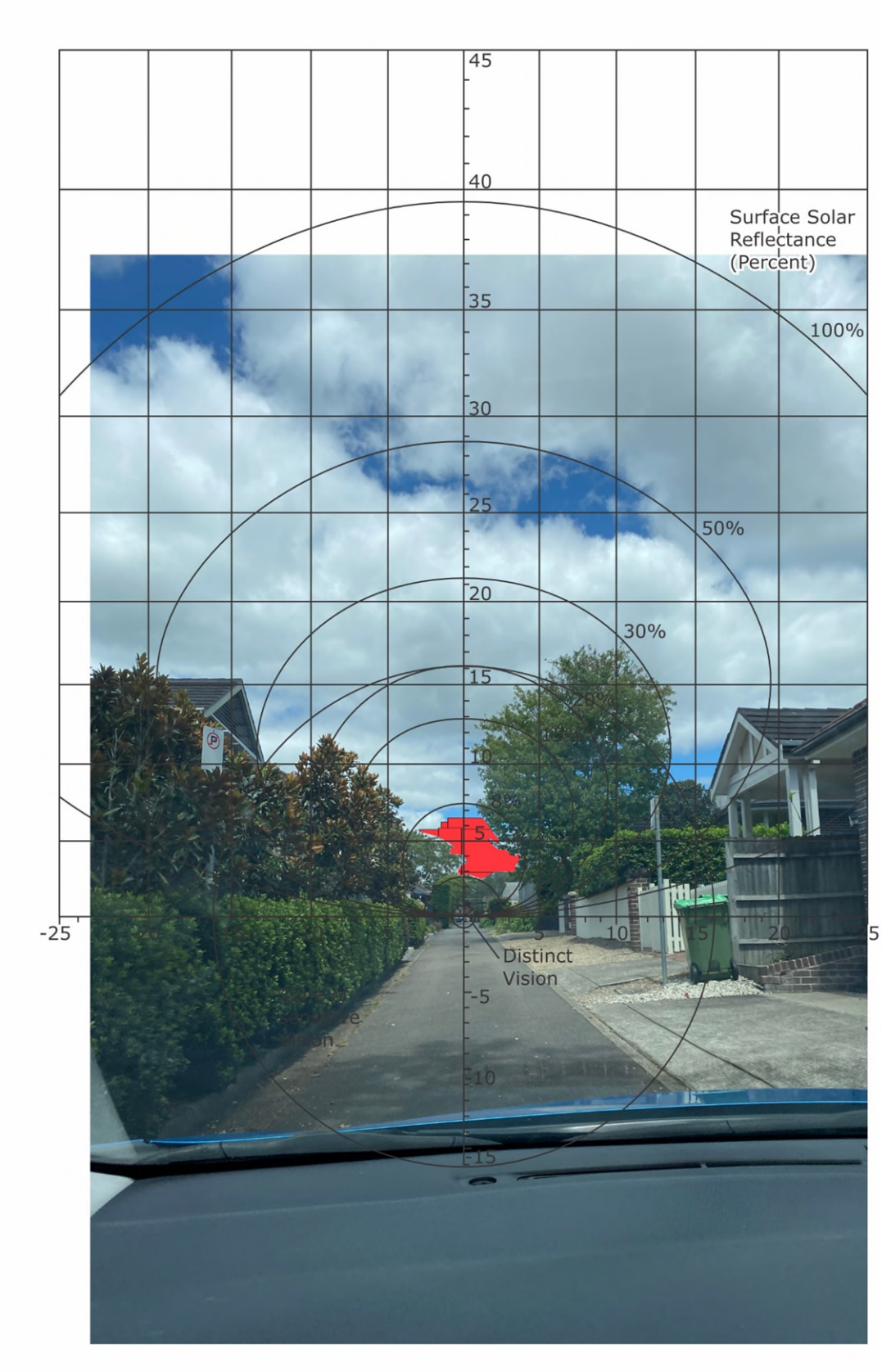



Figure A.6: Glare Overlay of the Viewpoint at Point 06

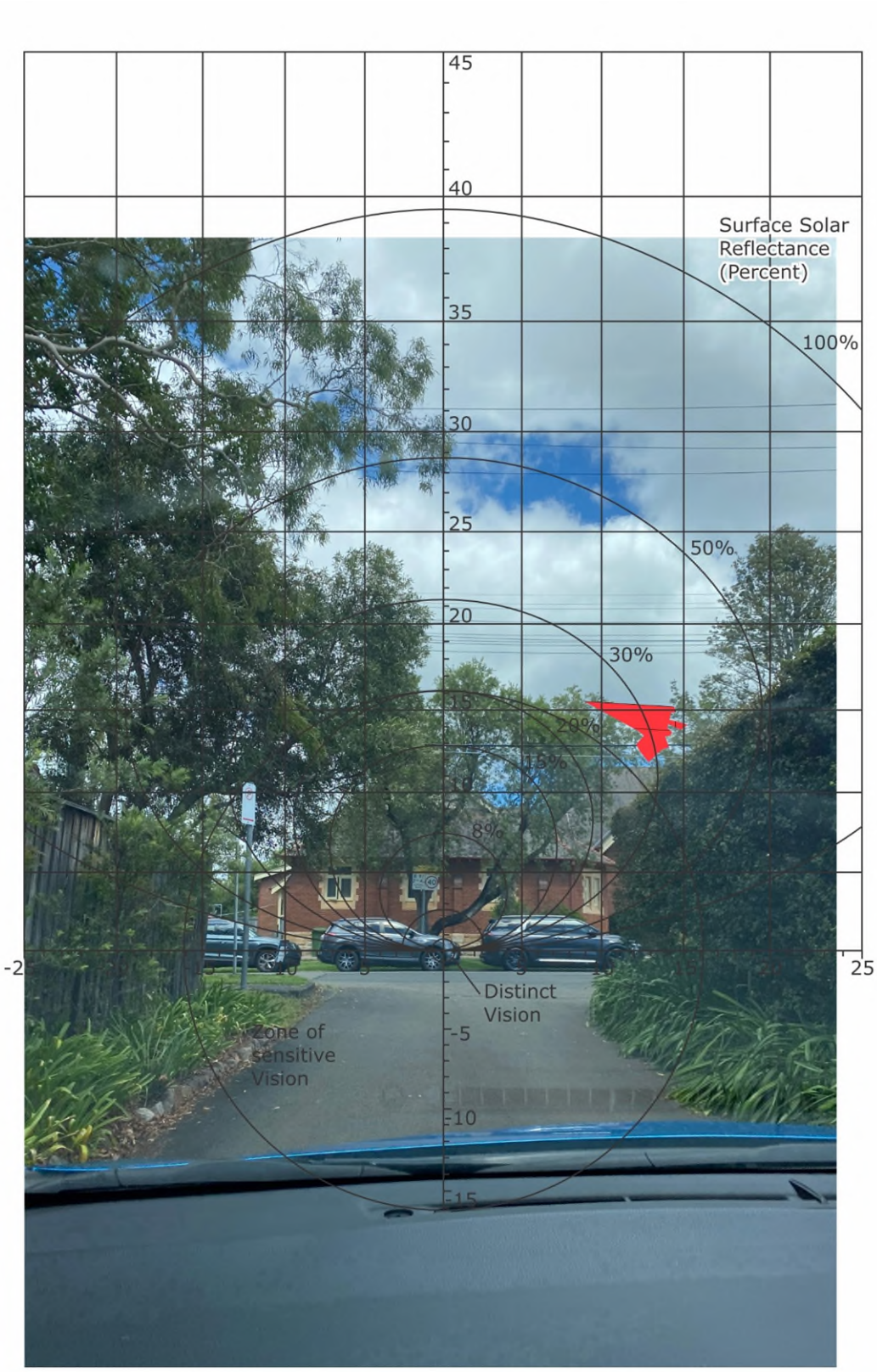



Figure A.7: Glare Overlay of the Viewpoint at Point 07

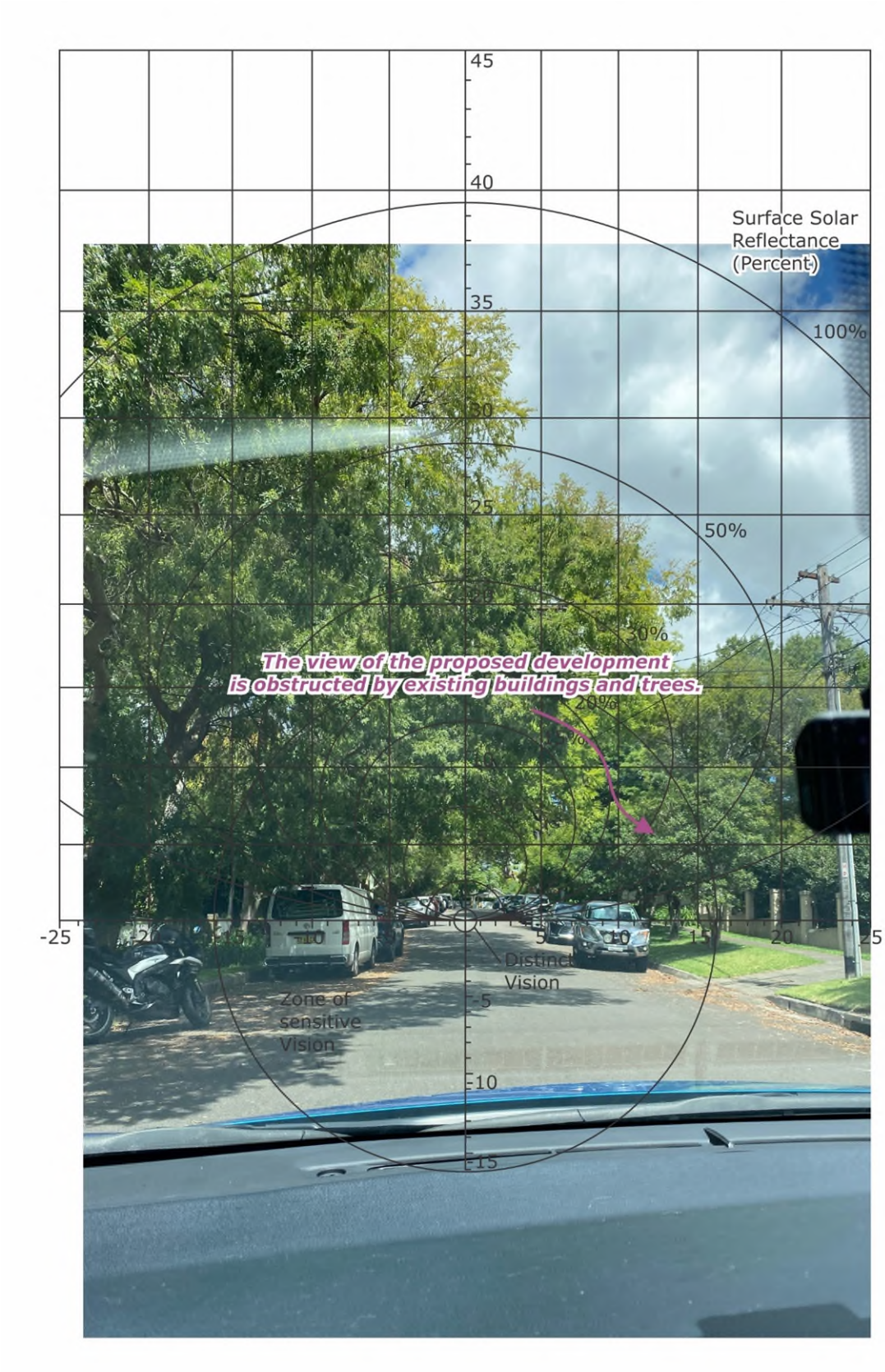



Figure A.8: Glare Overlay of the Viewpoint at Point 08


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

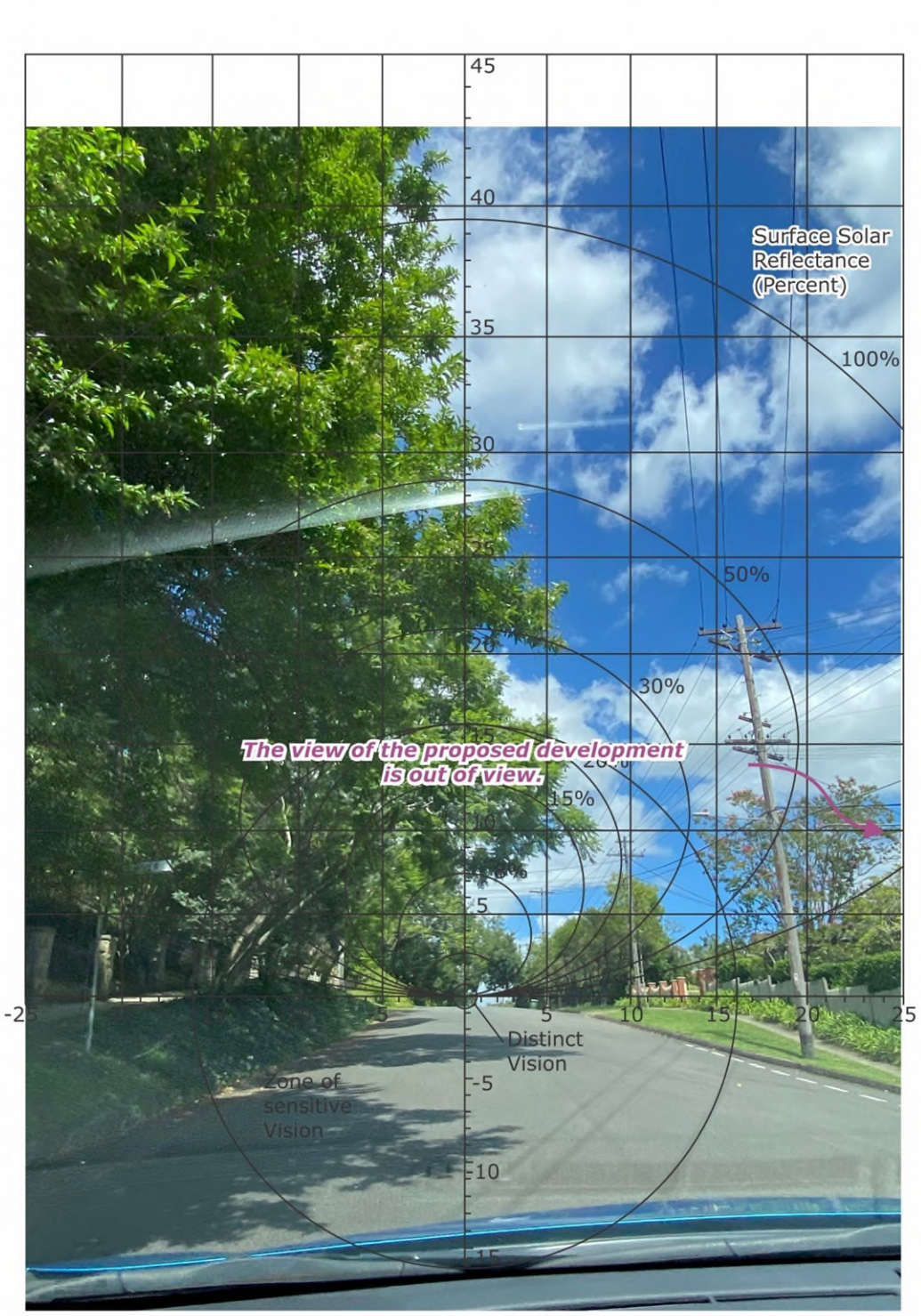



Figure A.10: Glare Overlay of the Viewpoint at Point 10

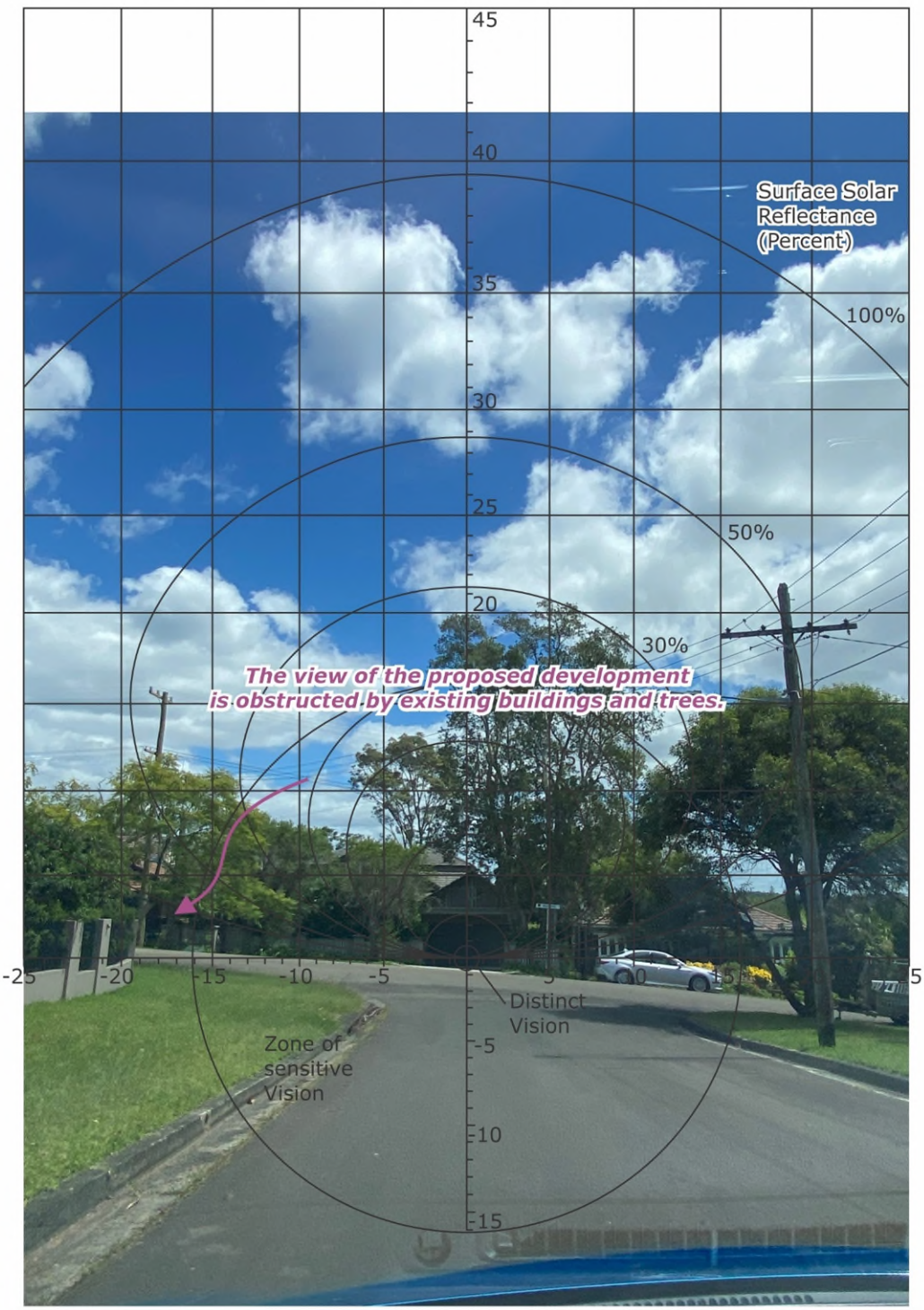



Figure A.11: Glare Overlay of the Viewpoint at Point 11

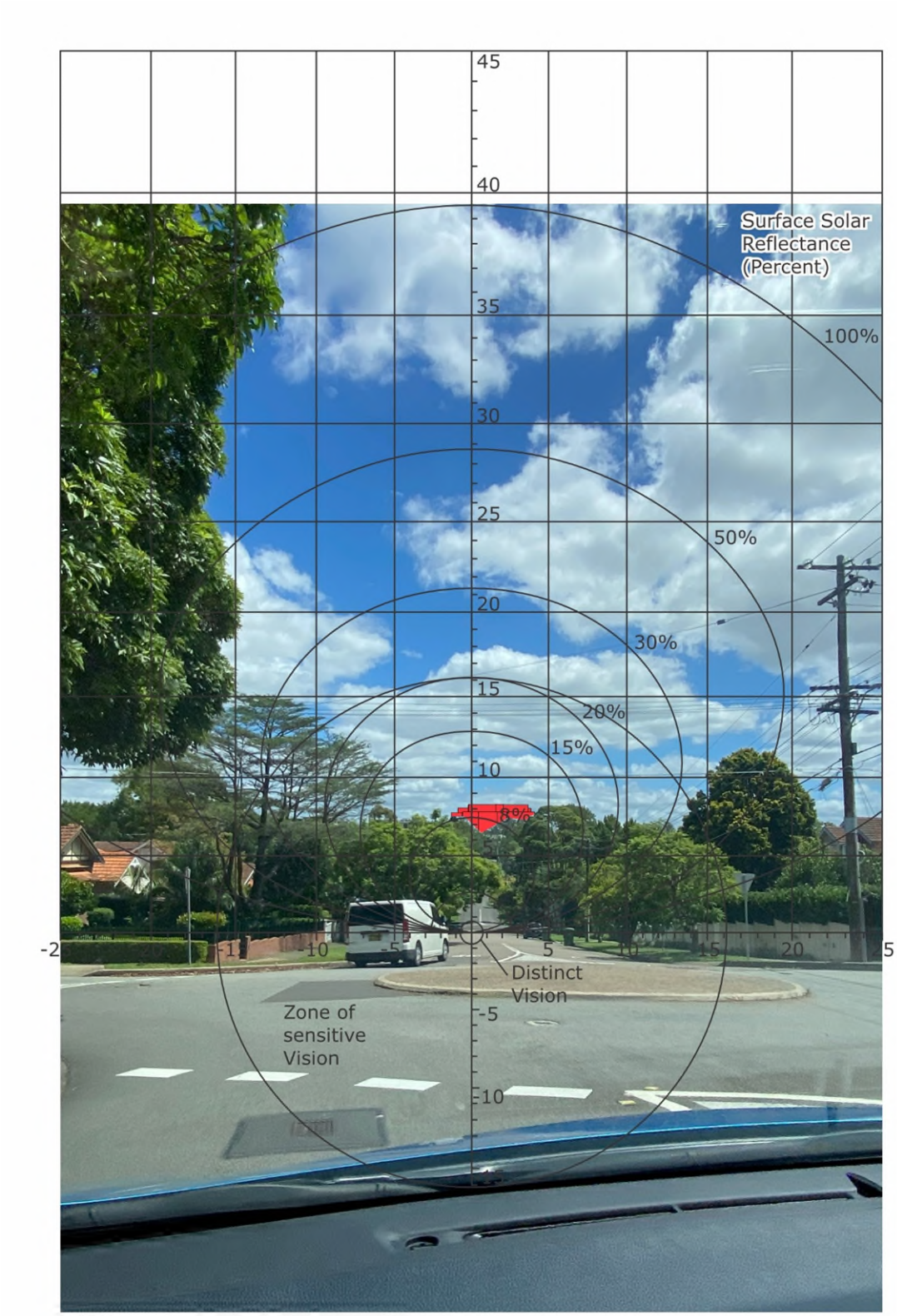



Figure A.12: Glare Overlay of the Viewpoint at Point 12

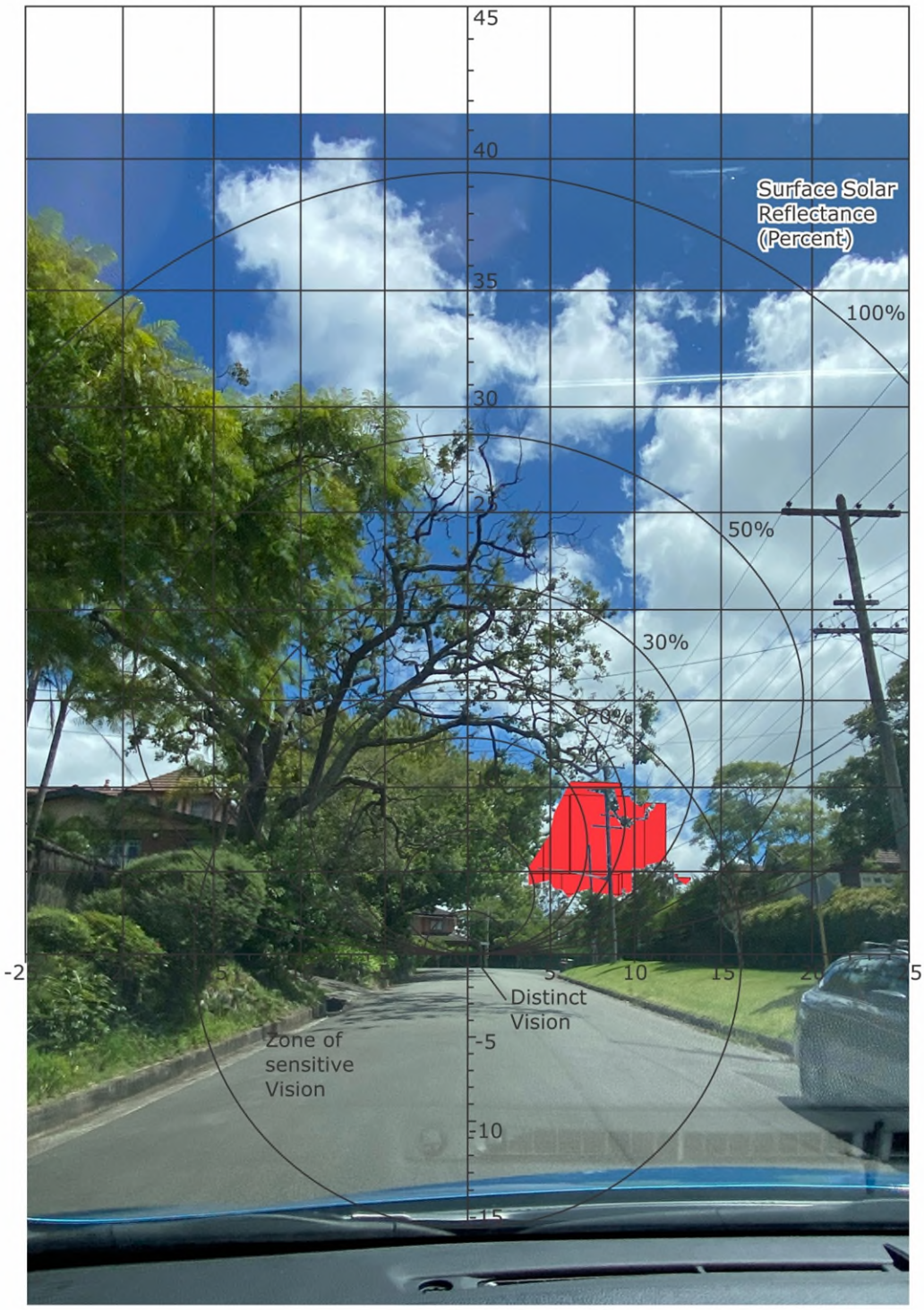



Figure A.13: Glare Overlay of the Viewpoint at Point 13

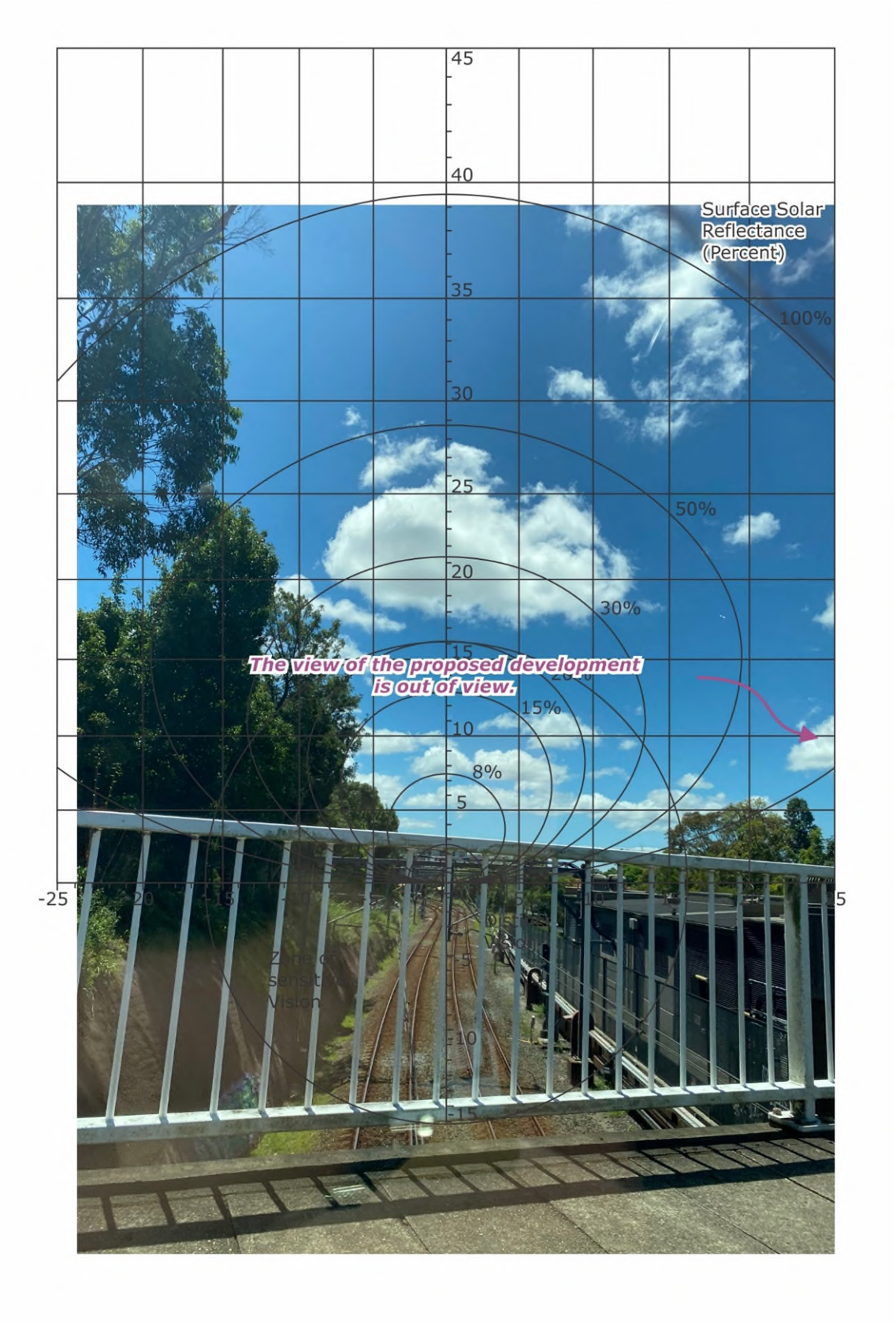



Figure A.14: Glare Overlay of the Viewpoint at Point 14


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

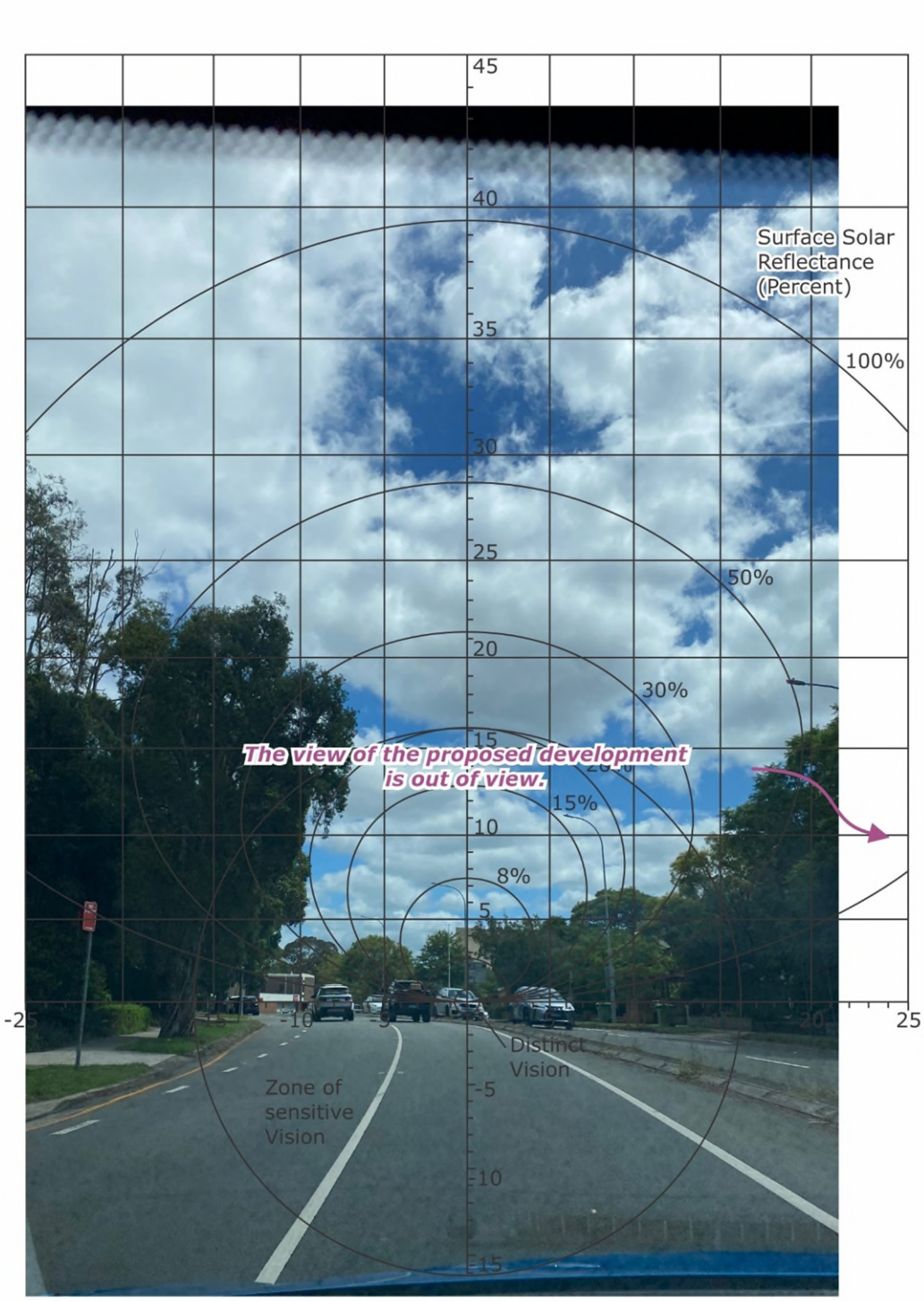



Figure A.16: Glare Overlay of the Viewpoint at Point 16

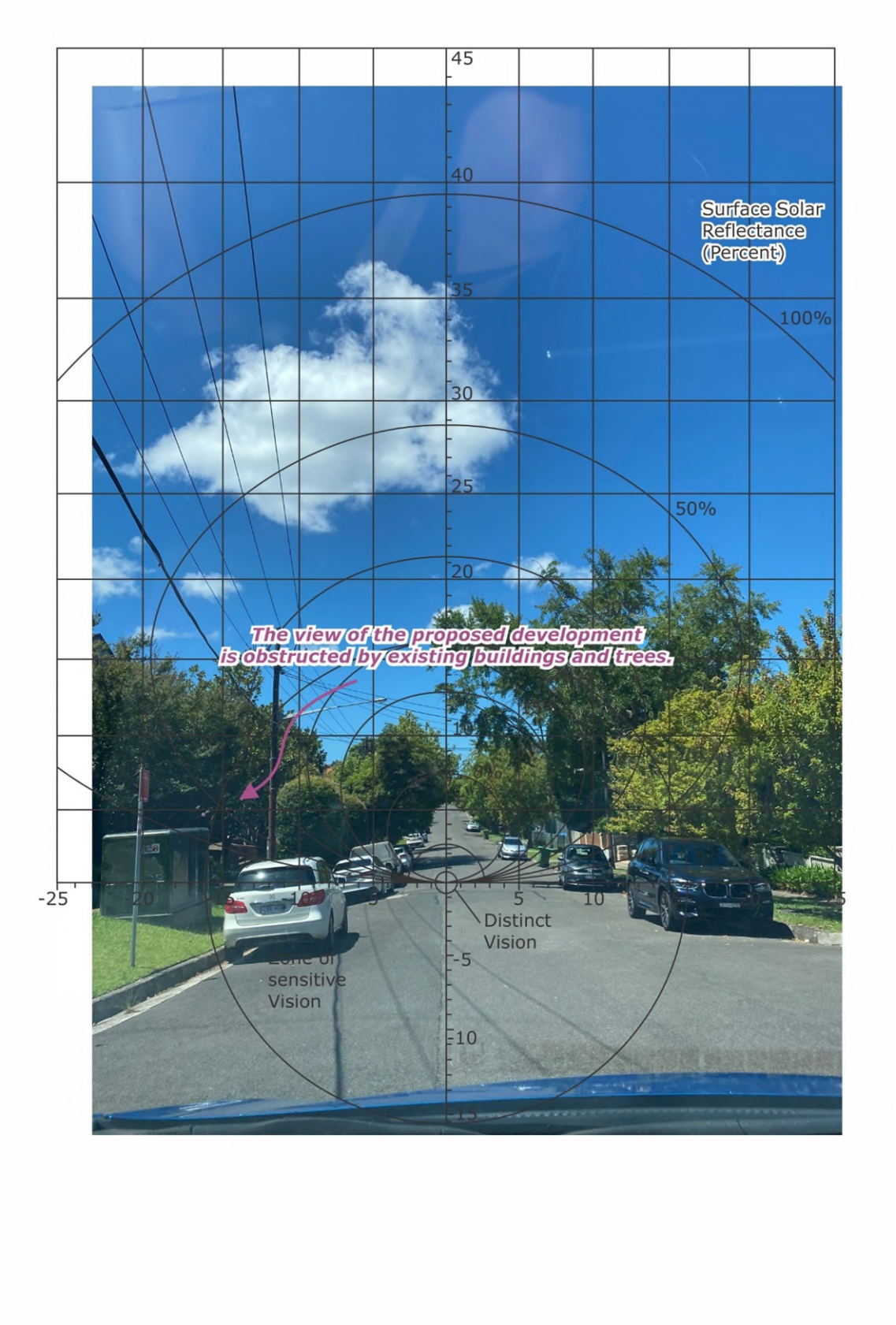



Figure A.17: Glare Overlay of the Viewpoint at Point 17

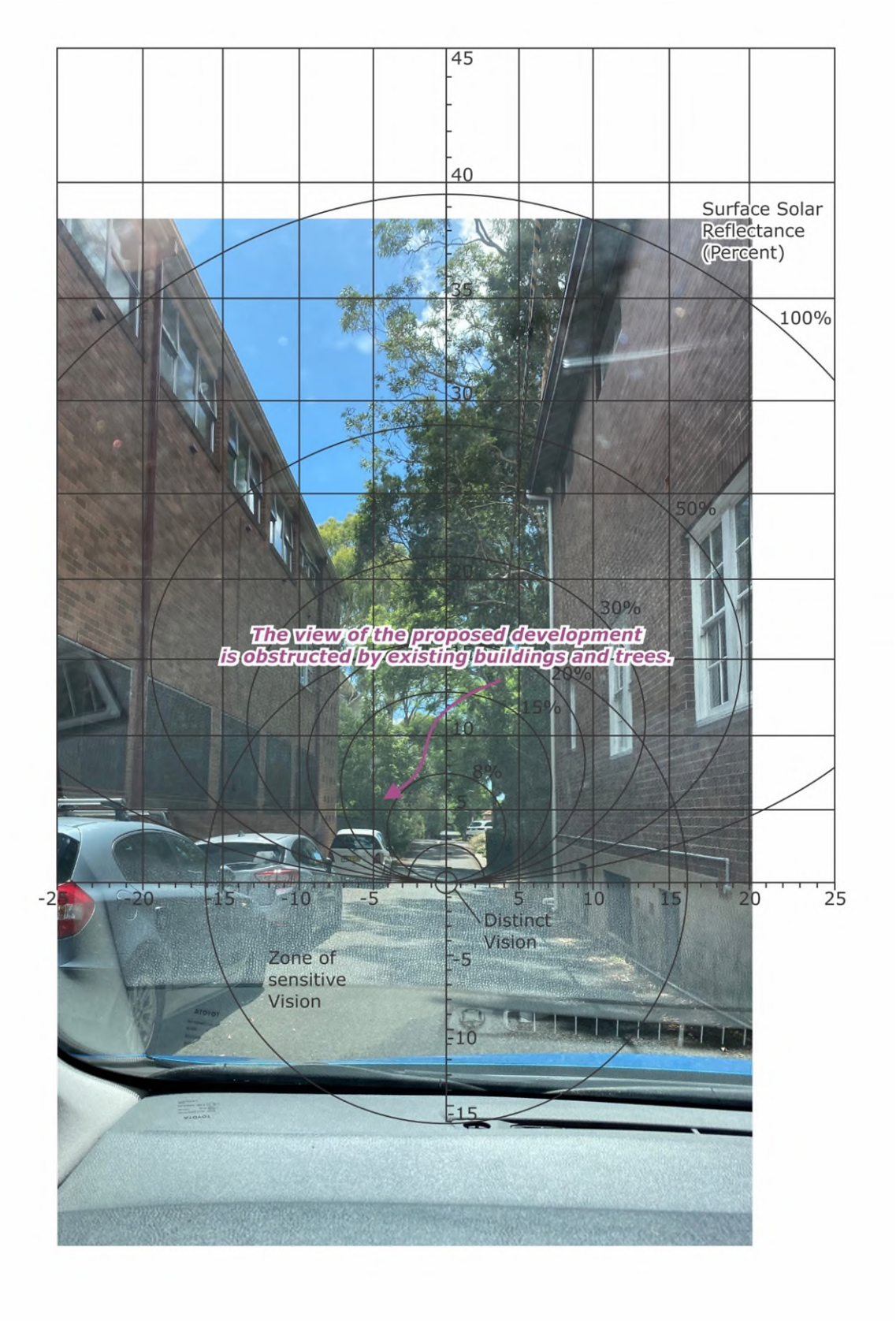



Figure A.18: Glare Overlay of the Viewpoint at Point 18

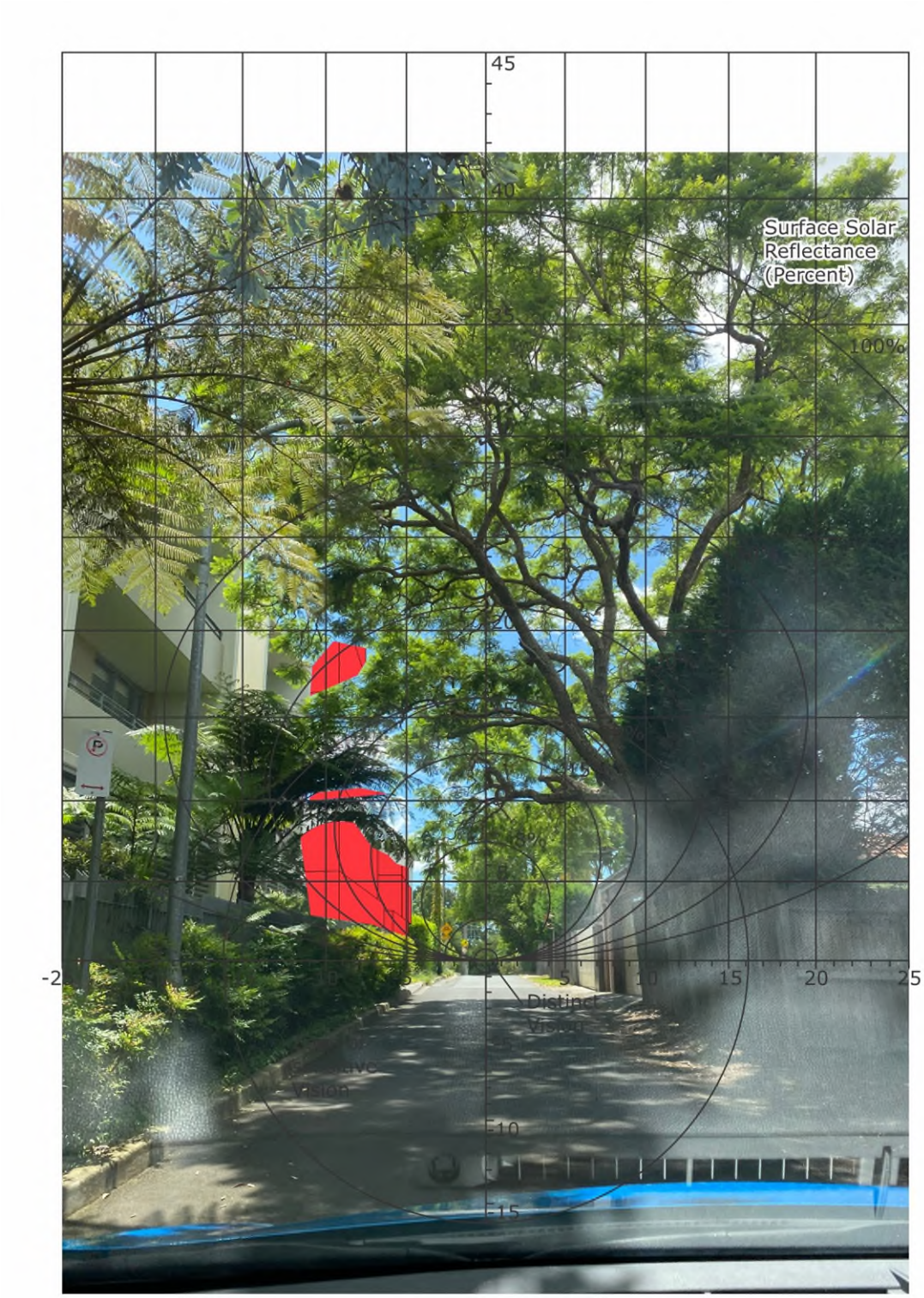



Figure A.19: Glare Overlay of the Viewpoint at Point 19

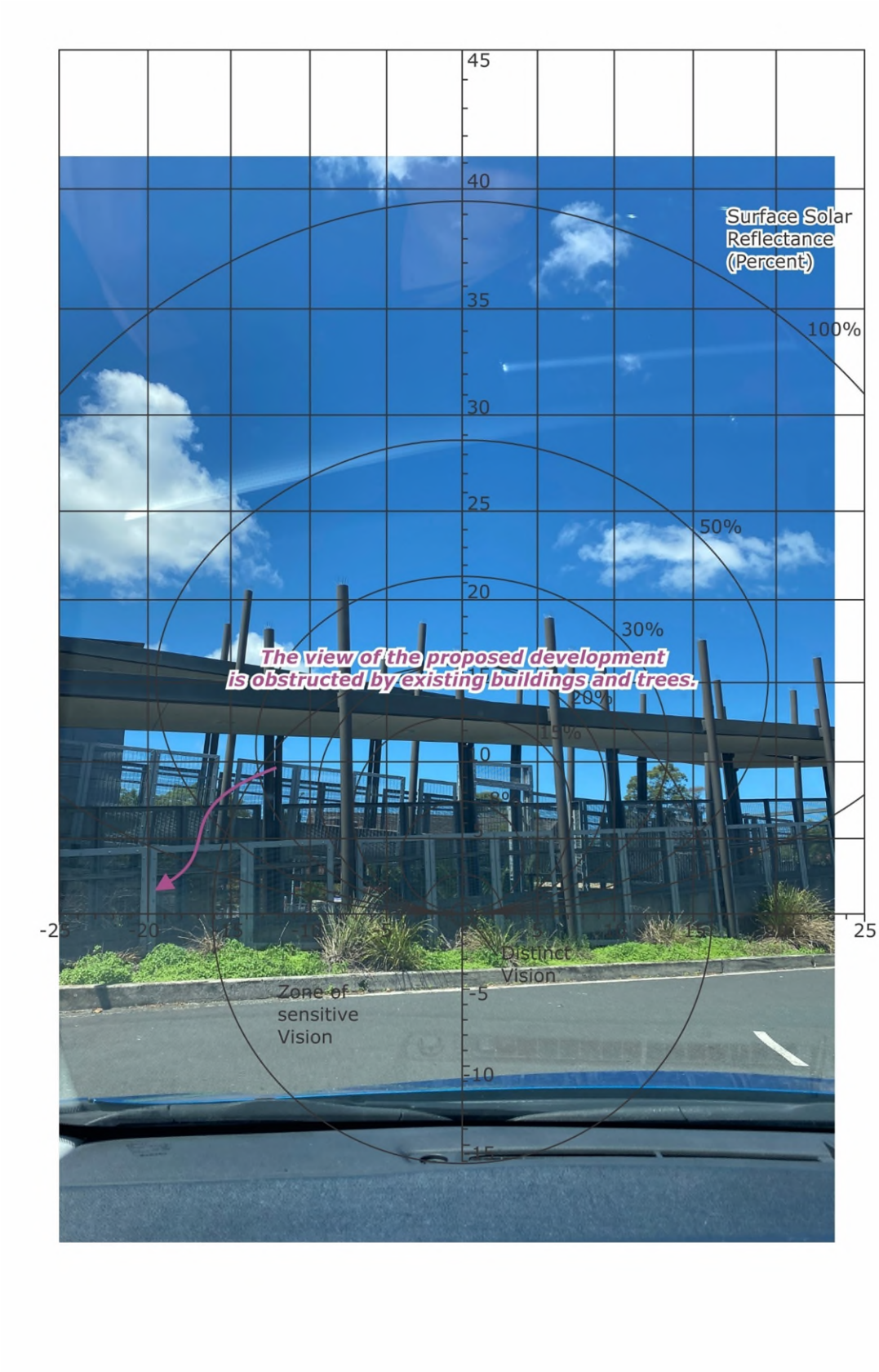



Figure A.20: Glare Overlay of the Viewpoint at Point 20

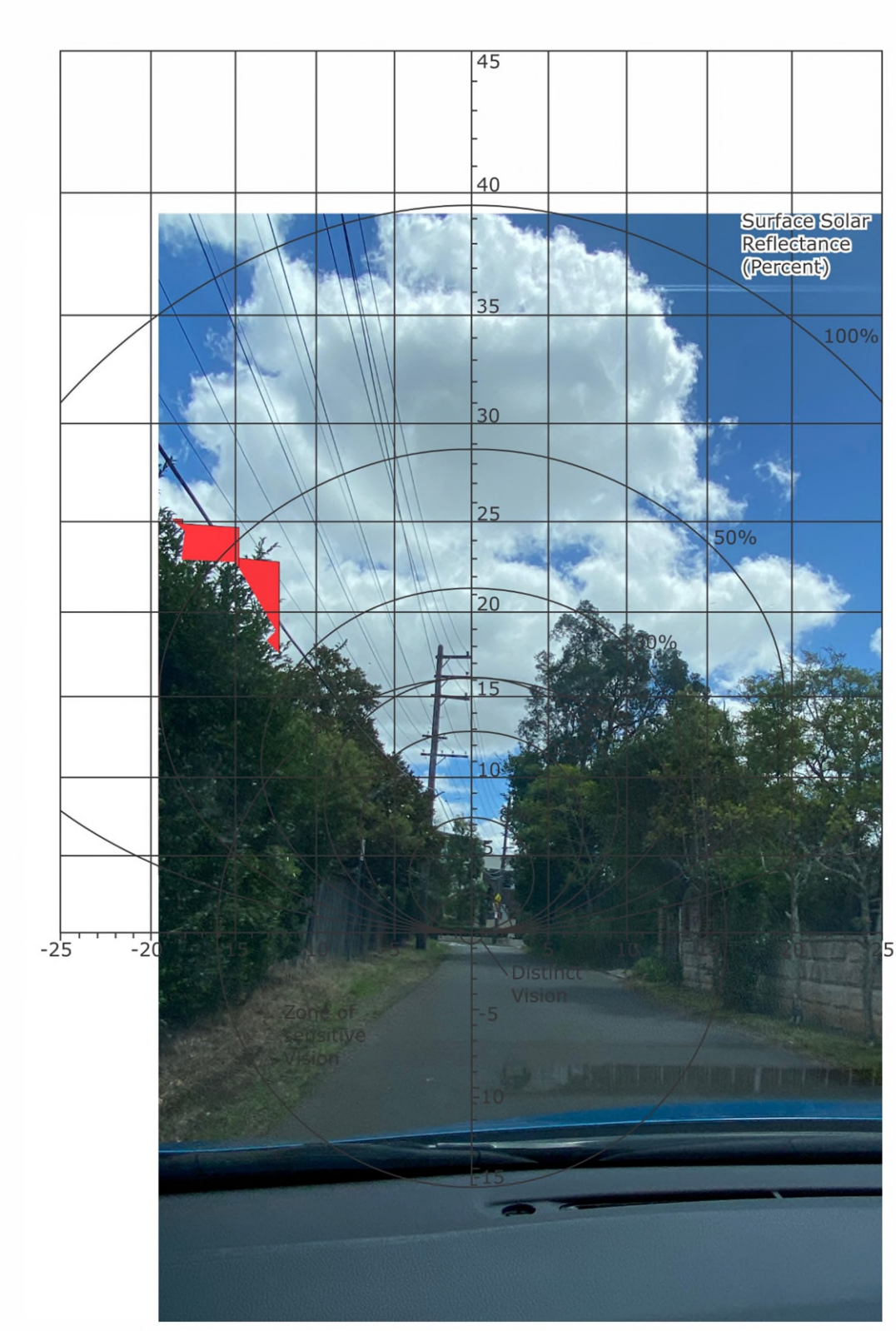



Figure A.21: Glare Overlay of the Viewpoint at Point 21

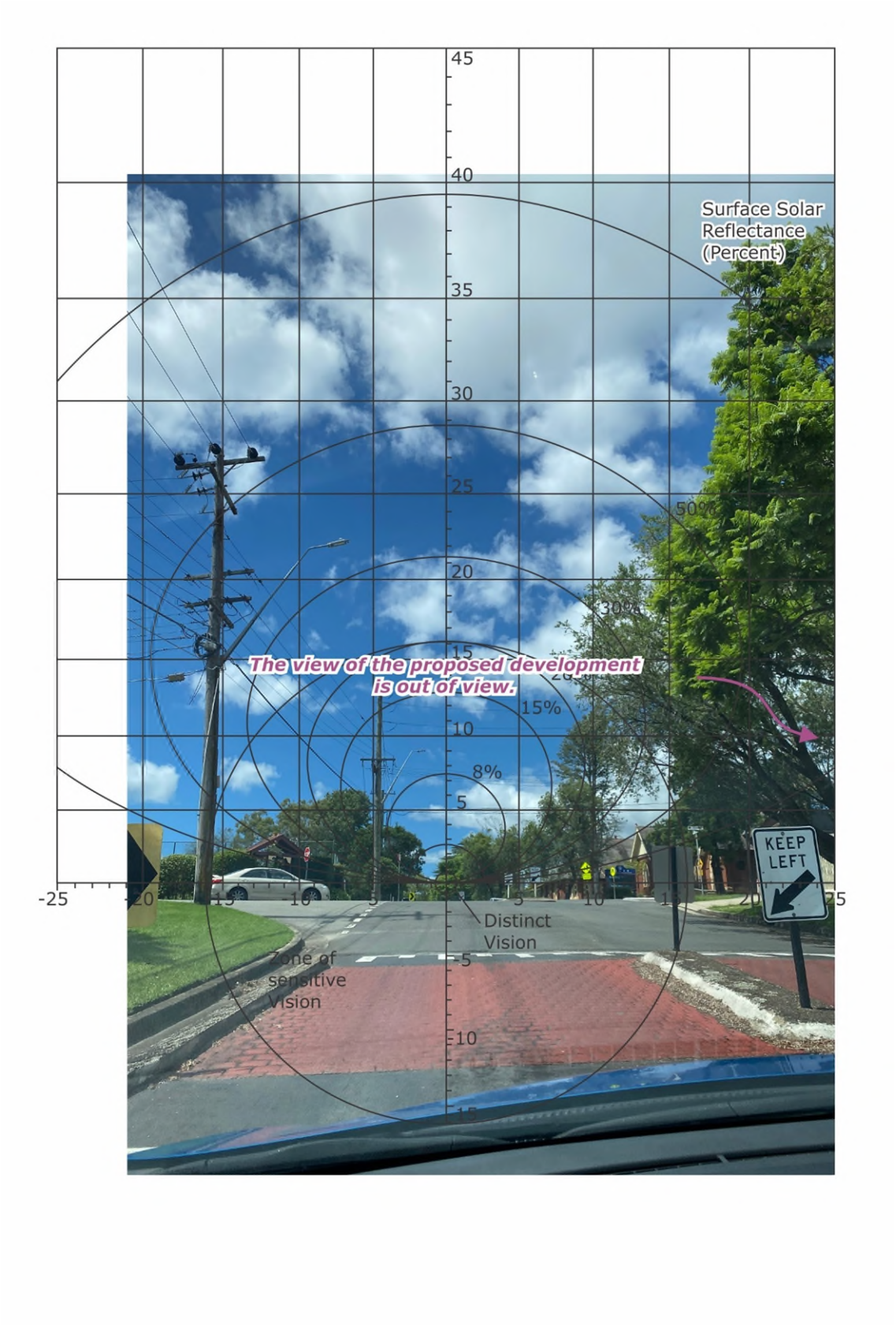



Figure A.22: Glare Overlay of the Viewpoint at Point 22

# APPENDIX B CRITICAL ASPECT SOLAR CHARTS

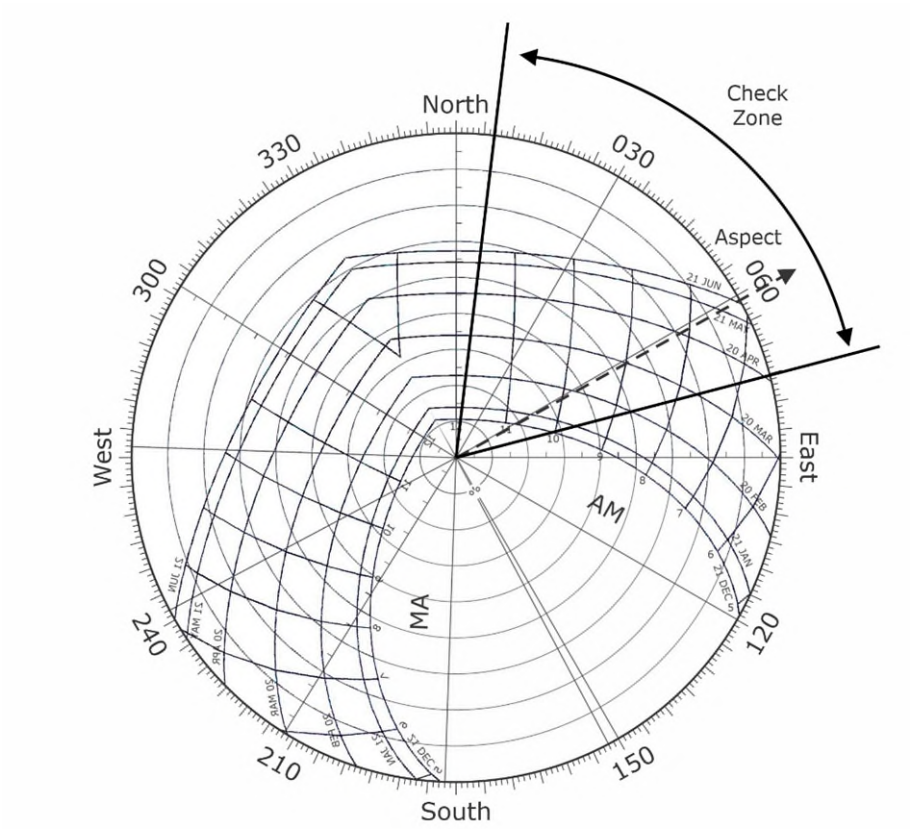



Figure B.1: Sun Chart for the 061° Aspect

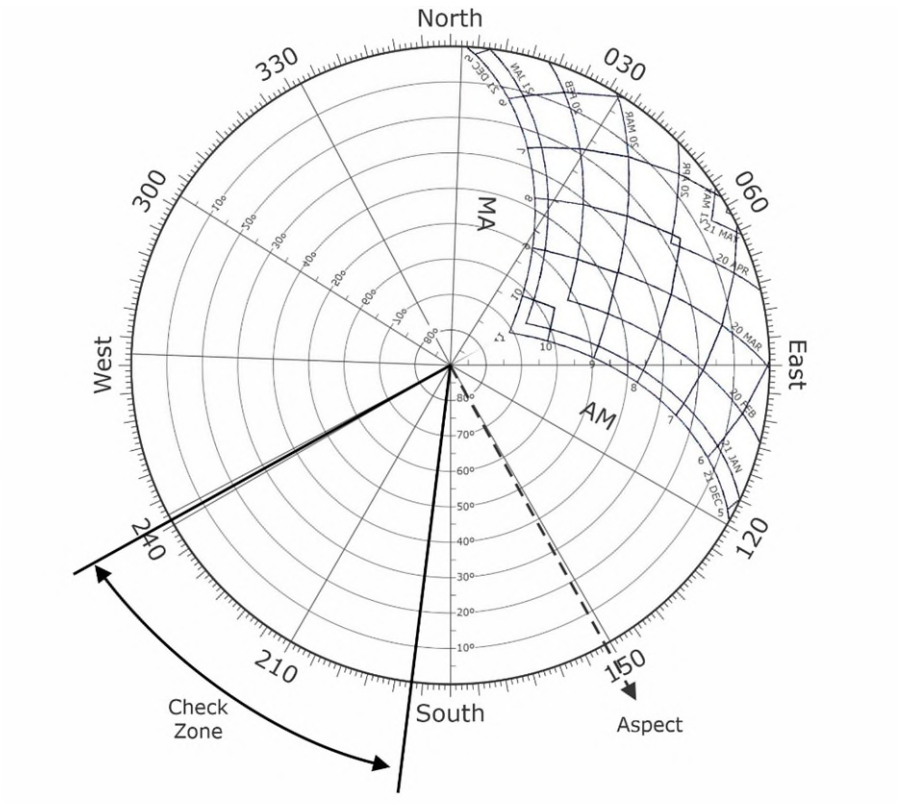



Figure B.2: Sun Chart for the 151° Aspect

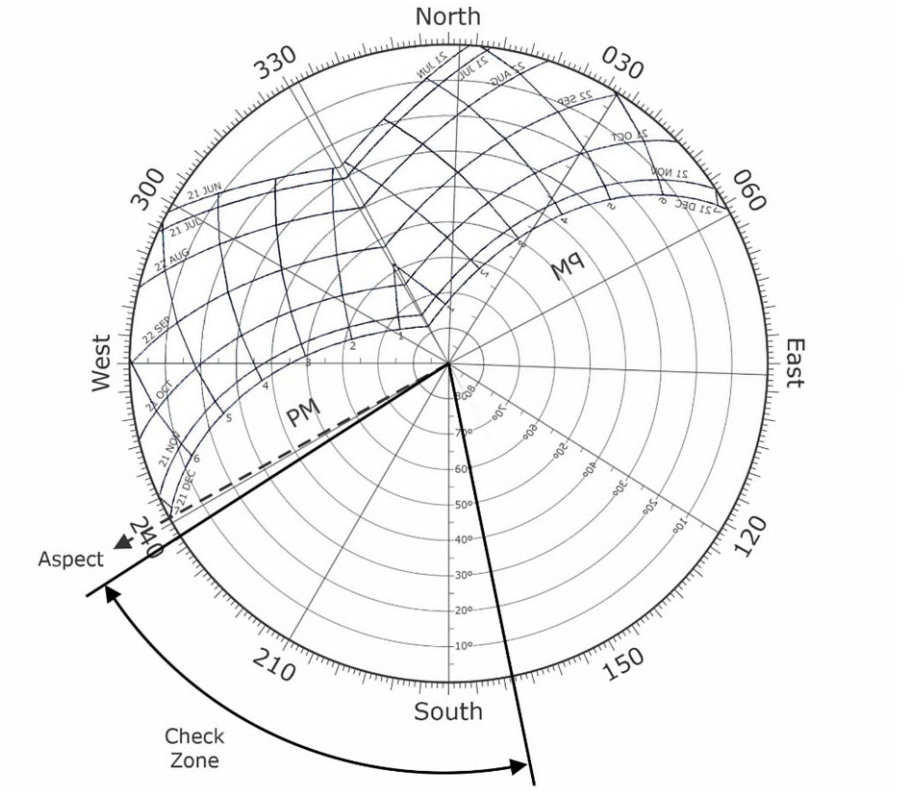



Figure B.3: Sun Chart for the 241° Aspect

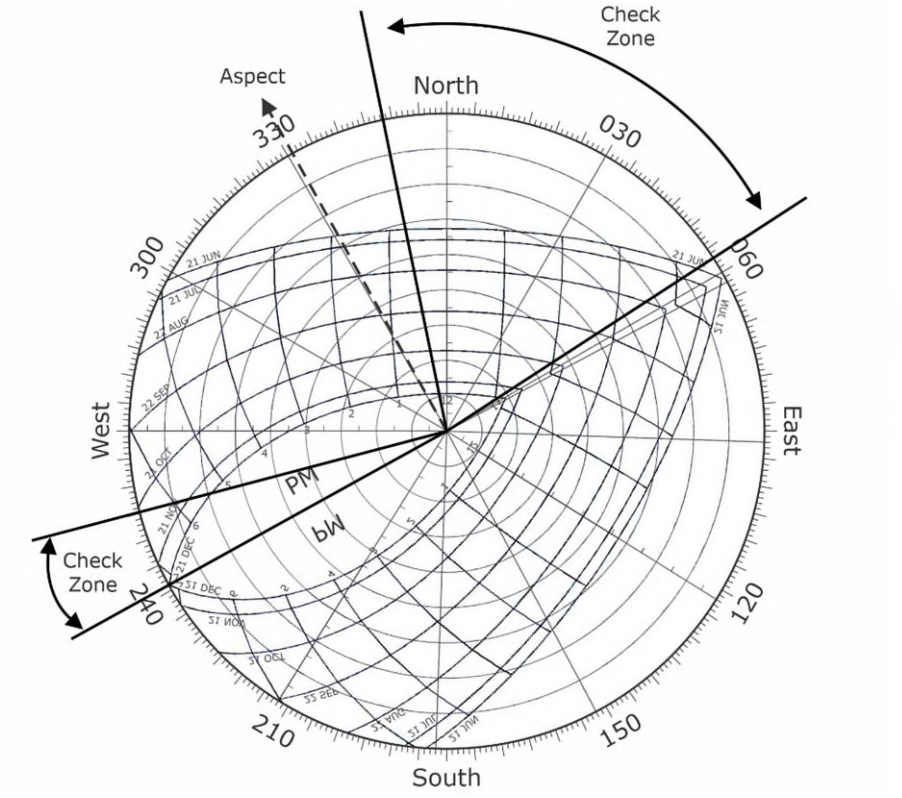



Figure B.4: Sun Chart for the 331° Aspect

# APPENDIX C STANDARD SUN CHART FOR THE REGION

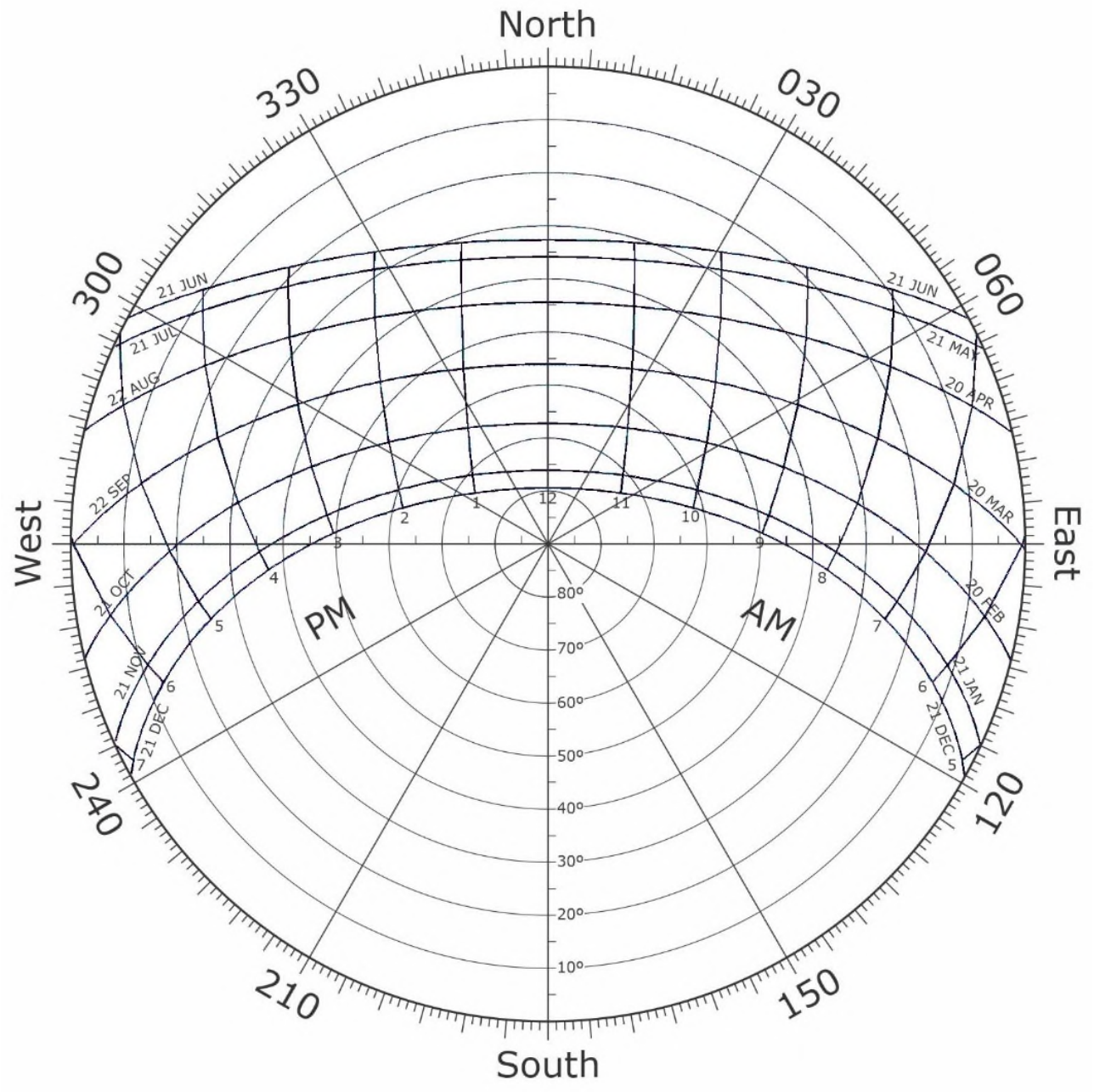



Figure C.1: Standard Sun Chart for the Sydney Region