WINDTECH

Solar Light Reflectivity Analysis

for the proposed development at

157 Redfern Street, Redfern

June 25, 2009

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Sydney • Melbourne • Singapore • Dubai www.windtech.com.au
WINDTECH Consultants Pty Ltd: 19 Willis St, Wolli Creek NSW 2205 Australia ABN 72 050 574 037
T: (61.2) 9567 0722 **F:** (61.2) 9567 0733 **E:** reception@windtech.com.au

Document Control

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0	02/06/09	Initial	AB	-	
1	25/06/09	Revised development description	TH	AB	TR

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1.0 Introduction

This study is to investigate the potential impact of solar glare from the proposed development at 157 Redfern Street, Redfern. The analysis takes into consideration potential reflectivity to the critical local surrounding street level locations, and to the surrounding buildings of the site.

The site is located at the corner of Gibbons and Redfern Streets, with the site being bounded by Redfern Street to the north and Gibbons Street to the east. The proposed development consists of 4 commercial and retail levels and 14 residential floors with the top level of residential level 18 having a roof terrace. It is proposed that the podium levels of the development will be used for commercial office use, and the Redfern RSL Club. The overall height of the development will be approximately 65m above the Redfern Street ground level.

An analysis has been undertaken based on the preliminary draft issue of the architectural drawings prepared by Nordon Jago Architects, dated May 26, 2009.

With regards to solar reflectivity, this study addresses the requirement of the City of Sydney October 2003 Development Control Plan, which states under Section 4.5 for reflectivity;

4.5.1 New buildings and facades should not result in glare that causes discomfort or threatens safety of pedestrians or drivers.

4.5.2 Visible light reflectivity from building materials used on the facades of new buildings should not exceed 20%.

4.5.3 A reflectivity report that analyses the potential solar glare from the proposed new development on pedestrians or motorists may be required.

A reflectivity analysis of the subject addition has been carried out using the technique published by Mr David N. H. Hassall (1991)[1].

The limiting veiling luminance of 500 candelas per square metre for the comfort of vehicle drivers, suggested in Hassall (1991) has been adopted as a basis of assessing the glare impact from the subject addition. In meeting this criterion for vehicle drivers, conditions will also be satisfactory for pedestrians. The glare impact onto occupants of neighbouring buildings is also discussed.

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

2.0 Analysis and Results

The various critical aspects of the proposed development are shown in Figure 1 below. Solar charts for the various critical aspects of the development are presented in Appendix B of this report. Check zones for the aspects indicated in Figure 1 have been identified based on the data obtained from the solar charts in Appendix B. The check zones highlight the zones that are potentially affected by solar reflections from each critical aspect. The various check zones for the subject addition are shown in Figure 2.

It should be noted that the check zones described 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 in the following section of this report.

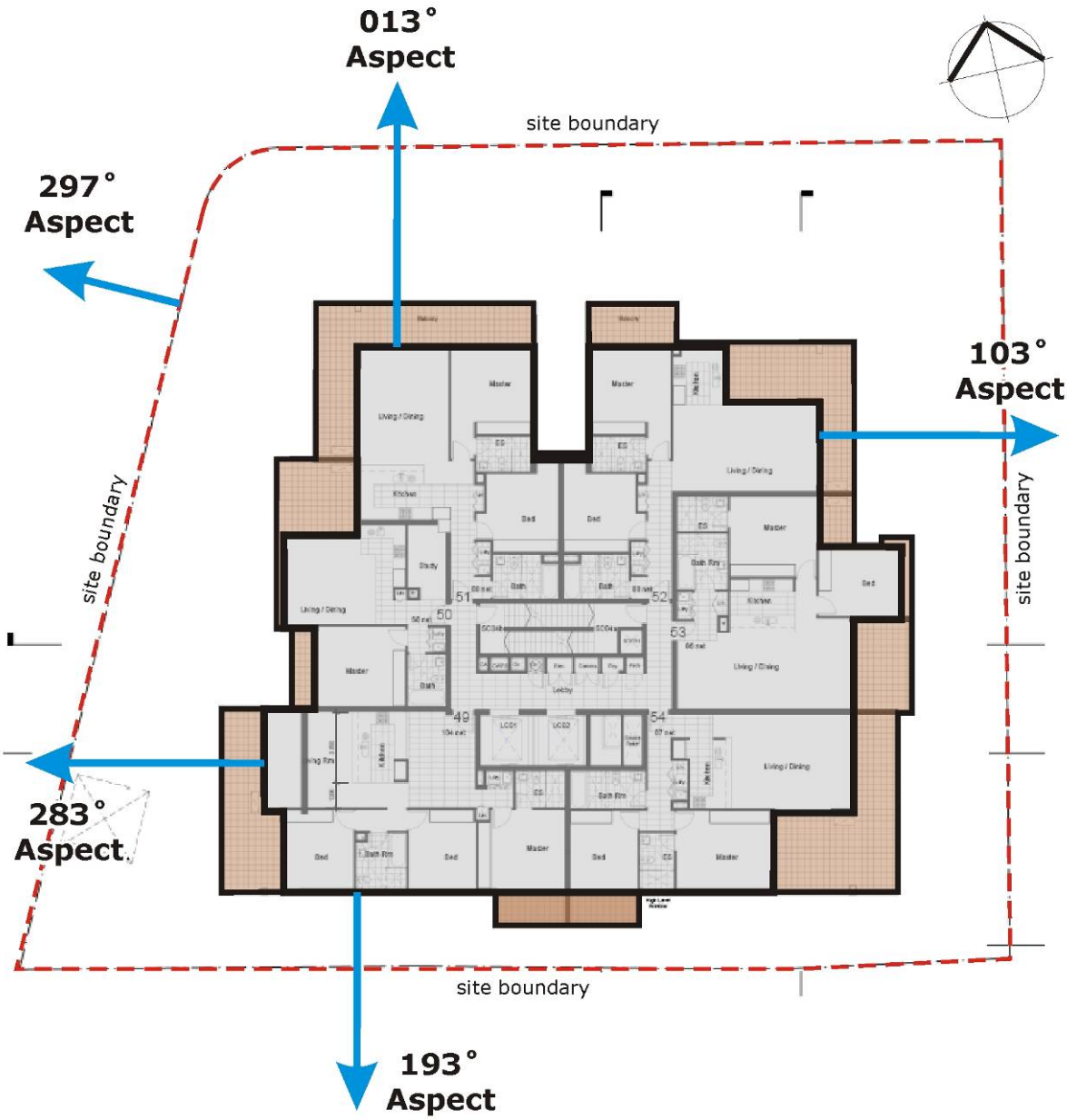

Figure 1: The Critical Aspects of the Proposed Development

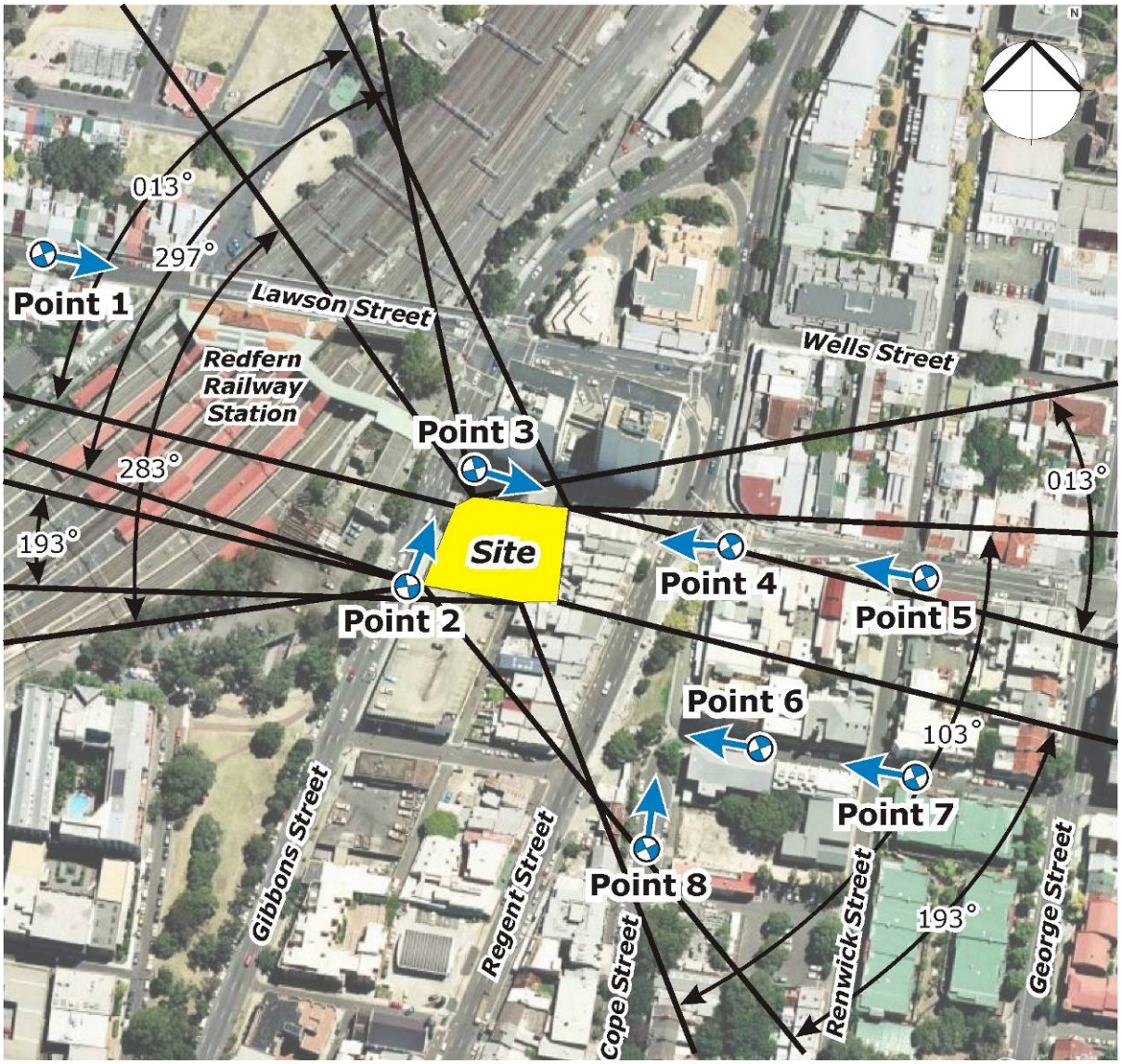

Figure 2: Check Zones for the Critical Aspects of the Development and the Location of the Various Study Points for the Study

Table 1: Aspects of the Site that affect each of the Study Points

Study Point(s)	Aspects
Point 1	013˚, 283˚ and 297˚ aspects
Point 2	193˚ and 283˚ aspects
Point 3	013˚ aspect
Points 4 and 5	013˚ and 103˚ aspects
Points 6, 7 and 8	103˚ and 193˚ aspects

2.1 Impact onto Drivers and Pedestrians

From the study of the check zones shown in Figure 2, and with consideration of the potential overshadowing effects of neighbouring buildings, 8 street level locations have been identified for analysis. The location of these study point locations are also shown in Figure 2. Table 1 summarises the effect of the various aspects on the selected study locations.

Photographs have been taken from the viewpoint of drivers and/or pedestrians using a calibrated camera from each of the selected study point locations. Views from the study point locations are presented in Appendix A of this report. A scaled glare protractor has been superimposed over each photograph.

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 candelas per square metre. Alternatively, the glare protractor can be used to determine the maximum acceptable reflectivity index for the glare to be within the criterion of 500 candelas/m^2.

2.1.1 Point 1

Point 1 is located to the north-west of the proposed development site on Lawson Street. This point represents a critical sightline of drivers heading east along Lawson Street at this location. This point is located within the check zones for the 013˚, 283˚ and 297˚ aspects of the proposed development.

The analysis of Point 1, shown in Figure A1 of Appendix A, indicates that the proposed development is blocked from view by the buildings along the southern side of Lawson Street alongside this study point location. Hence there will be no adverse glare from the proposed development to drivers and pedestrians heading east along Lawson Street at Point 1.

2.1.2 Point 2

Point 2 is located at the south-western corner of the site, on Gibbons Street. This point represents a critical sightline of drivers heading north-east along Gibbons Street at this location. This point is located within the check zones for the 193˚ and 283˚aspects of the proposed development.

The analysis of Point 2, shown in Figure A2 of Appendix A, indicates that only a portion of the 297˚aspect of the podium will be within the zone of sensitive vision at this location. Hence there will be no adverse glare from the proposed development to drivers and pedestrians heading north-east along Gibbons Street at Point 2.

2.1.3 Point 3

Point 3 is located at the north-western corner of the site, at the entrance to Redfern Street from Gibbons Street. This point represents the critical sightline of drivers heading east along Redfern Street at this location. This point is located within the check zone for the 013˚ aspect of the proposed development.

The analysis of Point 3, shown in Figure A3 of Appendix A, indicates that only a small portion of the 013˚ aspect of the podium will be within the zone of sensitive vision at this location. Further inspection shows that direct sun to this portion of the façade that could be reflected to Point 3 will be blocked by the eastern tower of the two neighbouring towers on Redfern Street. Hence there will be no adverse glare from the proposed development to drivers and pedestrians heading east along Redfern Street at Point 3.

2.1.4 Point 4

Point 4 is located to the east of the proposed development at the intersection of Redfern Street and Regent Street. This point represents a critical sightline of drivers facing west along Redfern Street at this location. This point is located within the check zone for the 013˚ and 103˚ aspects of the proposed development.

The analysis of Point 4, shown in Figure A4 of Appendix A, indicates that the podium levels of the proposed development will be blocked from view by the shops along the western side of Regent Street. The visible parts of the proposed development will not be within the zone of sensitive vision for drivers facing west at this location. Hence there will be no adverse glare from the proposed development to drivers and pedestrians facing west along Redfern Street at Point 4.

2.1.5 Point 5

Point 5 is located to the east of the proposed development at the intersection of Redfern Street and Renwick Street, further away from the site than Point 4. This point represents a critical sightline of drivers facing west along Redfern Street at this location. This point is located within the check zone for the 013˚ and 103˚ aspects of the proposed development.

The analysis of Point 5, shown in Figure A5 of Appendix A, indicates that approximately the lower half of the tower component of the proposed development will be in the direct sight-line of drivers and pedestrians at this location. Only a very thin view of the 013˚ aspect of the development is visible from this location, and for this aspect to reflect solar glare to Point 5 the sun would also be in direct view of drivers at this location, which would be considerably brighter than any glare reflected from this narrow view of the 013˚ aspect. Hence it is not necessary for the glazing on the 013˚ aspect of the development to have a maximum normal specular reflectivity less than 20 percent.

The 103˚ aspect of the development is in full view of drivers at this location, and the reflectance of the glazing to be used on the lower levels of the tower component of the development on this aspect should be minimised. However, it is noted that most of the glazing on the 103˚ aspect will be overshadowed by the various balconies and vertical blade walls on this aspect. Hence only the bedroom windows in the centre of this aspect are considered critical for potential adverse glare to Point 5. For those windows, the maximum normal specular reflectivity should be 8 percent or less. The remaining glazing on the 103˚ aspect of the development that will be overshadowed by the balconies and vertical blade walls should have a maximum normal specular reflectivity of 20 percent. This is shown in Figure 3 of this report.

If glass balustrades are to be used on the 103˚ aspect balconies, these will not benefit from any overshadowing effects and should also have a maximum normal specular reflectivity of 8 percent or less. This is also shown in Figure 3 of this report.

With these recommendations, it is not expected that the proposed development will cause any adverse solar glare to drivers and pedestrians facing west at this location.

2.1.6 Point 6

Point 6 is located to the south-east of the proposed development on Turner Street. This point represents a critical sightline of drivers heading west along Turner Street at this location. This point is located within the check zone for the 103˚ and 193˚ aspects of the proposed development.

The analysis of Point 6, shown in Figure A6 of Appendix A, indicates that the view of the proposed development will be blocked by the neighbouring buildings on the northern side of Turner Street. Hence there will be no adverse glare from the proposed development to drivers and pedestrians facing west along Turner Street at Point 6.

2.1.7 Point 7

Point 7 is located to the south-east of the proposed development on Turner Street, further away from the site than Point 6. This point represents a critical sightline of drivers facing west along Turner Street at this location. This point is located within the check zone for the 103˚ and 193˚ aspects of the proposed development.

The analysis of Point 7, shown in Figure A7 of Appendix A, indicates that only the upper levels of the tower component of the proposed development will be visible above the roofs of the townhouses along the northern side of Turner Street. This visible section of the proposed development will not be within the zone of sensitive vision for drivers or pedestrians heading west along Turner Street at Point 7. Hence there will be no adverse glare from the proposed development to this location.

2.1.8 Point 8

Point 8 is located to the south-east of the proposed development on Cope Street. This point represents a critical sightline of drivers heading north along Cope Street at this location. This point is located within the check zone for the 103˚ and 193˚ aspects of the proposed development.

The analysis of Point 8, shown in Figure A8 of Appendix A, indicates that the view of the proposed development will not be within the zone of sensitive vision. Hence there will be no adverse glare from the proposed development to drivers and pedestrians heading north along Cope Street at Point 8.

These glazed sections of the facade should have a maximum normal specular reflectivity of 8 percent

These glazed sections of the facade should have a maximum normal specular reflectivity of 20 percent

If glazed balustrades are to be used in these areas, the glazed sections of the balustrade should have a maximum normal specular reflectivity of 8 percent

If glazed balustrades are to be used in these areas, the glazed sections of the balustrade should have a maximum normal specular reflectivity of 20 percent

Figure 3: Recommended Reflectivity Properties of the Glazing for a Typical Level of the Residential Tower

2.2 Impact onto Occupants of Neighbouring Buildings

More research is required to properly assess what is considered an acceptable level of veiling luminance to occupants of surrounding buildings. Rofail and Dowdle (2004)[2] have highlighted the subjectivity of glare impact to occupants of surrounding buildings as it is highly affected by a number of factors, some of these are listed below:

- the intensity of glare
- duration of glare impact
- the type of use of the building
- the type of glazing used on the neighbouring building (eg. clear or tinted)
- shading elements on the façade of the neighbouring building
- level of tolerance by the occupant of the neighbouring building

Our past experience, involving approximately 200 projects, tends to indicate that buildings that tend to cause nuisance to 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. This reflectivity is defined as the level of luminance or normal specular reflectivity of visible light.

Hence, a general recommendation is made that all glazing used on the facades of the proposed development have a normal specular reflectivity of visible light of 20 percent or less to avoid adverse solar glare to occupants of neighbouring buildings.

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

3.0 Conclusion and Recommendations

A reflectivity analysis of the proposed development at 157 Redfern Street, Redfern, has been carried out using the technique published by Mr David N. H. Hassall. The analysis is based on the preliminary draft issue of the architectural drawings prepared by Nordon Jago Architects, dated May 26, 2009.

To avoid any adverse glare to drivers and pedestrians on the surrounding streets of the proposed development, and to comply with the reflectivity requirements of Section 4.5 of the City of Sydney October 2003 Development Control Plan, the following recommendations are made:

- All glazed surfaces of the eastern aspect of the residential tower component of the proposed development should have a maximum normal specular reflectivity of 8 percent or less, unless the glazed surface will be sufficiently shaded by the balconies and/or vertical blade walls.

- All other glazed surfaces on the external façade of the proposed development should have a maximum normal specular reflectivity of 20 percent.

With the above recommendations satisfied, the results of this analysis indicate that the proposed development will not cause adverse solar glare to drivers or pedestrians in any of the surrounding streets or other outdoor areas, or to the occupants of the surrounding buildings.

Appendix A

Analysis of Sight-Lines from the Various Study Locations

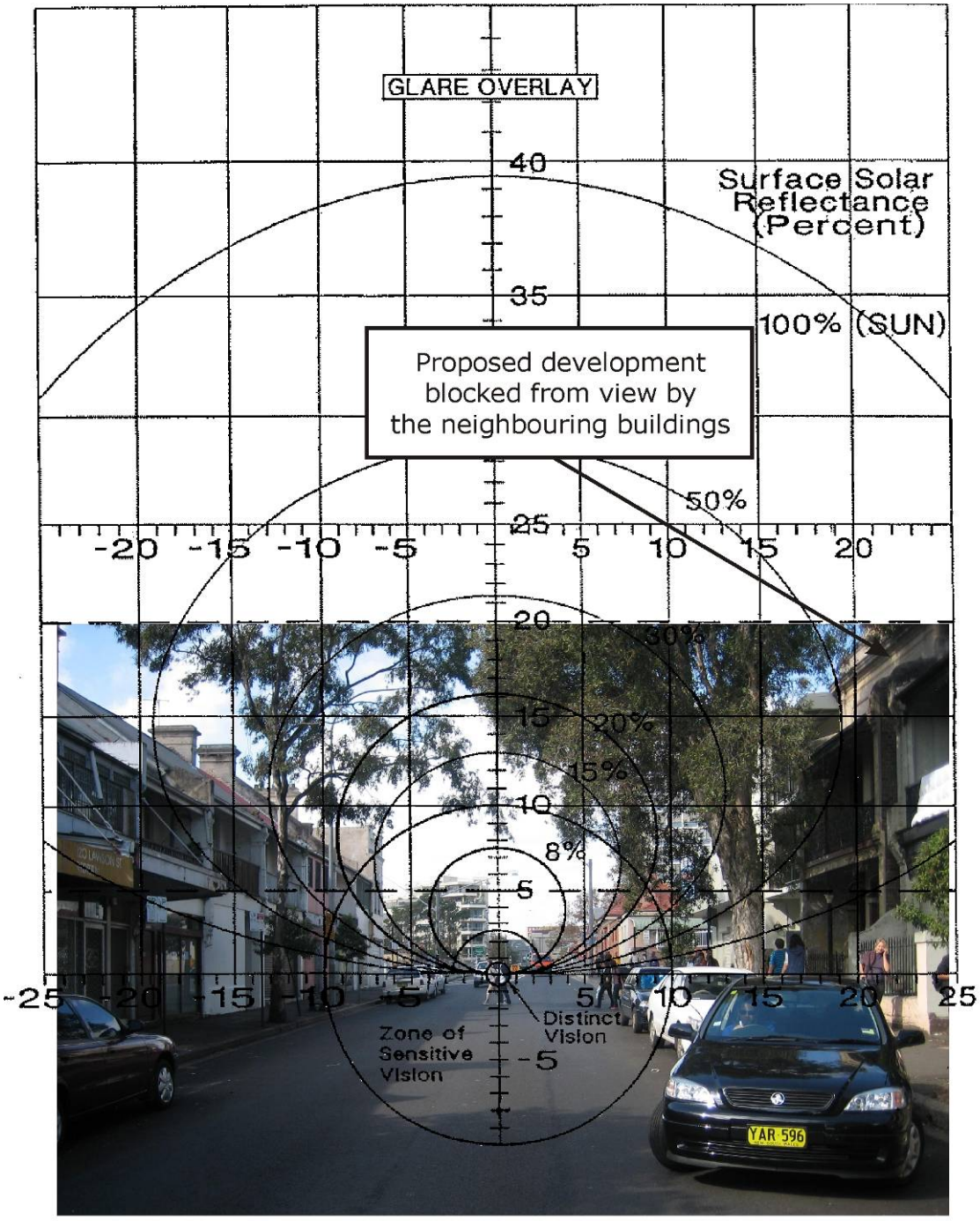

Figure A1: Glare Overlay for Point 1

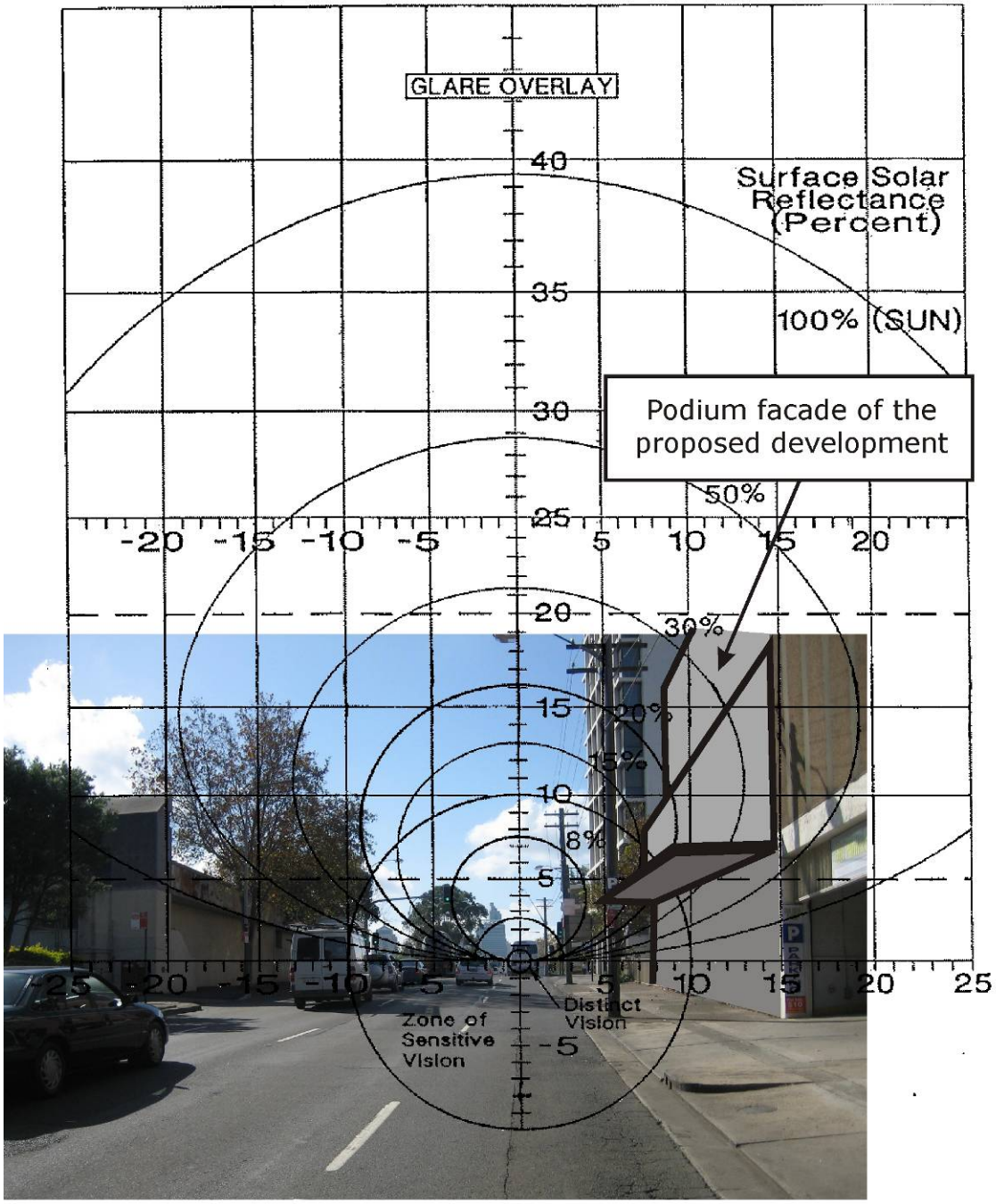

Figure A2: Glare Overlay for Point 2

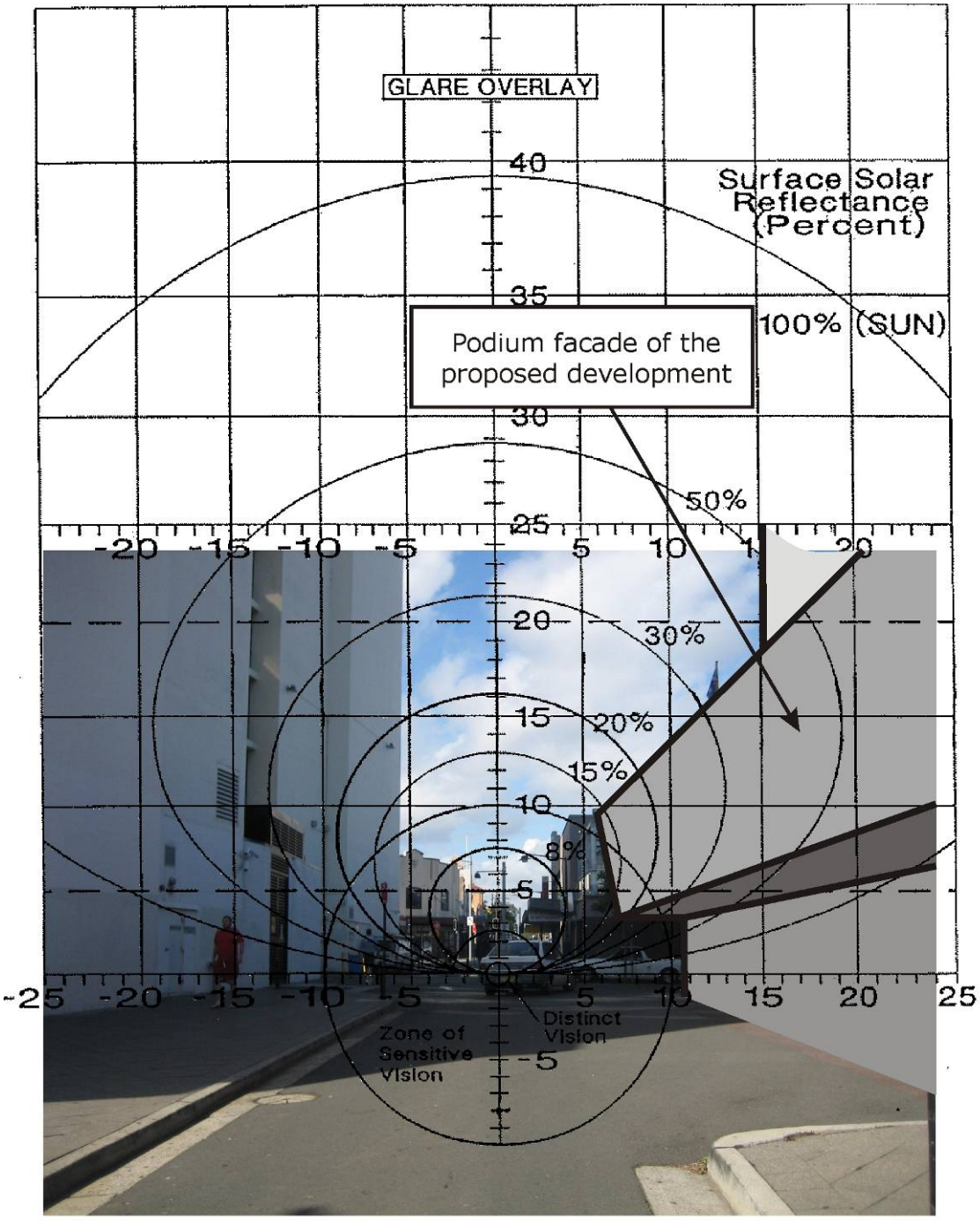

Figure A3: Glare Overlay for Point 3

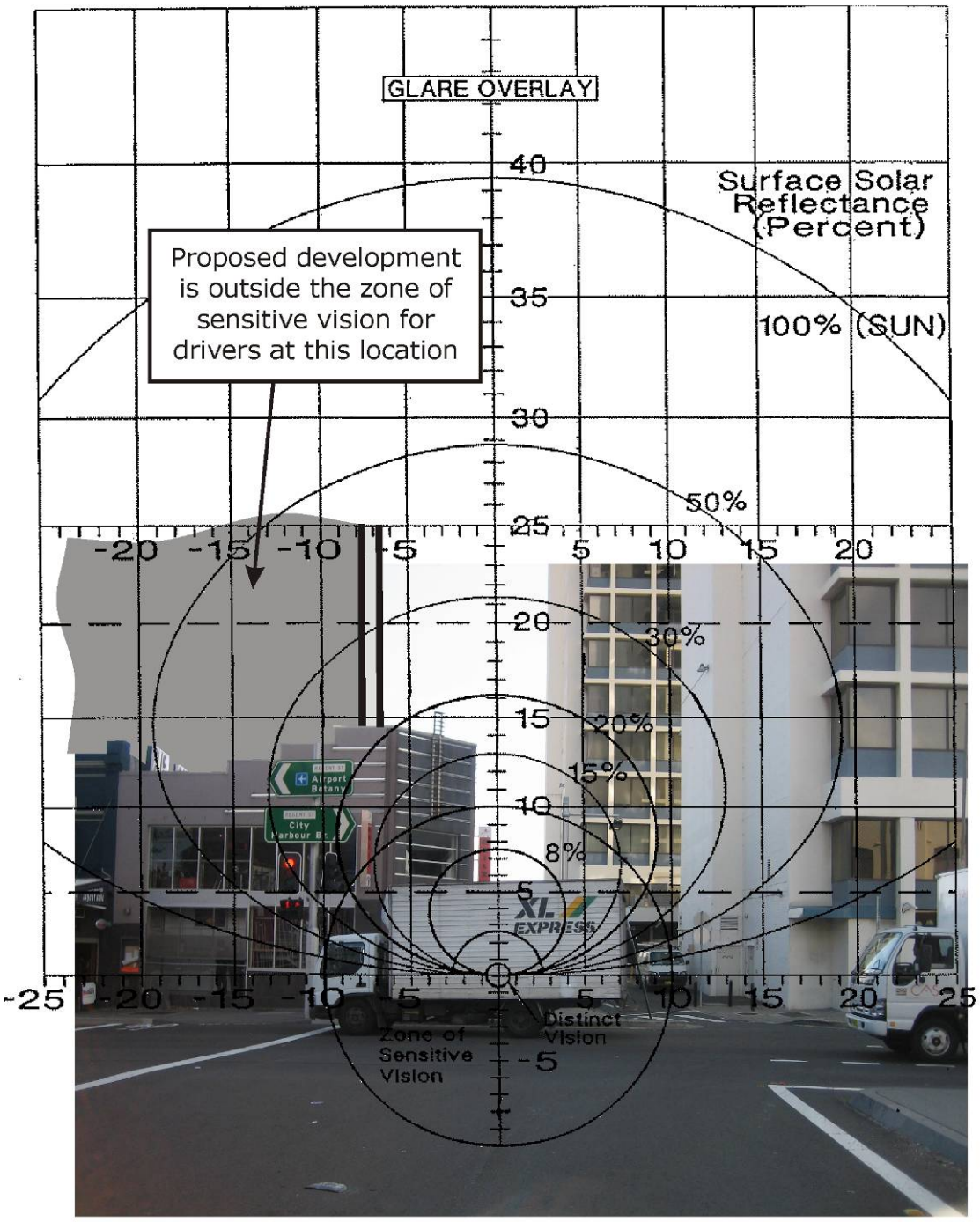

Figure A4: Glare Overlay for Point 4

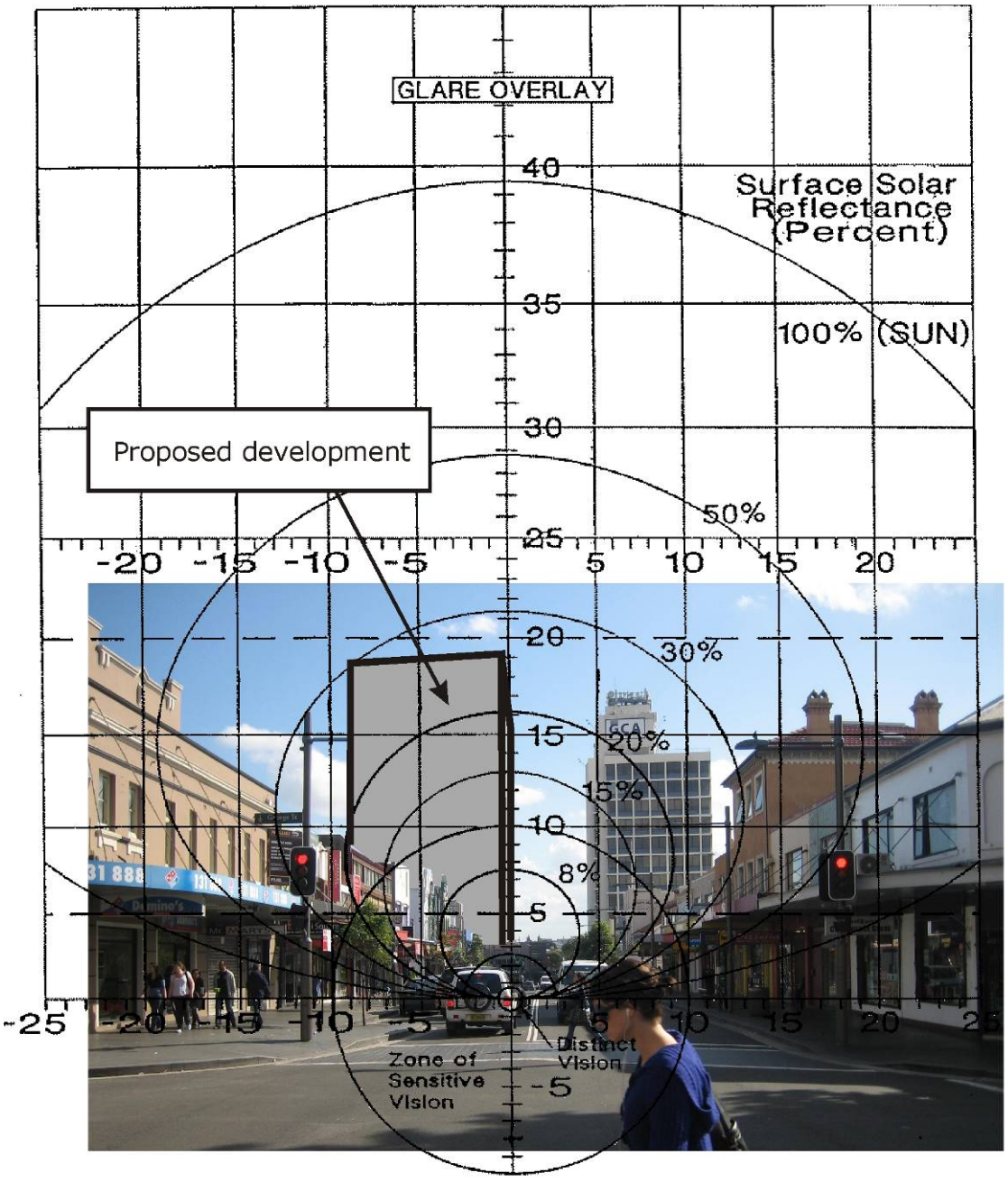

Figure A5: Glare Overlay for Point 5

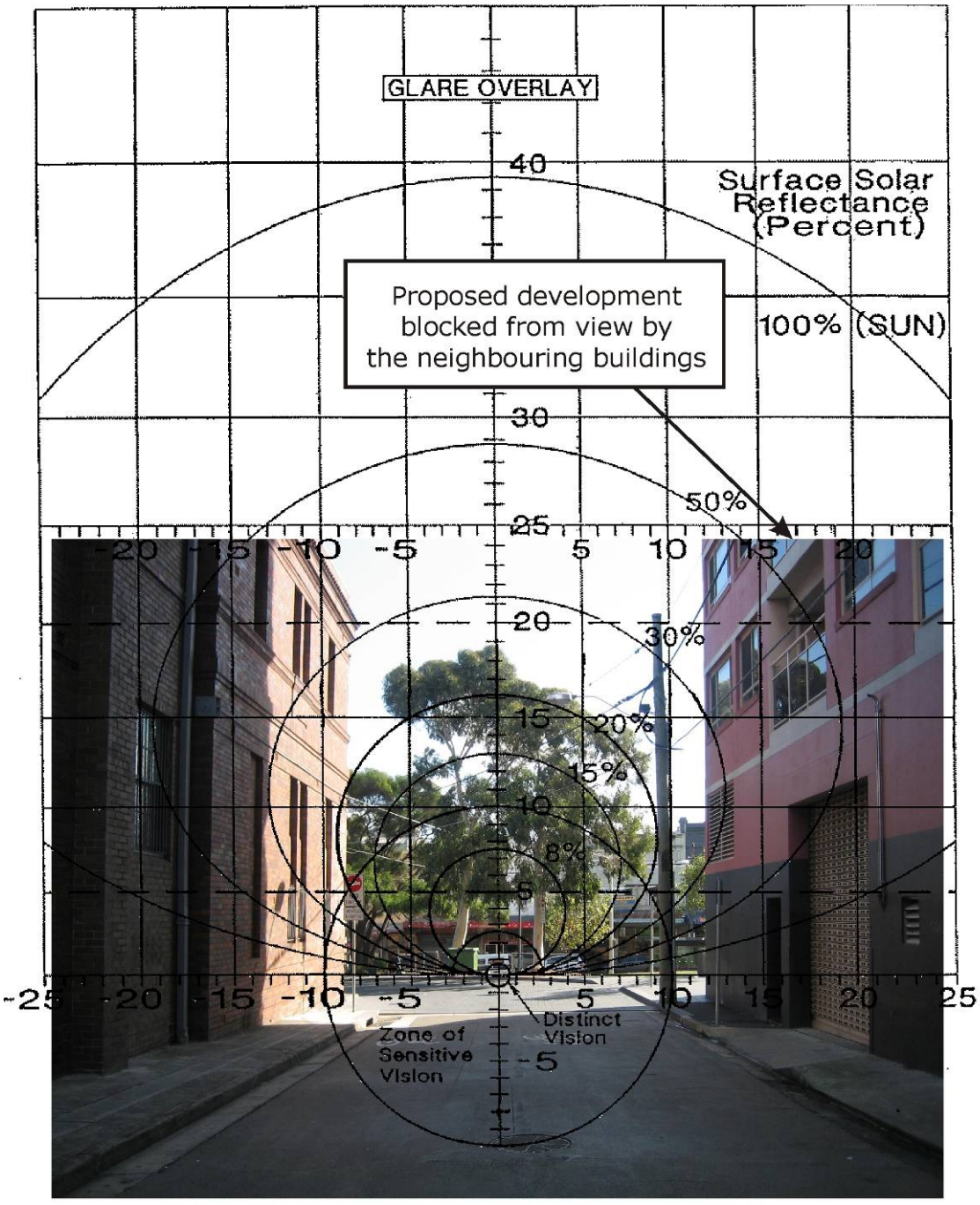

Figure A6: Glare Overlay for Point 6

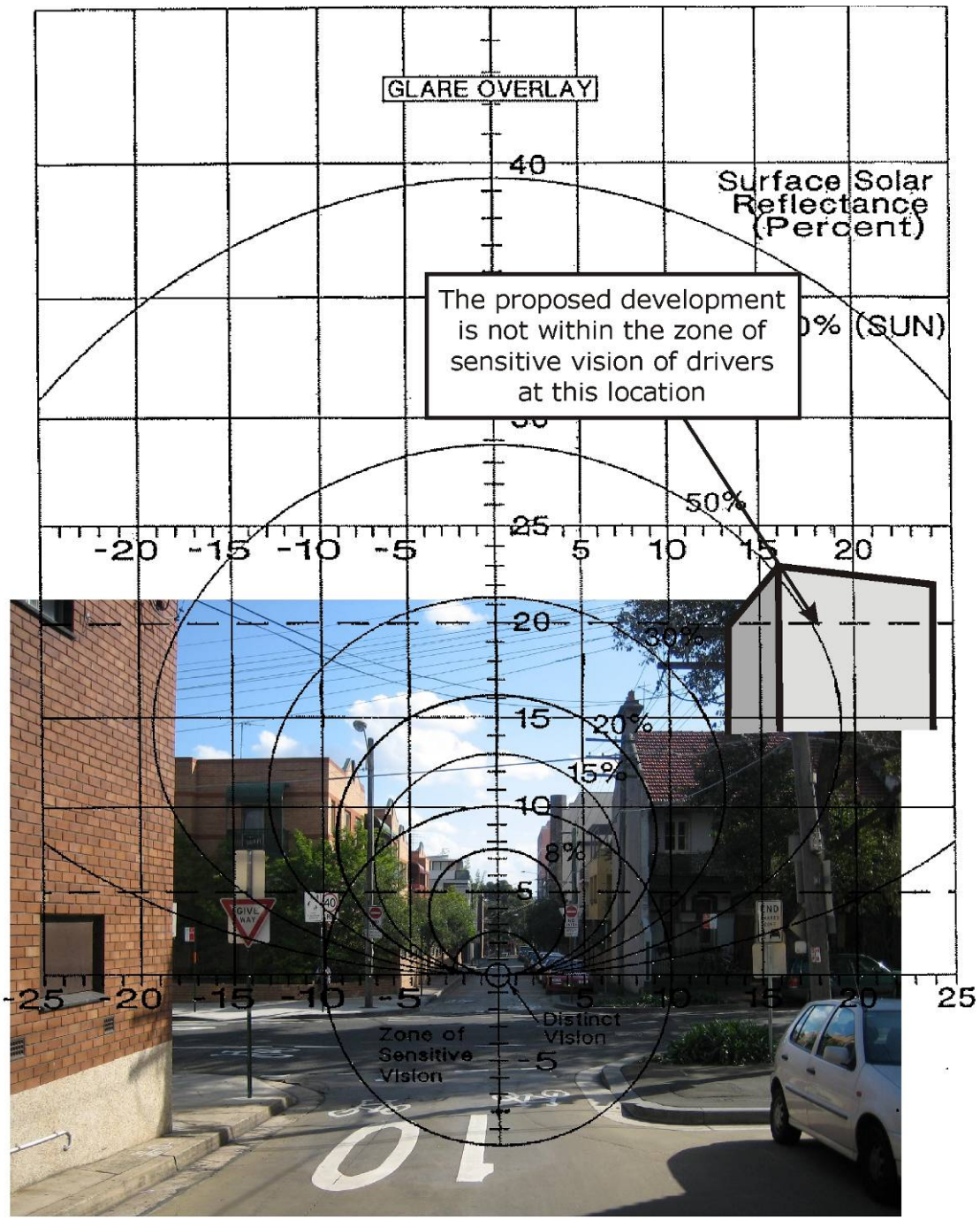

Figure A7: Glare Overlay for Point 7

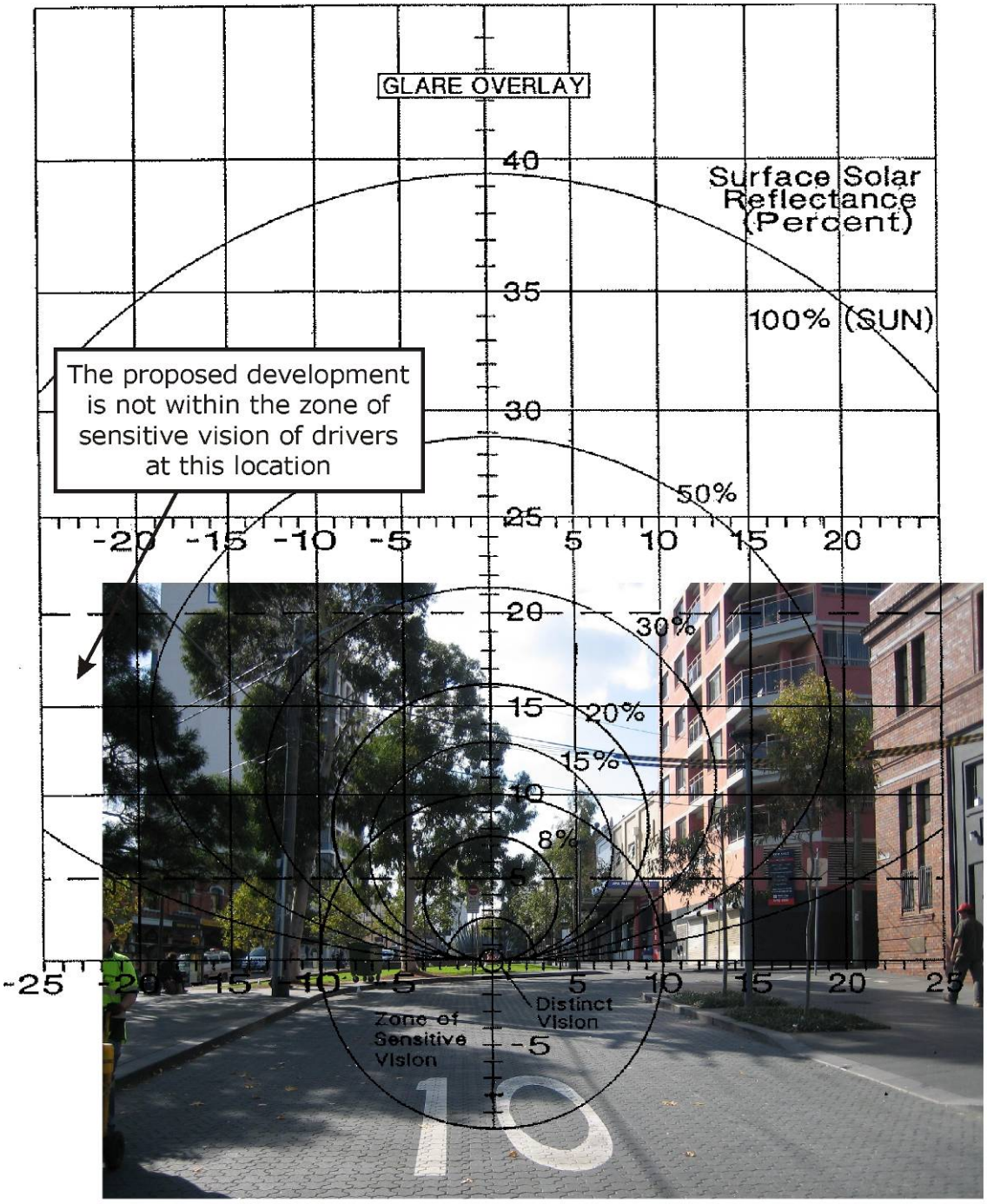

Figure A8: Glare Overlay for Point 8

Appendix B

Solar Charts for the Various Aspects of the Proposal

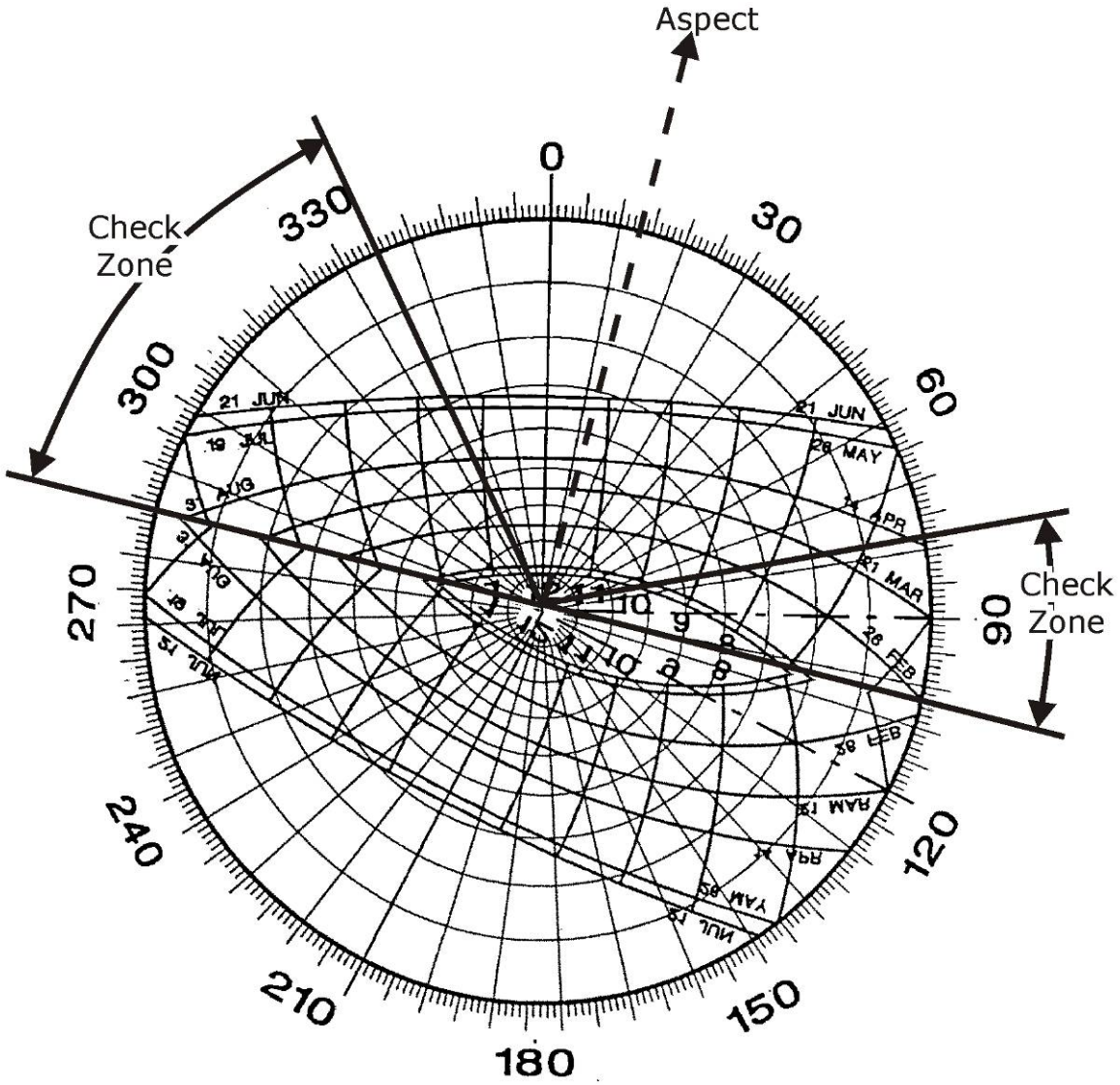

Figure B1: Sun Chart for Aspect 013°

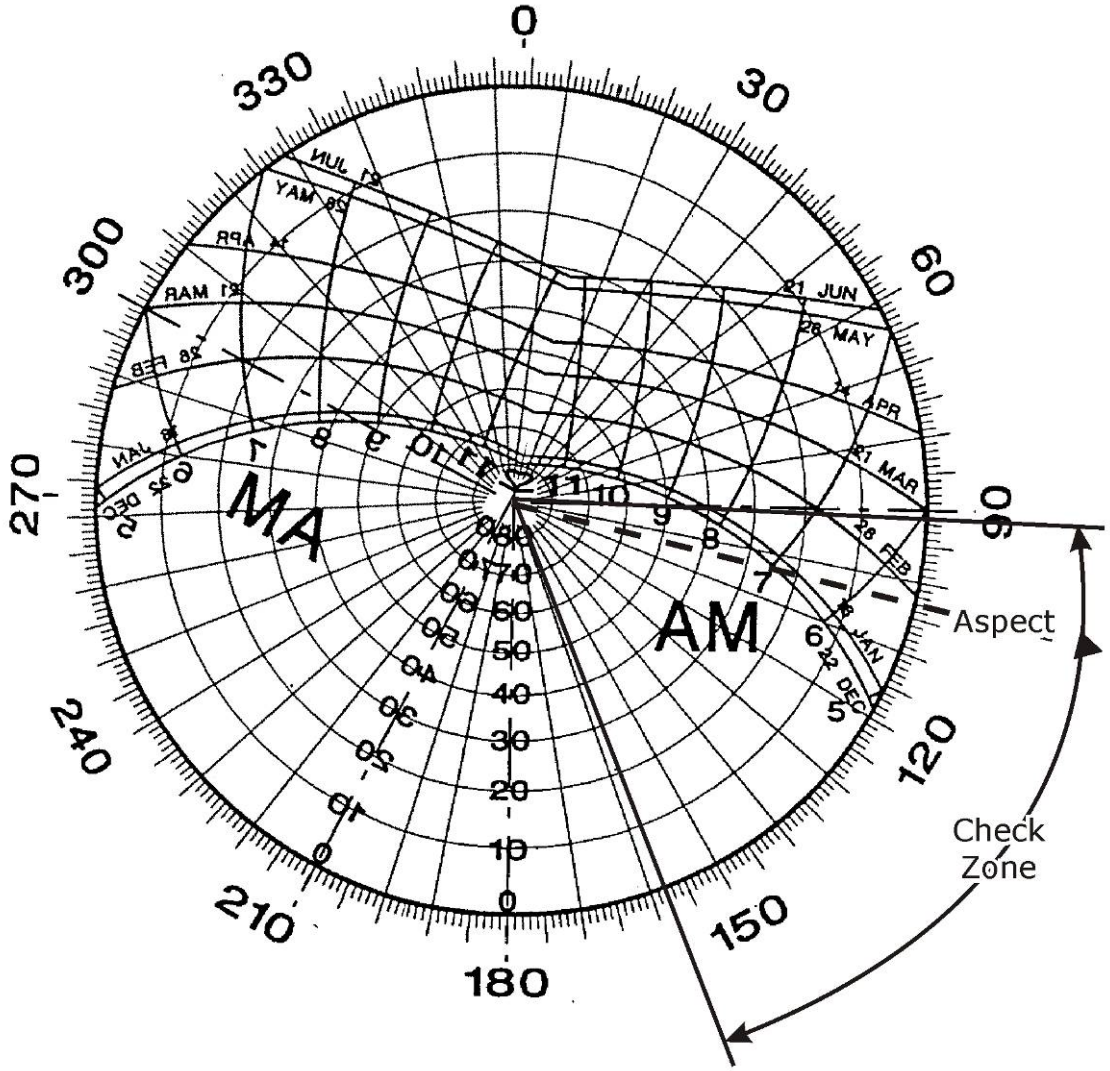

Figure B2: Sun Chart for Aspect 103°

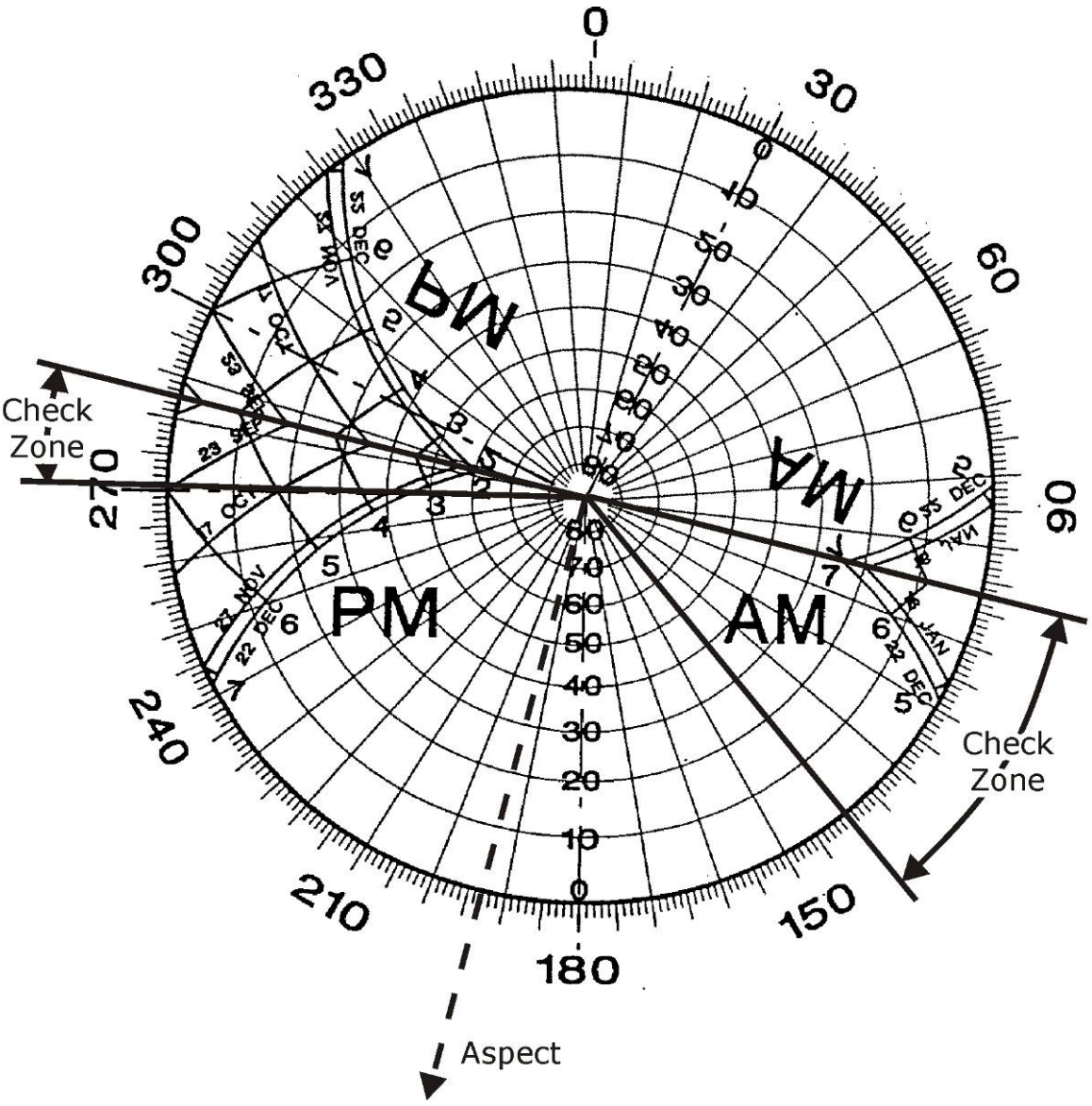

Figure B3: Sun Chart for Aspect 193°

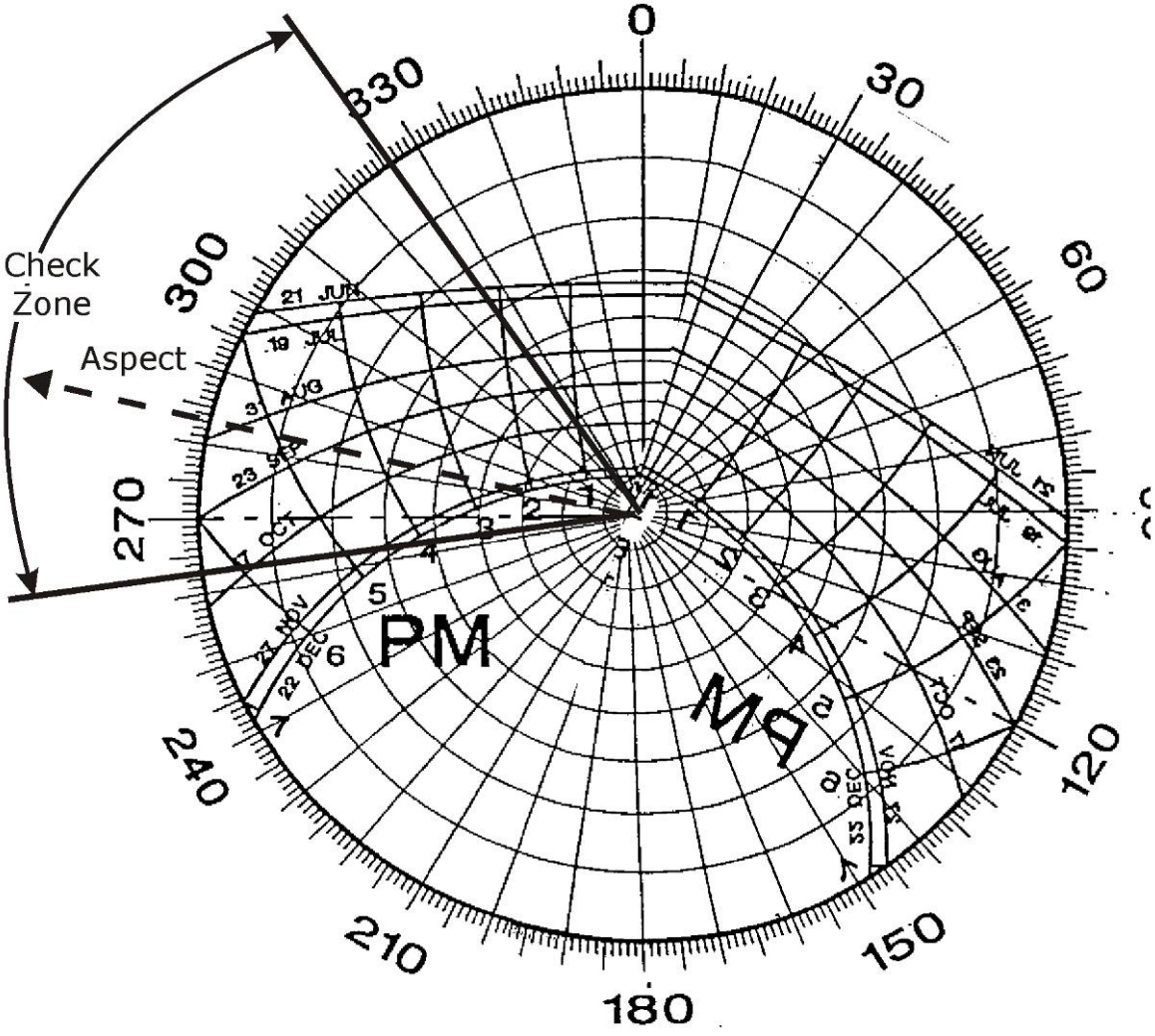

Figure B4: Sun Chart for Aspect 283°

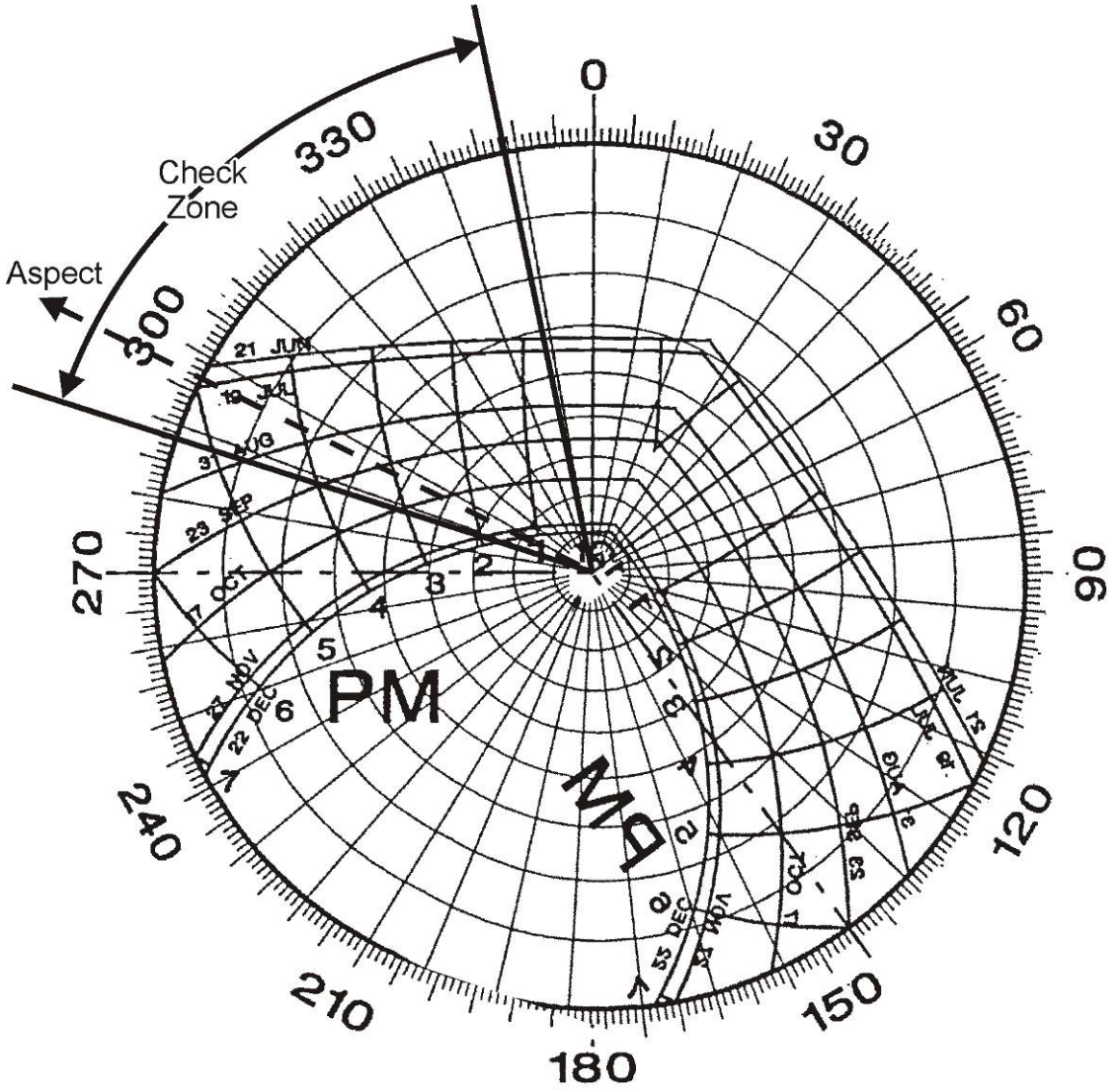

Figure B5: Sun Chart for Aspect 297°