SOLAR LIGHT REFLECTIVITY STUDY

ROYAL HALL OF INDUSTRIES, MOORE PARK

WE596-01F02(REV1)- SR REPORT

MAY 15, 2019

Prepared for:

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DOCUMENT CONTROL

Date	Revision History	Issued Revision	Prepared By (initials)	Instructed By (initials)	Reviewed & Authorised by (initials)
May 8, 2019	Initial.	0	TH	SWR	TH
May 15, 2019	Updated with comments.	1	TH	SWR	TH

EXECUTIVE SUMMARY

This report presents the results of a detailed study for the effect of potential solar glare from the proposed adaptive reuse of the Royal Hall of Industries, located at 1 Driver Avenue, Moore Park. 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 City of Sydney Development Control Plan 2012.

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:

- The maximum normal specular reflectance of visible light on the façade and windows on all levels of the western 265^{o} aspect of the Royal Hall of Industries building development is to be 11%.
- The maximum normal specular reflectance of visible light on the façade and windows on all levels of the eastern 85^{o} aspect of the proposed Swifts building development is to be 11%.
- All other glazing (windows and balustrades) on the Royal Hall of Industries and proposed Swifts Buildings 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.

The composite metal panel roof sheeting of the proposed Swifts building will be a colorbond finish. As mentioned above, painted metallic surfaces have a low maximum normal specular reflectance value and thus adverse glare is not expected to be observed from the roof of the proposed Swifts building.

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 the City of Sydney Development Control Plan 2012.

CONTENTS

1 INTRODUCTION

This solar light reflectivity report has been prepared on behalf of the Sydney Swans Limited in support of a State Significant Development (SSD) application for the proposed adaptive reuse of the Royal Hall of Industries for a high-performance sport and community facility. The facility will enable a range of land uses, including a new home for the Sydney Swans and NSW Swifts. It will accommodate a multi-purpose facility available for community uses, sporting, medical and rehabilitation areas, administration and office spaces and associated plant and store rooms.

2 SITE

The site is located at 1 Driver Avenue, Moore Park and comprises a portion of two separate lots, legally described as Lot 3, DP861843 and Lot 52 of DP1041134. The site is owned by the Centennial Park and Moore Park Trust and is leased to the Sydney Swans for the purposes of the development.

The proposed application will relate to the Royal Hall of Industries (RHI) building, and the associated courtyard area to the immediate south of the building. The development area is located in the south-western corner of the Entertainment Quarter precinct and has a direct frontage to Driver Avenue to the west, Lang Road to the south and Errol Flynn Boulevard to the east, an access road within the Entertainment Quarter precinct.

The RHI has in recent times been utilised as an exhibition space. The building has a rectilinear plan form with symmetrically placed entrances on all four sides, four to the east and west, and two to each of the north and south facades. The building has a gross floor area of approximately 5,700sqm at ground level with basement toilets at the southern end of the building.

The courtyard to the south of the building currently accommodates loading and general plant services associated with the RHI building and storage sheds. The building and courtyard area is surrounded by a 6.95m high brick wall. The total area of the subject site extends to approximately 1.9ha and is illustrated at Figure 1 below.

Figure 1 – Site Location

3 REGIONAL CONTEXT

The site is located within the southwestern corner of the Moore Park Showground Precinct, a major recreational area in the eastern suburbs of Sydney. Measuring approximately 28.7 hectares in area, the precinct includes a range of passive and active recreational areas with a focus on cultural, entertainment, and sporting uses. Key land uses include the Entertainment Quarter, Centennial Parklands Equestrian Centre and Fox Studios.

The location of the site is strategically significant due to its proximity to a number of key land uses within Sydney, including:

- Royal Randwick Racecourse – 1.8km
- UNSW and Prince of Wales Hospital – 3.7km
- Sydney CBD – 4.5km
- Sydney Airport – 11.9km

4 LOCAL CONTEXT

The site is located in the City of Sydney Local Government Area (LGA). The predominant character of the area is associated with entertainment, leisure and recreational land uses, with infrastructure changes associated with the CSELR (CBD and South East Light Rail) construction.

The site has a direct frontage to Driver Avenue to the west, Lang Road to the south and Errol Flynn Boulevard to the east, an internal access road within the Entertainment Quarter precinct. Mature fig trees are located along Lang Road, Driver Avenue and Anzac Parade.

The land uses in the immediate surrounding area comprise the following:

- The Hordern Pavilion is located to the immediate north of the site, which operates as a live music and entertainment venue with an associated pedestrianised forecourt area.
- The Entertainment Quarter, to the immediate east of the site, is an entertainment, dining and leisure precinct with cinemas, restaurants, bars and an outdoor sporting, performance and event space. A 2,000-space car park is also provided.
- To the immediate south of the site is the Centennial Parklands Sports Centre, comprising netball and tennis courts with a large area of open space.
- The SCG and Allianz Stadium is located further north of the site. Allianz Stadium is currently undergoing demolition associated with the construction of a new sports stadium on the site, expected to be completed by mid-2022.
- Moore Park is located on the west and east of Anzac Parade, and Centennial Park and Queens Park are located to the south-east of the site. Collectively known as the Centennial Parklands, the parks measure 360ha in area.

5 OVERVIEW OF PROPOSED DEVELOPMENT

This application seeks approval for the proposed adaptive reuse of the Royal Hall of Industries (RHI) for a high-performance sport and community facility. The development will maintain the structural integrity and façade of the RHI, whilst re-purposing the interior of the building to support a number of compatible uses and utilise the space effectively.

In addition to the repurposing of the RHI, an extension of the building will be constructed to the south of the building in the current service and courtyard area. The built form of the extension is consistent in height, scale and material with the RHI and will be largely concealed behind the existing courtyard wall.

The facility will include:

- Home of the Sydney Swans;
- Home of the NSW Swifts;
- Multi-purpose indoor facility available for community use and public events such as junior club nights, school graduations, functions
- An indoor netball court for the NSW Swifts Netball Team and netball community
- Facilities for a Swans team in the AFL National women's competition
- Player change areas, lockers and wet areas;
- Wet recovery – pool and hot/cold hydrotherapy;
- Go Foundation and Clontarf Foundation for indigenous education;
- Australian Red Cross Blood Service Donation Centre;
- Medical, rehabilitation and sport science areas;
- Gymnasium, museum, media centre and auditorium
- Back of house offices and café/canteen;
- Entry foyer and retail/shop units;
- Plant and store rooms; and
- Sydney Swans Academy.

6 GLARE OBSERVED BY MOTORISTS

6.1 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 2. 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 3. 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 3 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 6.2 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 ±10° of the direct sight-line). These are shown in Figure 3, and summarised in Table 1. Photographs have been taken from the viewpoint of motorists at each study point location using a calibrated camera. A scaled glare protractor has been superimposed over each viewpoint image.

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^2. 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^2, 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.

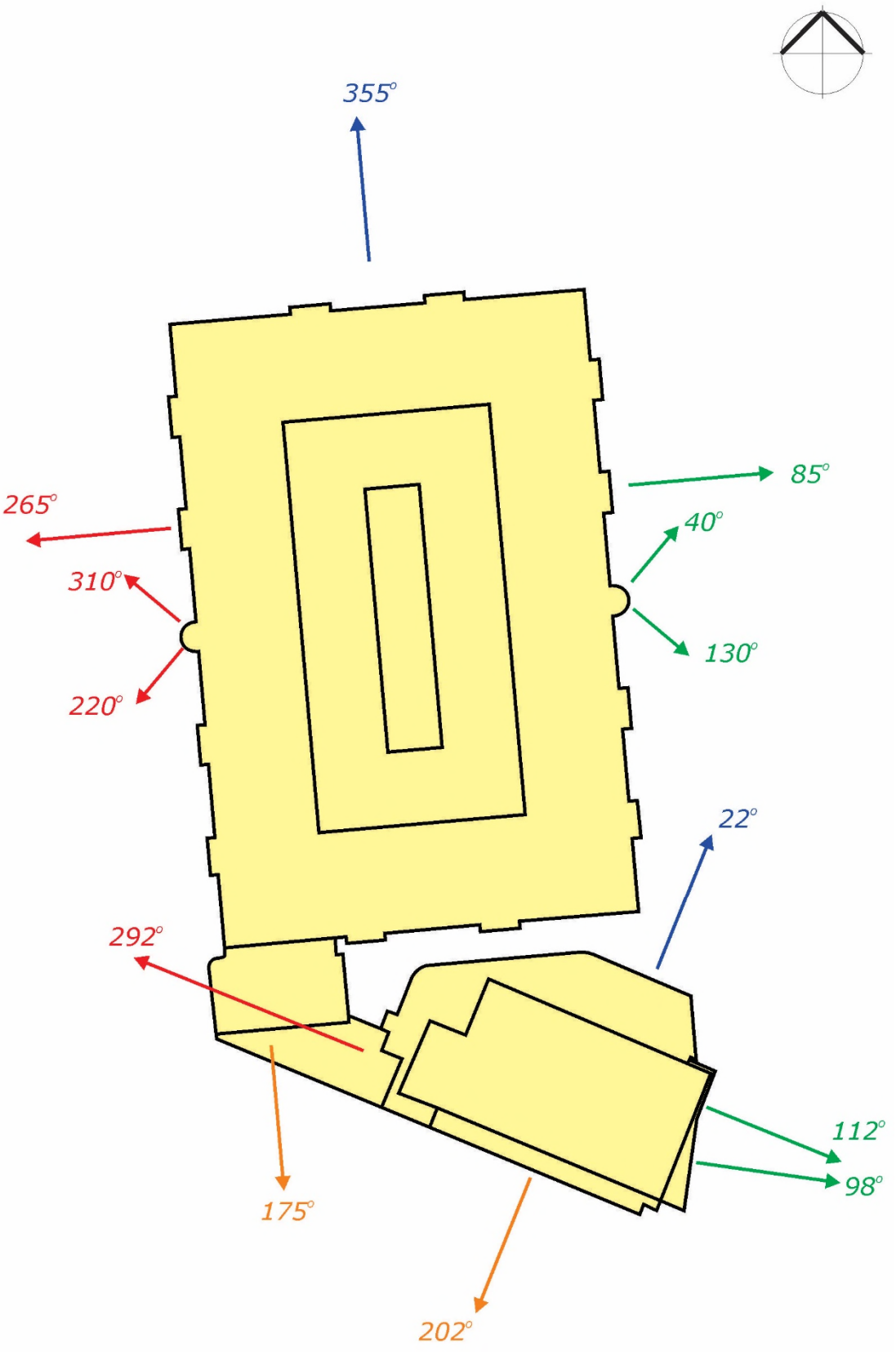

Figure 2: Critical Glazed Aspects of the Development

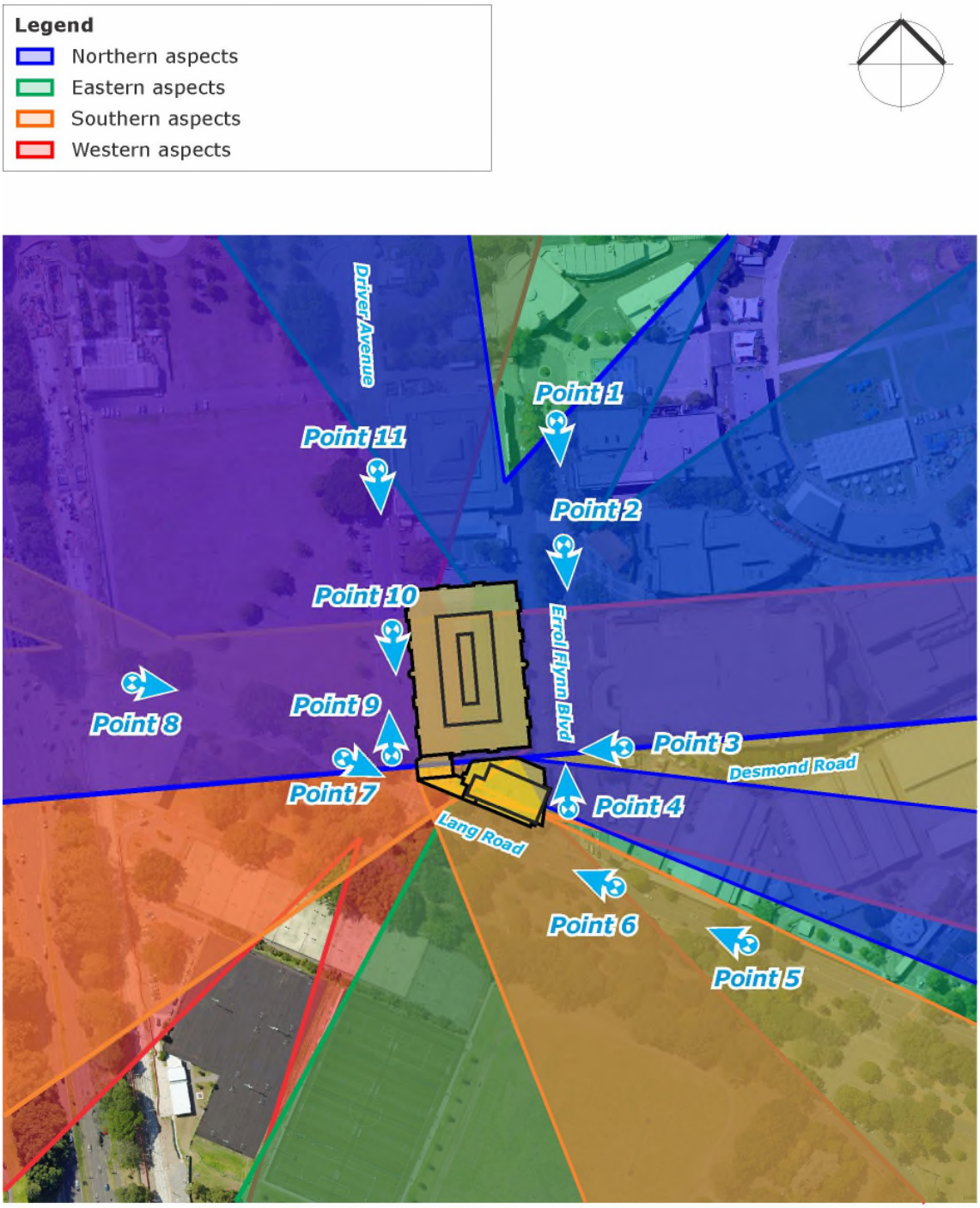

Figure 3: Check Zones and Study Point Locations
(the check zones are the areas where glare could potentially be observed)

Table 1: 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
01	Errol Flynn Drive, heading south.	Northern and eastern aspects.
02	Errol Flynn Drive, heading south.	Northern and eastern aspects.
03	Desmond Road, heading west.	Northern, eastern and southern aspects.
04	Errol Flynn Drive, heading south.	Northern, eastern and southern aspects.
05	Lang Road, heading west.	Eastern and southern aspects.
06	Lang Road, heading west.	Eastern, southern and western aspects.
07	Lang Road, heading east.	Northern, southern and western aspects.
08	Lang Road, heading east.	Northern, southern and western aspects.
09	Driver Avenue, heading north.	Northern, southern and western aspects.
10	Driver Avenue, heading south.	Northern, southern and western aspects.
11	Driver Avenue, heading south.	Northern and western aspects.

6.2 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.

6.2.1 Motorists heading south along Errol Flynn Drive

Points 01 and 02 are located along Errol Flynn Drive, to the east and north-east of the development site. These points represent the critical sightline of motorists heading south along Errol Flynn Drive at these locations. Calibrated images of the viewpoint of motorists at these locations has been overlaid with a scaled glare meter, as shown in Appendix A.

An analysis of the glare meter overlaid onto the viewpoint image at Point 01 indicates that the view of the proposed RHI developments will not be visible from this location due to the obstruction from the local densely foliating vegetation. Hence there will be no adverse solar glare observed by motorists heading south along Errol Flynn Drive at this location.

An analysis of the glare meter overlaid onto the viewpoint image at Point 02 indicates that parts of the northern and eastern aspects of the proposed Swifts development are visible and within the zone of sensitive vision. However, further analysis indicates that these study points are not located within the check zones for the portions of the aspects which are visible within the zone of sensitive vision. Hence there will be no adverse solar glare observed by motorists heading south along Errol Flynn Drive at this location.

6.2.2 Motorists heading west along Desmond Road

Point 03 is located along Desmond Road, to the east of the development site. This point represents the critical sightline of motorists heading west along Desmond Road at this location. Calibrated images of the viewpoint of motorists at these locations has been overlaid with a scaled glare meter, as shown in Appendix A.

An analysis of the glare meter overlaid onto the viewpoint image at Point 03 indicates that parts of the northern and eastern aspects of the proposed Swifts development will be visible and within the zone of sensitive vision. A further analysis indicates that Point 03 lies outside the check zone for the portions of the northern 22° aspect of the development inside the zone of sensitive vision. It is however within the check zone of the eastern 85° aspect of the development hence there is potential for solar glare to be observed. Further analysis indicates that this will occur during the early morning period. To mitigate adverse glare being observed from the development at Point 03, it is recommended that the glazing used on the eastern 85° aspect of the proposed Swifts development to have a maximum normal specular reflectance of visible light of 11%.

6.2.3 Motorists heading north along Errol Flynn Drive

Point 04 is located along Errol Flynn Drive, to the east of the development site. This point represents the critical sightline of motorists heading north along Errol Flynn Drive at this

location. Calibrated images of the viewpoint of motorists at these locations has been overlaid with a scaled glare meter, as shown in Appendix A.

An analysis of the glare meter overlaid onto the viewpoint image at Point 04 indicates that the view of the proposed RHI developments will not be visible within the zone of sensitive vision from this location. Hence there will be no adverse solar glare observed by motorists heading north along Errol Flynn Drive at this location.

6.2.4 Motorists heading west along Lang Road

Points 05 and 06 are located along Lang Road, to the south-east of the development site. These points represent the critical sightline of motorists heading west along Lang Road at these locations. Calibrated images of the viewpoint of motorists at these locations has been overlaid with a scaled glare meter, as shown in Appendix A.

An analysis of the glare meter overlaid onto the viewpoint image at Point 05 indicates that parts of the eastern aspect of the proposed Swifts development will be visible and within the zone of sensitive vision. Point 05 is within the check zone of the eastern 98° and 112° aspects of the development and hence there is potential for solar glare to be observed. Further analysis indicates that this will occur during the early morning period. However, the visible portion of the façade will be overshadowed by the neighbouring buildings at the times when solar glare could have otherwise been observed. Hence there will be no adverse solar glare observed by motorists heading west along Lang Road at this location.

An analysis of the glare meter overlaid onto the viewpoint image at Point 06 indicates that only the existing brick wall of the proposed Swifts development will be visible and within the zone of sensitive vision. Reflected solar glare from brickwork is negligible (ie: less than 1% normal specular reflectance) and hence will not cause any adverse solar glare effects for motorists heading west along Lang Road at this location.

6.2.5 Motorists heading east along Lang Road

Points 07 and 08 are located along Lang Road, to the west of the development site. These points represent the critical sightline of motorists heading east along Lang Road at these locations. Calibrated images of the viewpoint of motorists at these locations has been overlaid with a scaled glare meter, as shown in Appendix A.

An analysis of the glare meter overlaid onto the viewpoint at Point 07 indicates that portions of the southern and western aspects of the proposed Swifts development will be visible and within the zone of sensitive vision. Point 07 is within the check zone of the southern 202° and western 292° aspects of the development and hence there is potential for solar glare to be observed. Further analysis of the visible southern aspect will be overshadowed by the large densely foliating trees along Lang Road when solar glare could have been observed (early morning period). Similarly, the visible western aspect will be overshadowed by the large densely foliating trees along Lang Road and the existing RHI building to the north of the proposed Swifts

development. Hence there will be no adverse solar glare observed by motorists heading east along Lang Road at this location.

An analysis of the glare meter overlaid onto the viewpoint at Point 08 indicates that portions of the southern and western aspects of the proposed Swifts development, and the western aspect of the RHI development will be visible and within the zone of sensitive vision. Point 08 is within the check zone of the southern 202° and western 292° aspects of the proposed Swifts development and western 265° aspect of the RHI development. Hence solar glare could potentially be observed from these aspects at this location. As mentioned above for Point 07, there will be no adverse solar glare observed by motorists from the southern 202° and western 292° aspects of the proposed Swifts development due to the overshadowing of the surrounding large densely foliating trees along Lang Road and from the RHI Building. The western 265° aspect of the RHI development, however does not benefit from the overshadowing of the neighbouring buildings nor from the smaller densely foliating trees along Driver Avenue. Hence, it is recommended that the glazing used on the western 265° aspect of the RHI development to have a maximum normal specular reflectance of visible light of 11% to mitigate the adverse glare observed from this aspect onto motorists heading east along Lang Road at this location.

6.2.6 Motorists heading north along Driver Avenue

Point 09 is located along Driver Avenue, to the west of the development site. This point represents the critical sightline of motorists heading north along Driver Avenue at this location. Calibrated images of the viewpoint of motorists at these locations has been overlaid with a scaled glare meter, as shown in Appendix A.

An analysis of the glare meter overlaid onto the viewpoint at Point 09 indicates that portions of the western aspect of the RHI development will be visible and within the zone of sensitive vision. Point 09 is within the check zone of the western 265° aspect of the RHI development and hence there is potential for solar glare to be observed. Further analysis indicates the majority of the visible façade is brickwork which has a negligible normal specular reflectance value of approximately 1%. The visible glazing within the zone of sensitive vision will have an angular width of less than 0.5deg arc and hence the intensity of glare observed from that small area of glazing will be less than 500cd/m^2 (providing that the maximum normal specular reflectance of visible light of the glazing is 20%).

6.2.7 Motorists heading south along Driver Avenue

Points 10 and 11 are located along Driver Avenue, to the west and north-west of the development site. These points represent the critical sightline of motorists heading south along Driver Avenue at these locations. Calibrated images of the viewpoint of motorists at these locations has been overlaid with a scaled glare meter, as shown in Appendix A.

An analysis of the glare meter overlaid onto the viewpoint image at Point 10 indicates that only the existing brick wall of the proposed Swifts development will be visible and within the zone of sensitive vision. Reflected solar glare from brickwork is negligible (ie: less than 1% normal

specular reflectance) and hence will not cause any adverse solar glare effects for motorists heading south along Driver Avenue at this location.

An analysis of the glare meter overlaid onto the viewpoint at Point 11 indicates that portions of the western aspect of the RHI development, and the existing brick wall of the proposed Swifts development will be visible and within the zone of sensitive vision. Point 11 lies outside the check zone for western aspects of the RHI developments. Hence there will be no adverse solar glare observed by motorists heading south along Driver Avenue at this location.

7 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.

8 TYPICAL NORMAL SPECULAR REFLECTANCE OF BUILDING SURFACES

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.

8.1 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:

- 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%

8.2 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.

The composite metal panel roof sheeting of the proposed Royal Hall of Industries (RHI) Swifts building will be a colorbond finish. As mentioned above, painted metallic surfaces have a low maximum normal specular reflectance value and thus adverse glare is not expected to be observed from the roof of the proposed Swifts building.

Powder-coated or painted metallic surfaces typically have a maximum normal specular reflectance of visible light in the range of 1% to 5%. Similarly, anodised metallic surfaces also typically have a maximum normal specular reflectance of visible light of up to 5%, although many finishes are available in the case of anodised metallic surfaces and some of these may have a higher reflectance value than 5%. Metallic surfaces that tend to be smoother, or polished, can potentially have reflectance values in excess of 20%. It is important to check the maximum normal specular reflectance of visible light data for the chosen material before specifying.

9 CONCLUSION

A detailed study has been undertaken for the effect of potential solar glare from the proposed adaptive reuse of the Royal Hall of Industries, located at 1 Driver Avenue, Moore Park. 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 City of Sydney Development Control Plan 2012.

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:

- The maximum normal specular reflectance of visible light on the façade and windows on all levels of the western 265^{o} aspect of the Royal Hall of Industries building development is to be 11%.
- The maximum normal specular reflectance of visible light on the façade and windows on all levels of the eastern 85^{o} aspect of the proposed Swifts building development is to be 11%.
- All other glazing (windows and balustrades) on the Royal Hall of Industries and proposed Swifts Buildings 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.

The composite metal panel roof sheeting of the proposed Swifts building will be a colorbond finish. As mentioned above, painted metallic surfaces have a low maximum normal specular reflectance value and thus adverse glare is not expected to be observed from the roof of the proposed Swifts building.

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 the City of Sydney Development Control Plan 2012.

10 REFERENCES

City of Sydney Council, 2012 "City of Sydney Development Control Plan 2012".

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.

APPENDIX A GLARE OVERLAYS FOR THE CRITICAL SIGHT-LINES

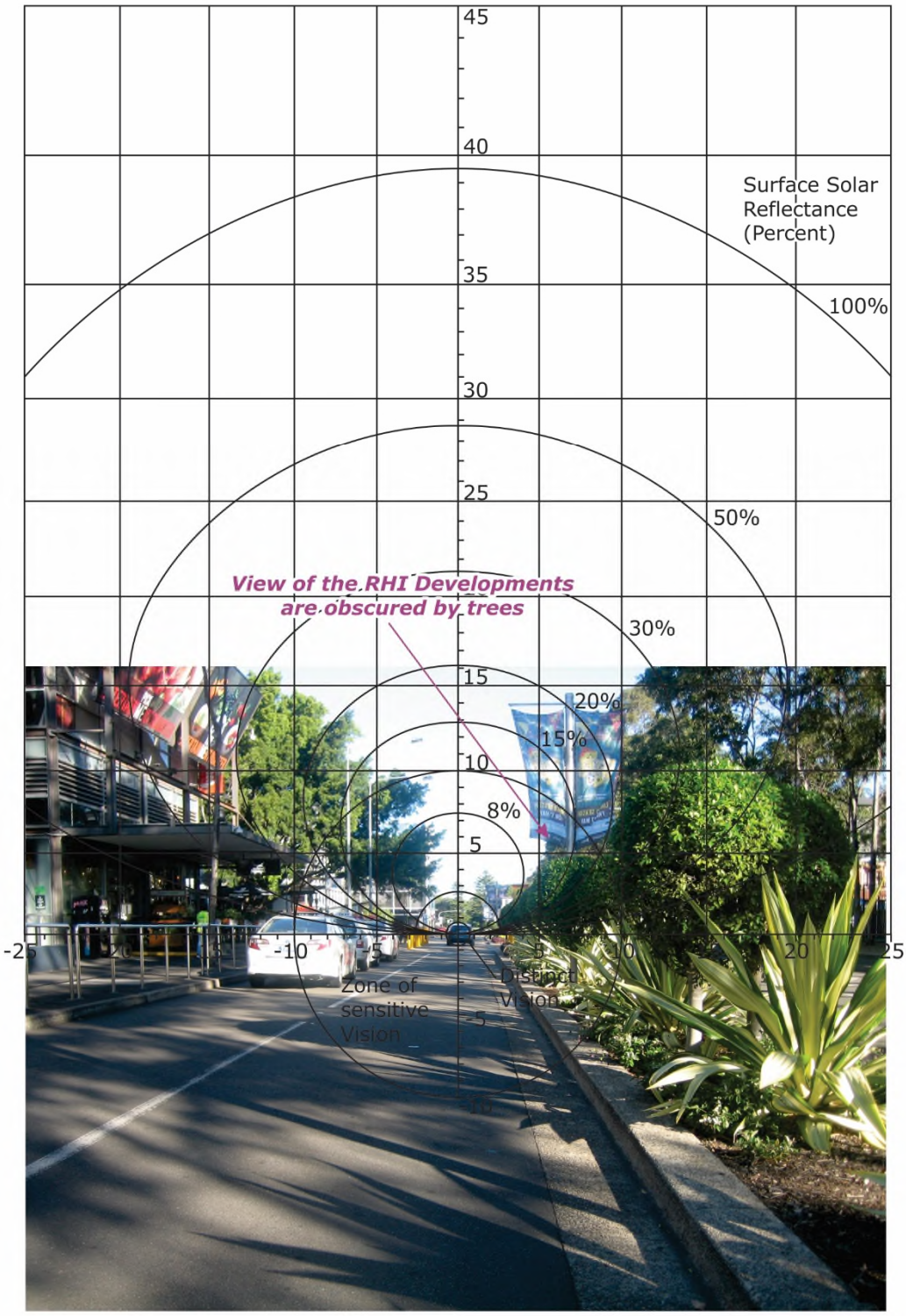

Figure A.1: Glare Overlay of the Viewpoint at Point 01

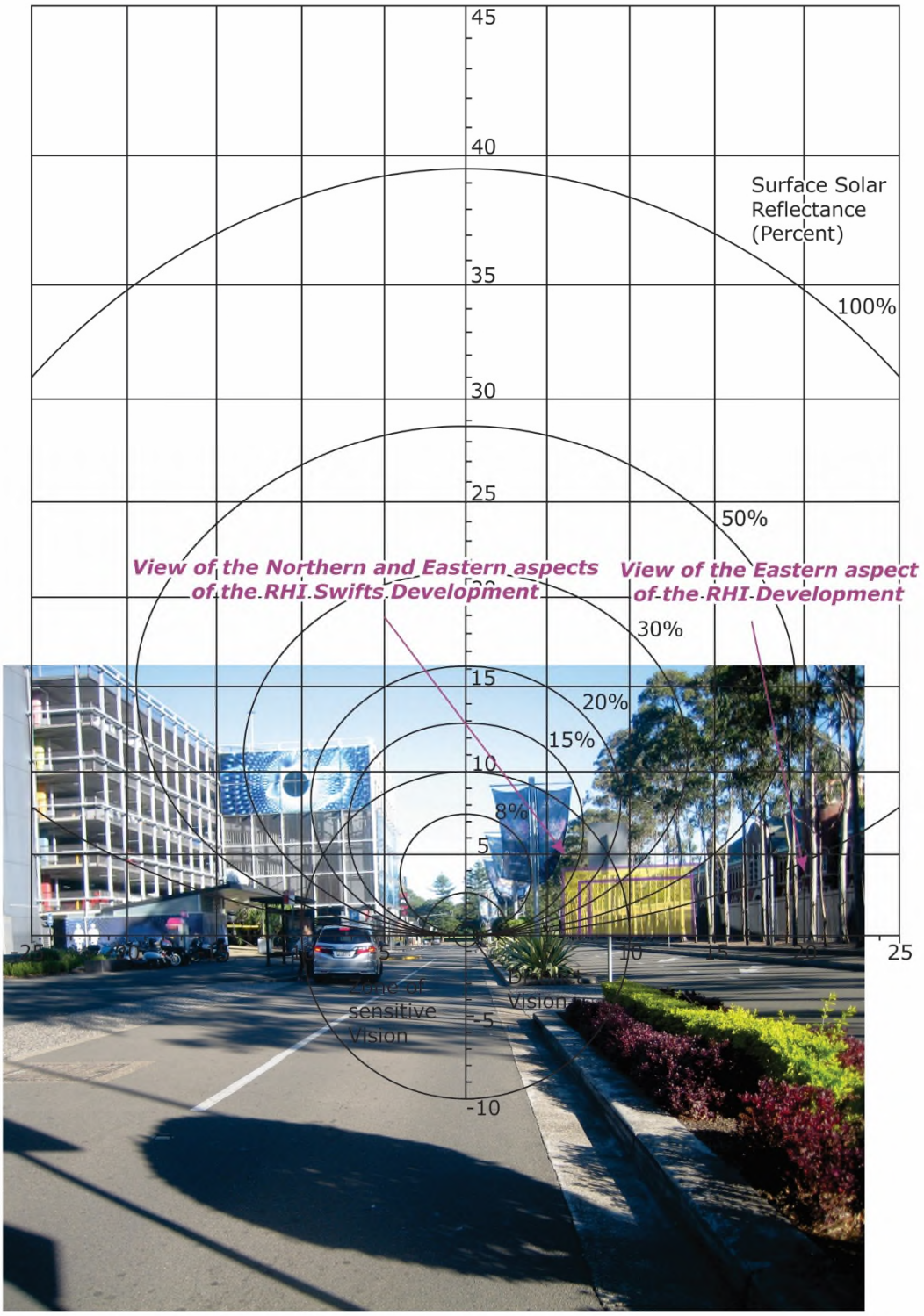

Figure A.2: Glare Overlay of the Viewpoint at Point 02

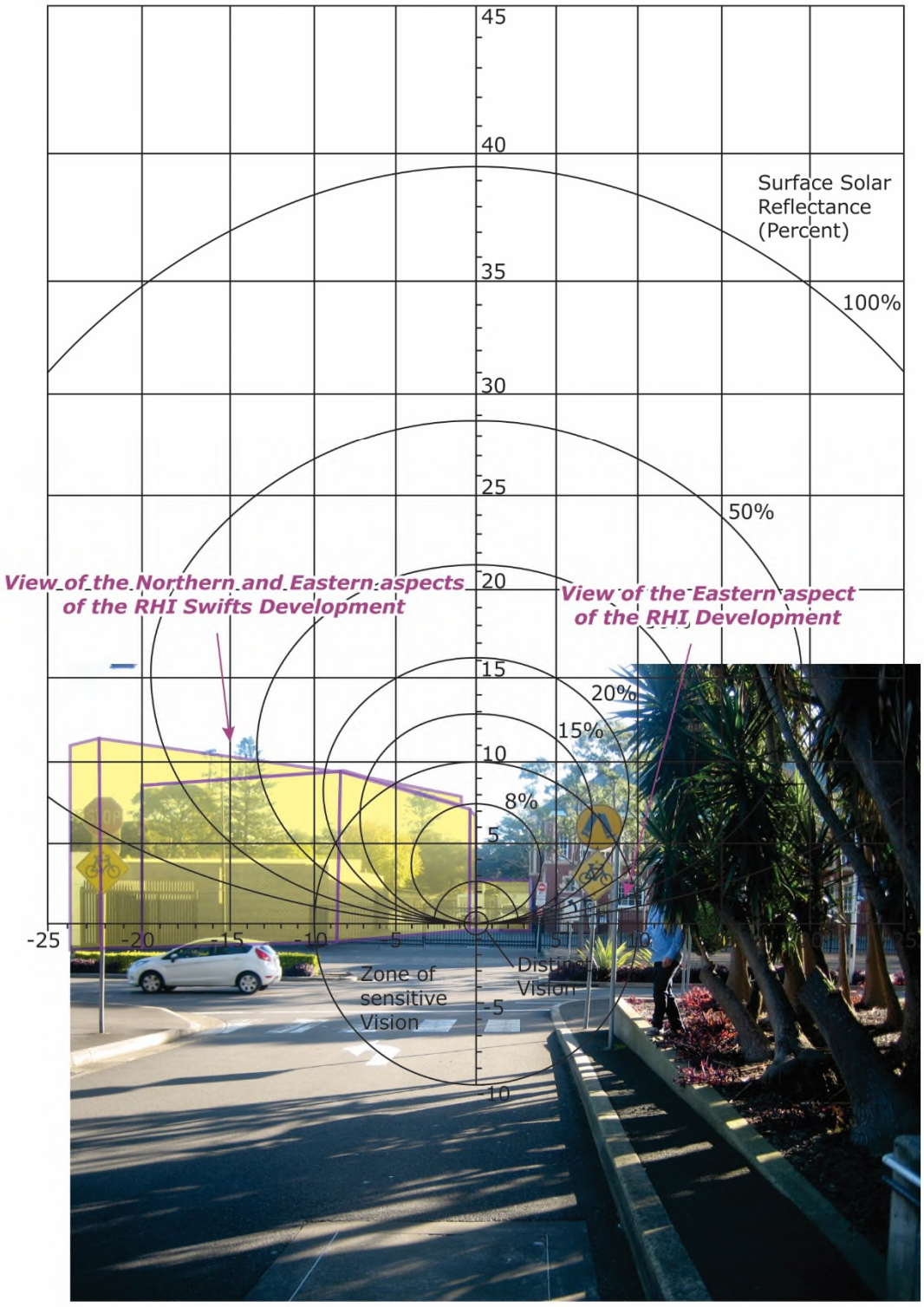

Figure A.3: Glare Overlay of the Viewpoint at Point 03

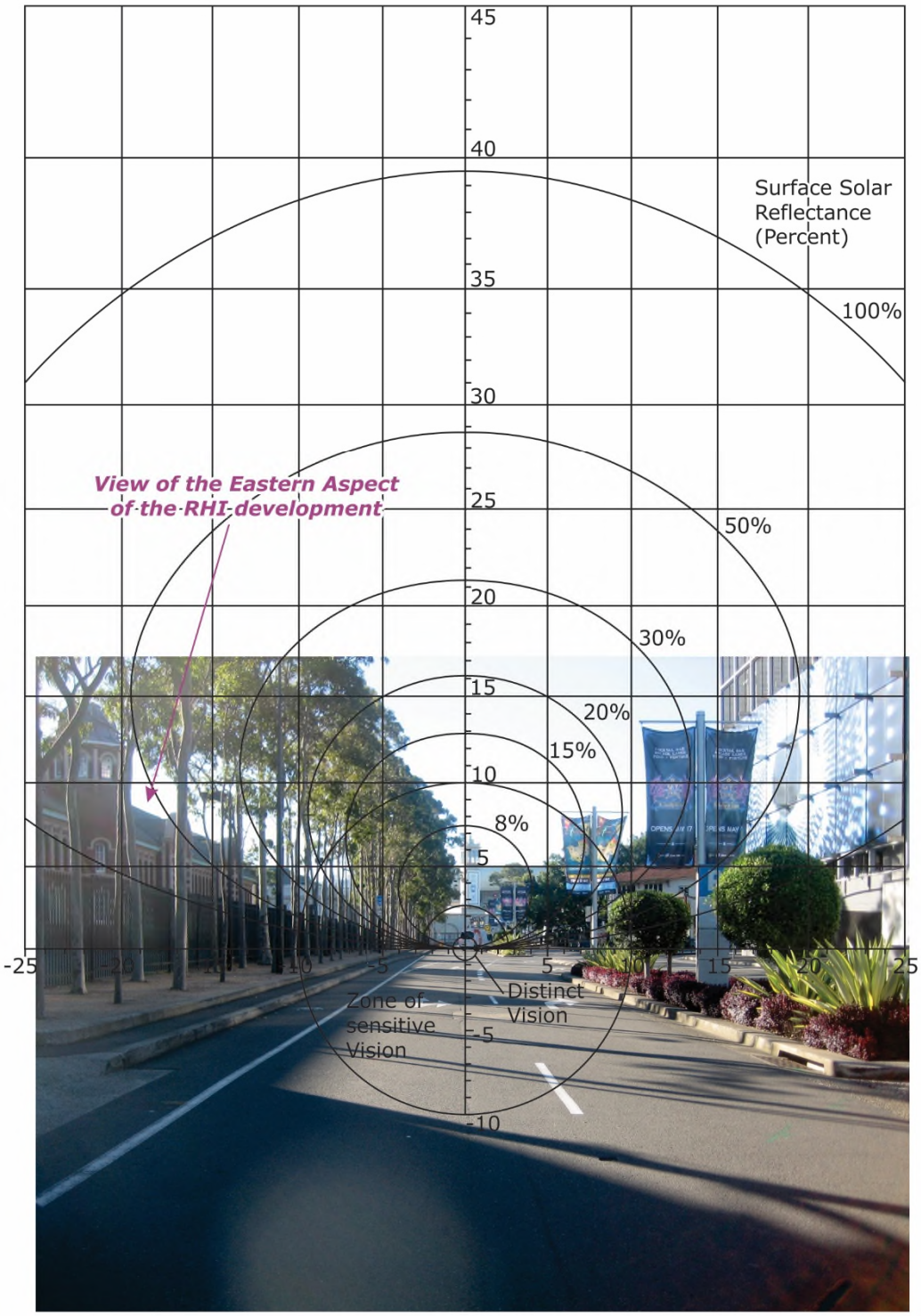

Figure A.4: Glare Overlay of the Viewpoint at Point 04

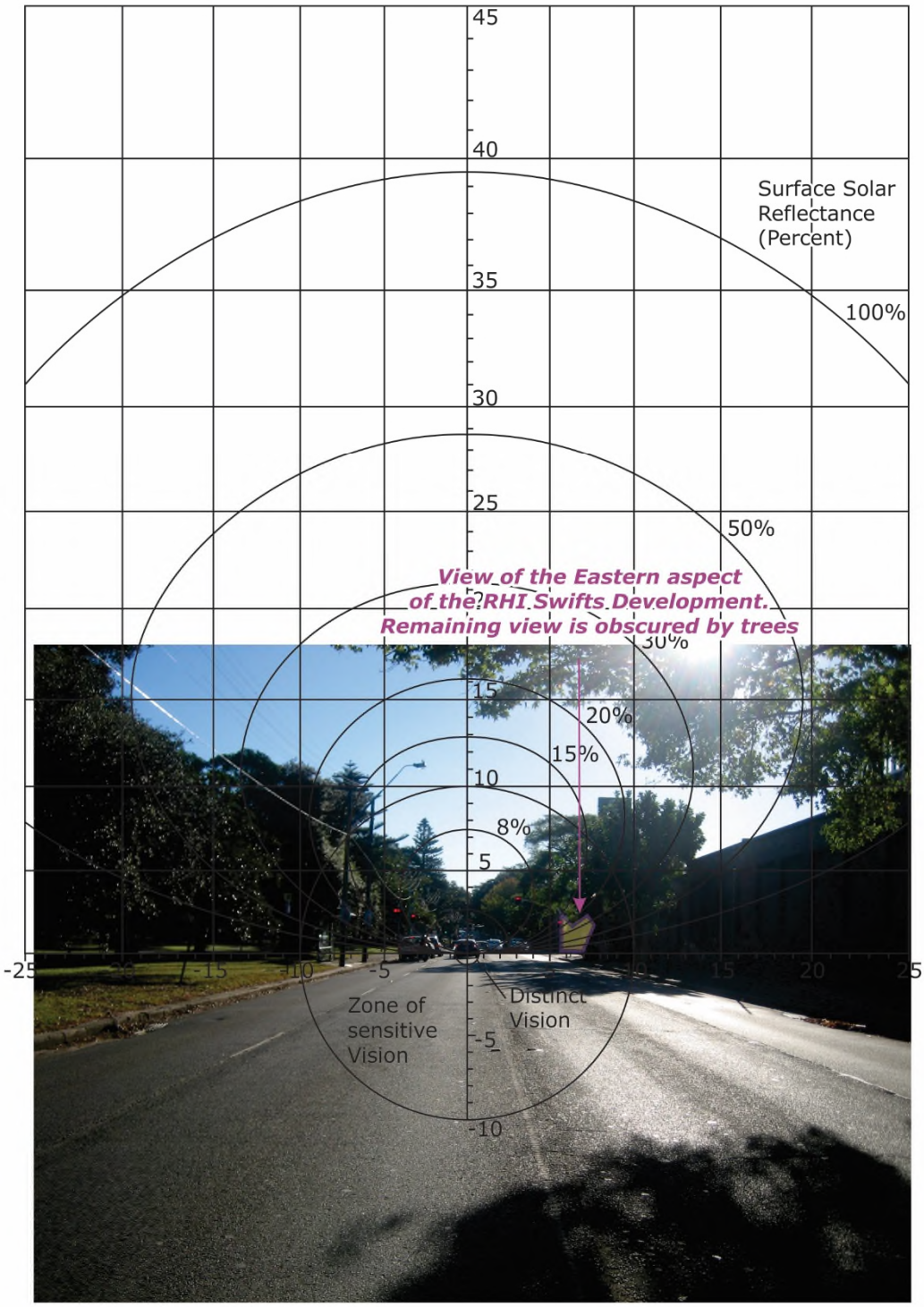

Figure A.5: Glare Overlay of the Viewpoint at Point 05

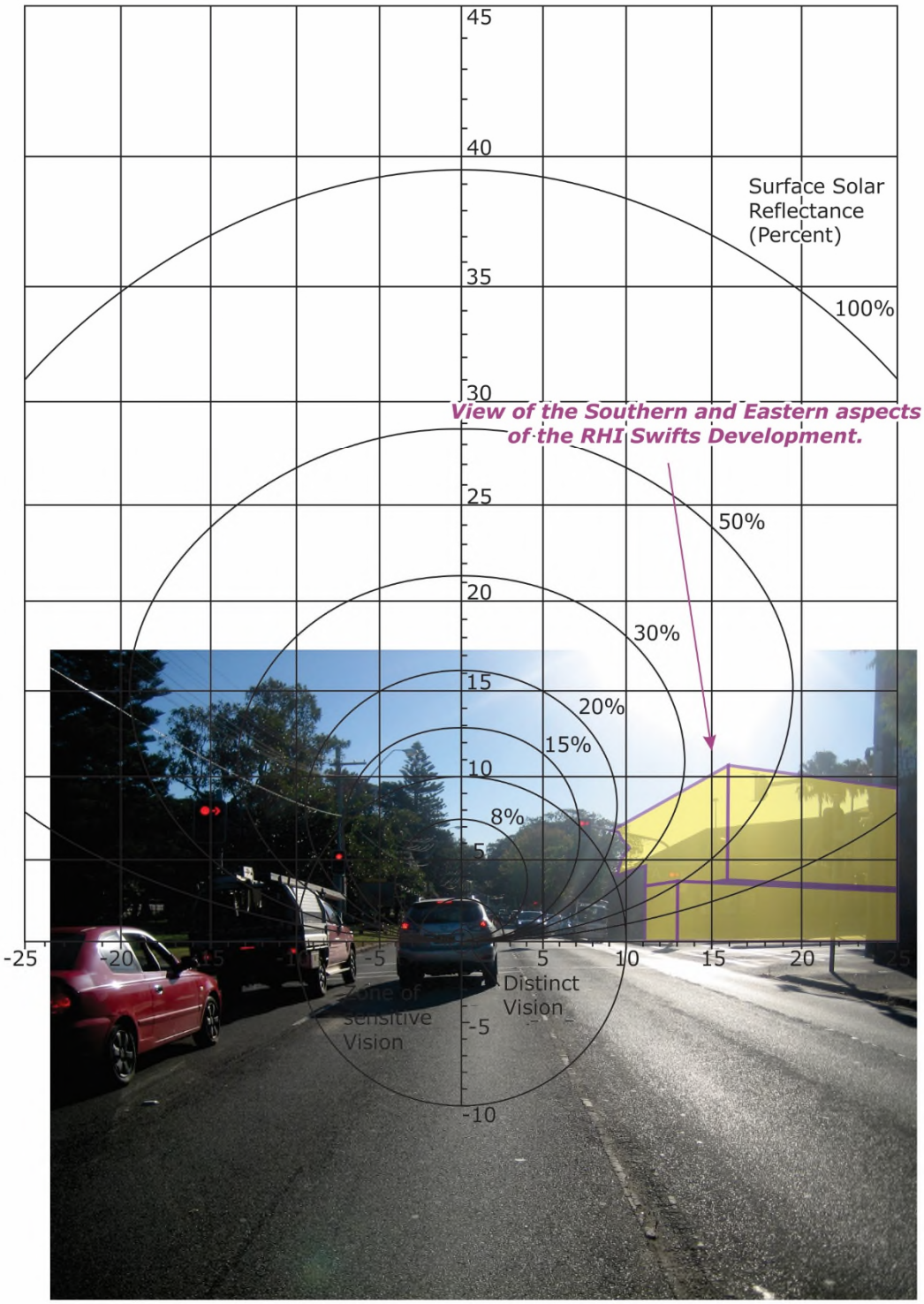

Figure A.6: Glare Overlay of the Viewpoint at Point 06

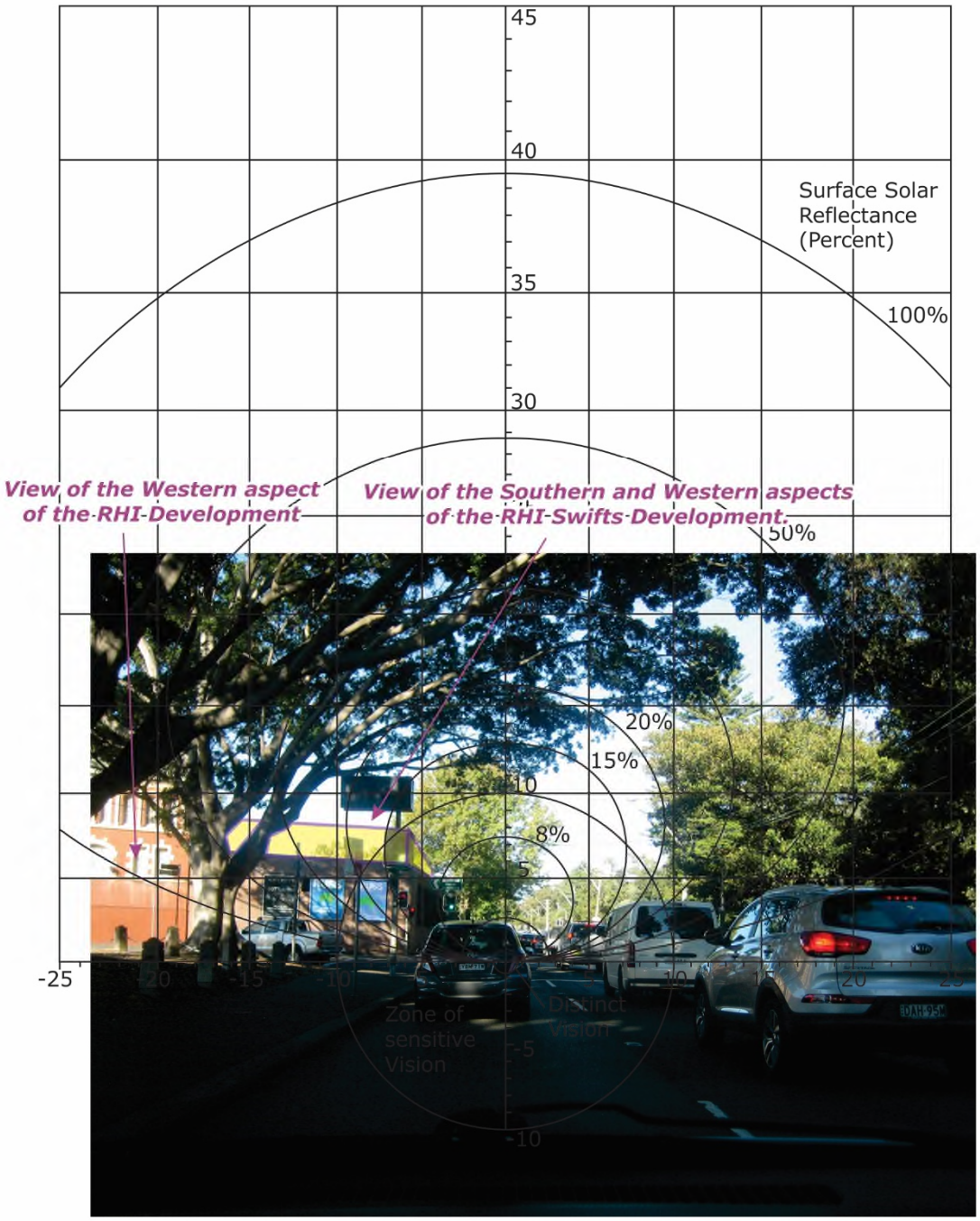

Figure A.7: Glare Overlay of the Viewpoint at Point 07

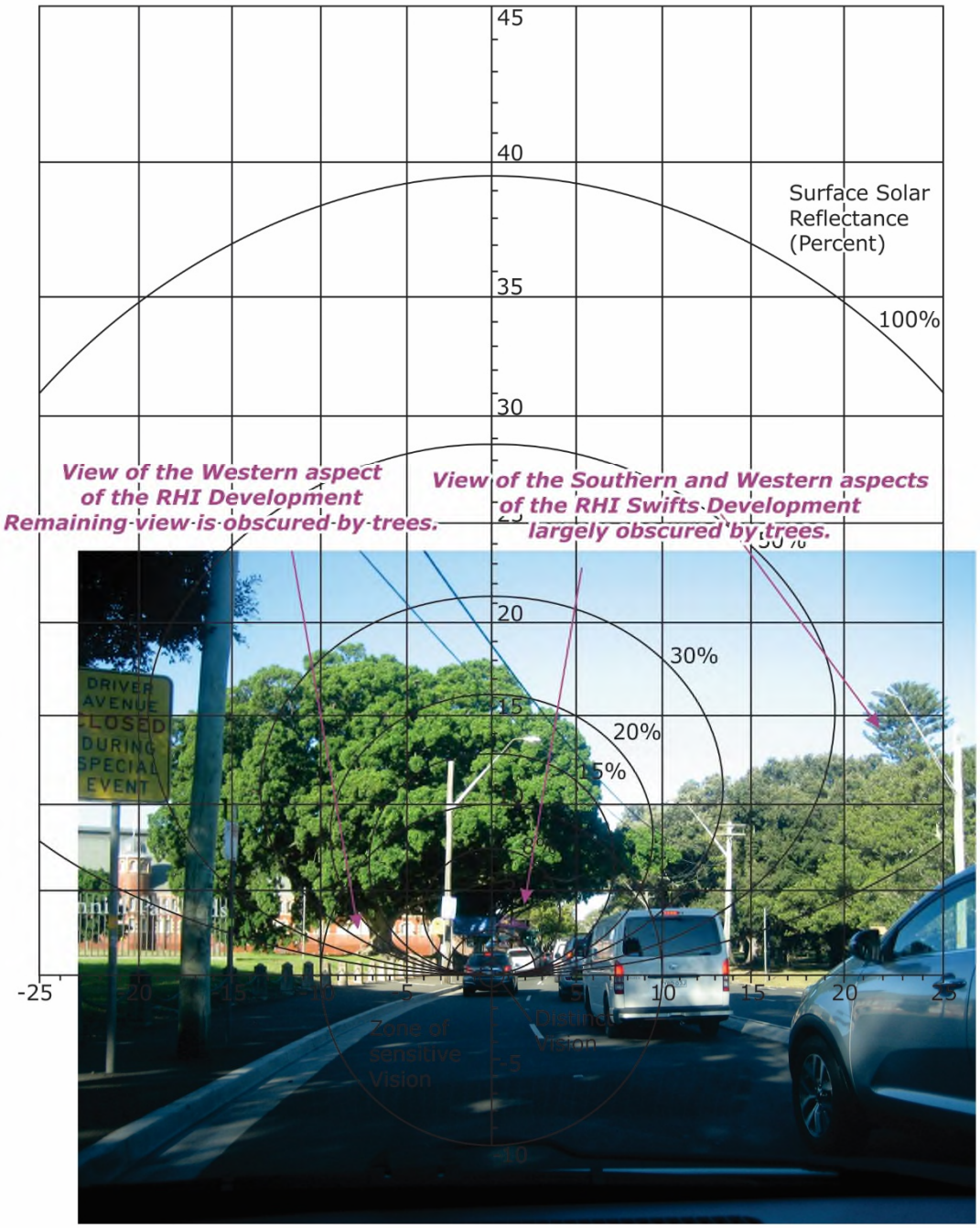

Figure A.8: Glare Overlay of the Viewpoint at Point 08

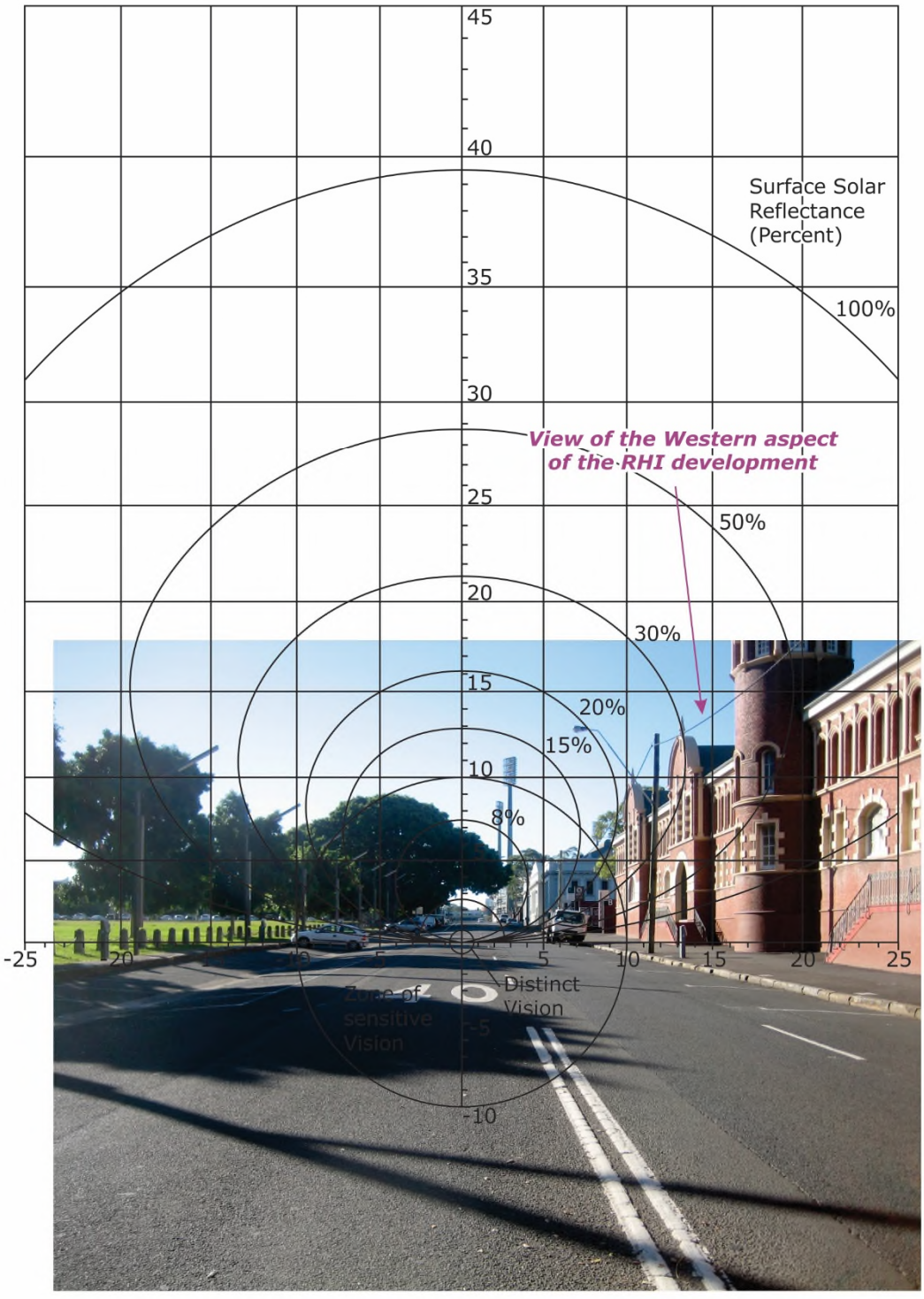

Figure A.9: Glare Overlay of the Viewpoint at Point 09

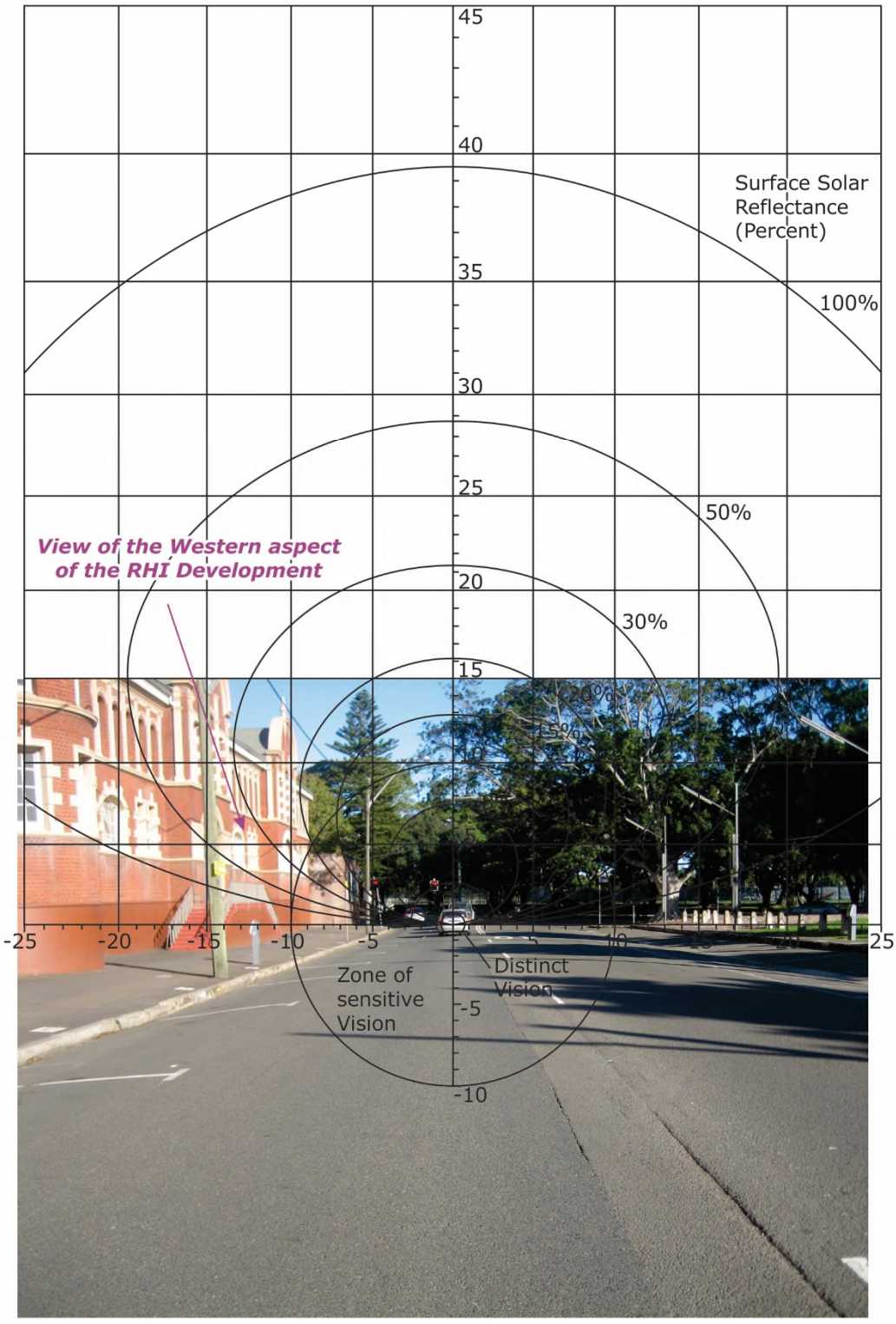

Figure A.10: Glare Overlay of the Viewpoint at Point 10

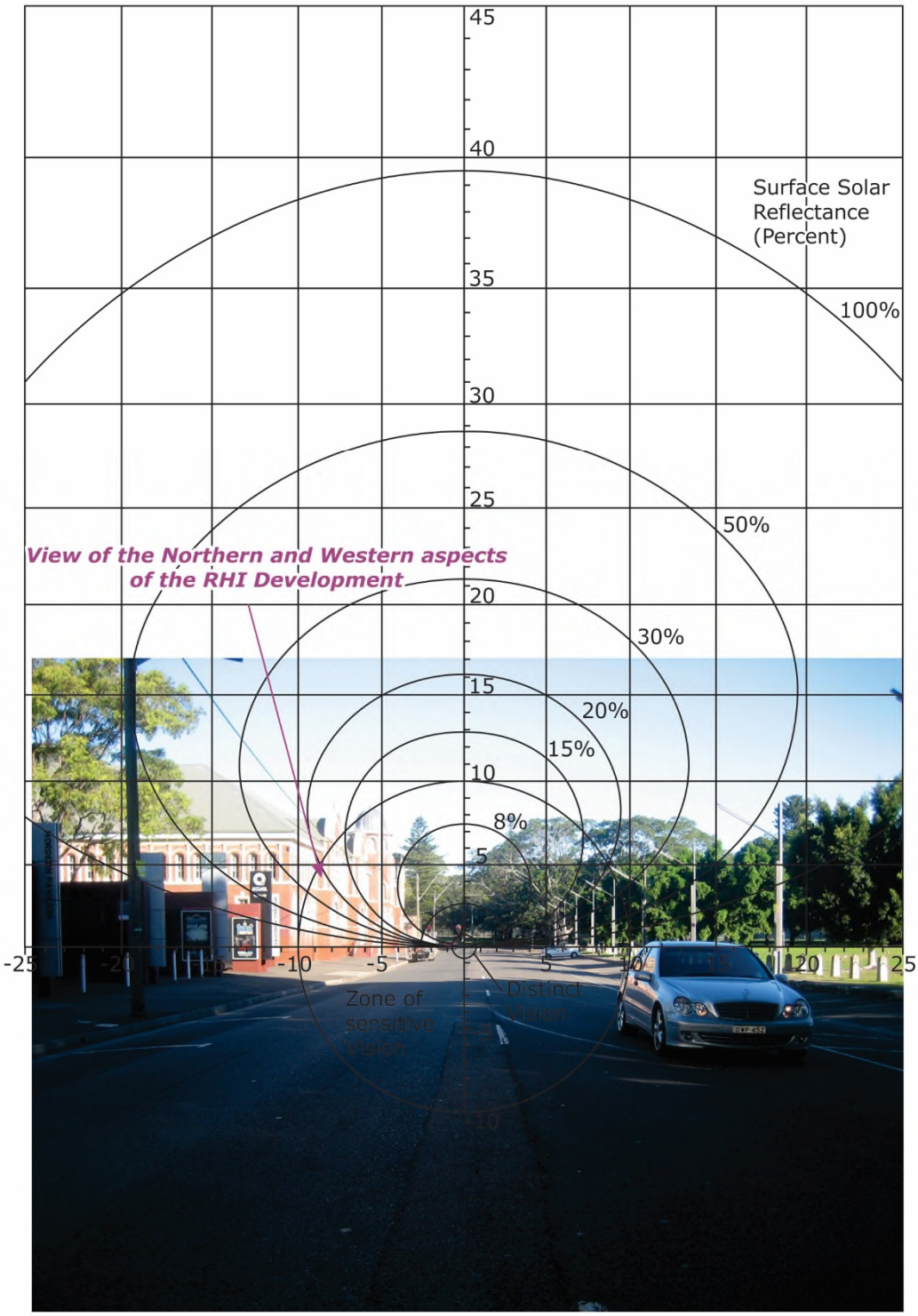

Figure A.11: Glare Overlay of the Viewpoint at Point 11

APPENDIX B SOLAR CHARTS FOR THE VARIOUS CRITICAL ASPECTS

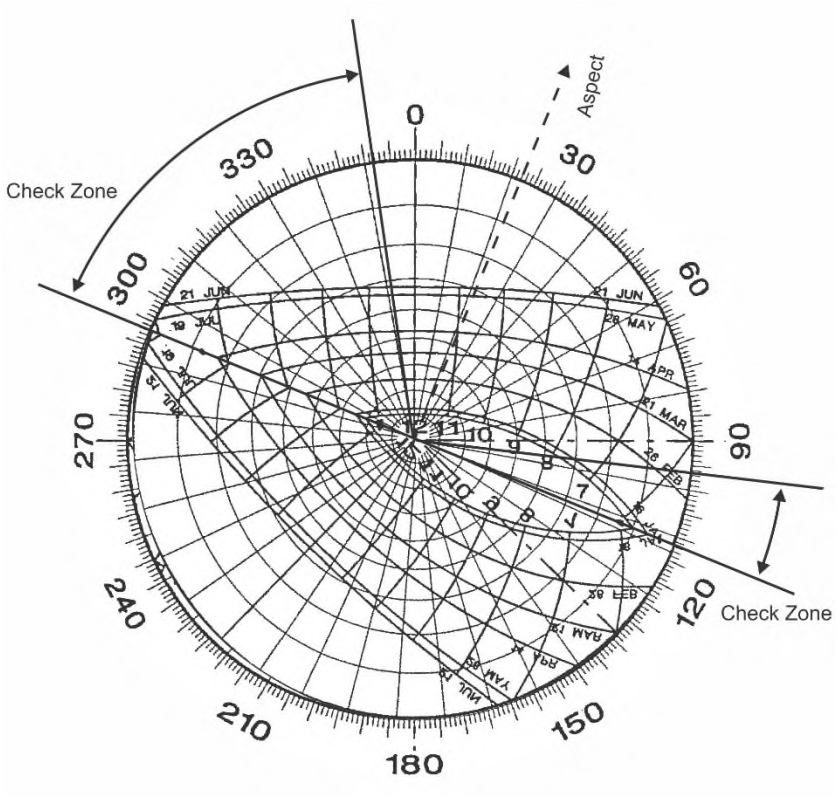

Figure B.1: Sun Chart for the 022° Aspect

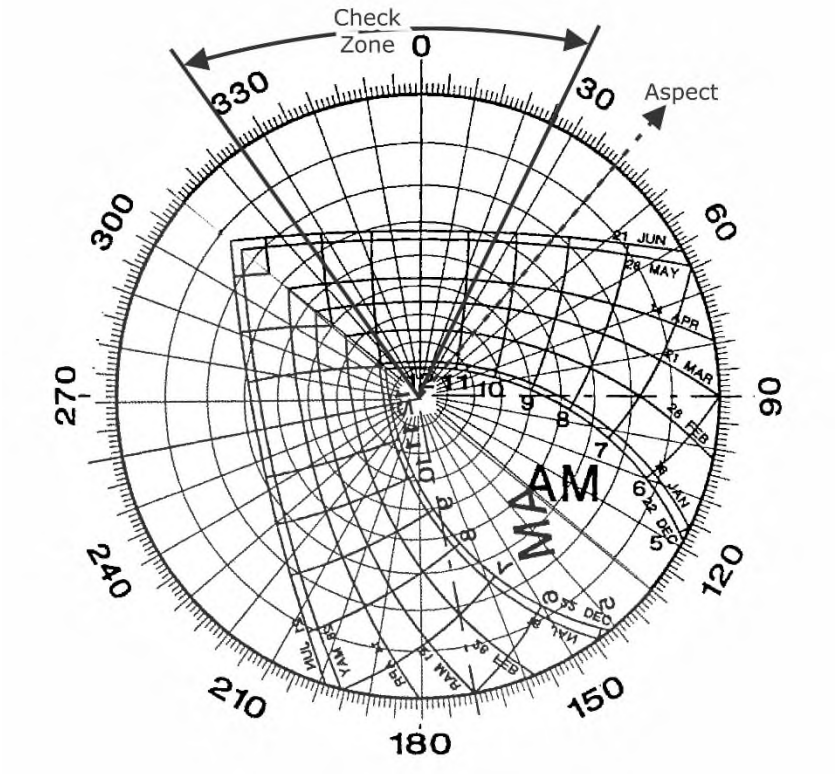

Figure B.2: Sun Chart for the 040° Aspect

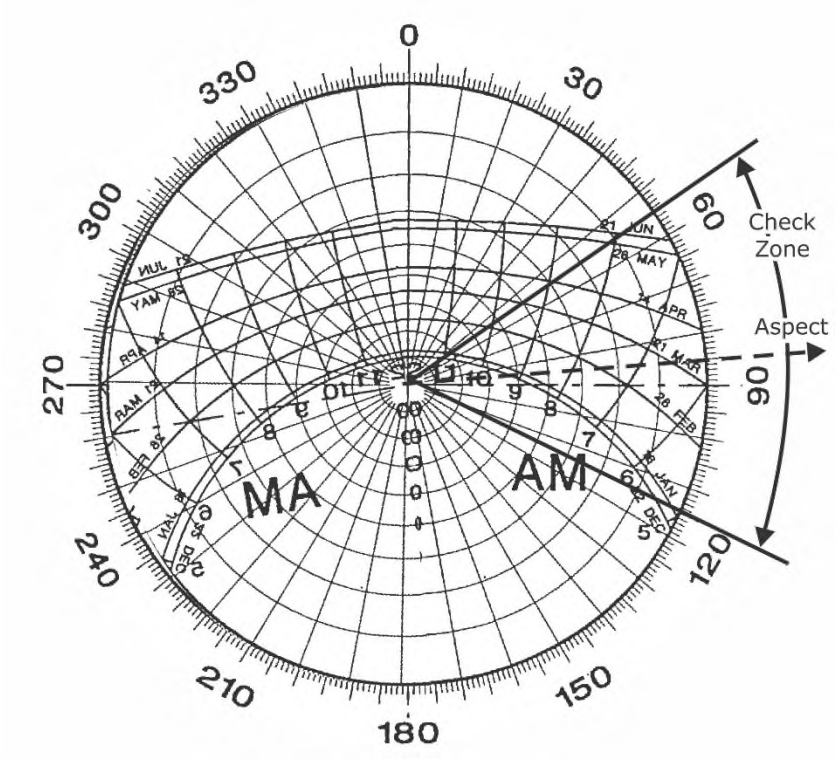

Figure B.3: Sun Chart for the 085° Aspect

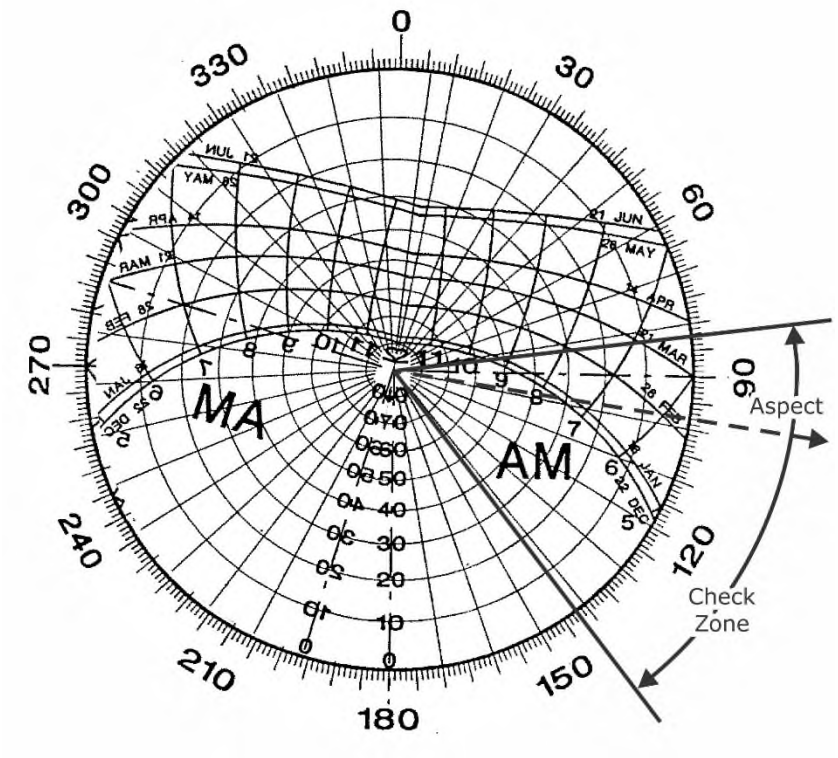

Figure B.4: Sun Chart for the 098° Aspect

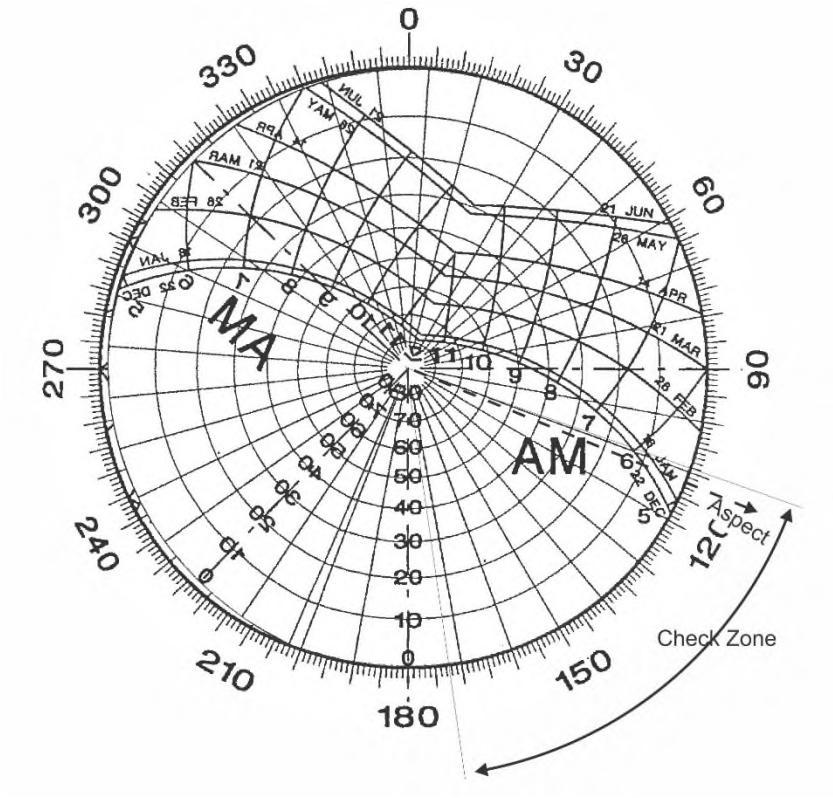

Figure B.5: Sun Chart for the 112° Aspect

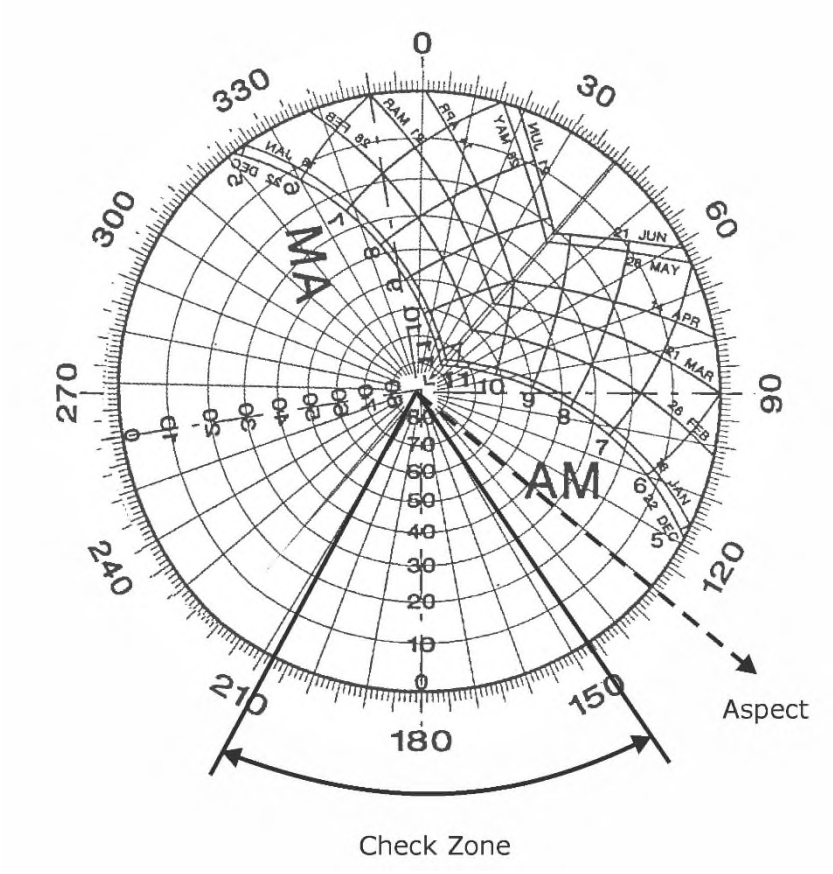

Figure B.6: Sun Chart for the 130° Aspect

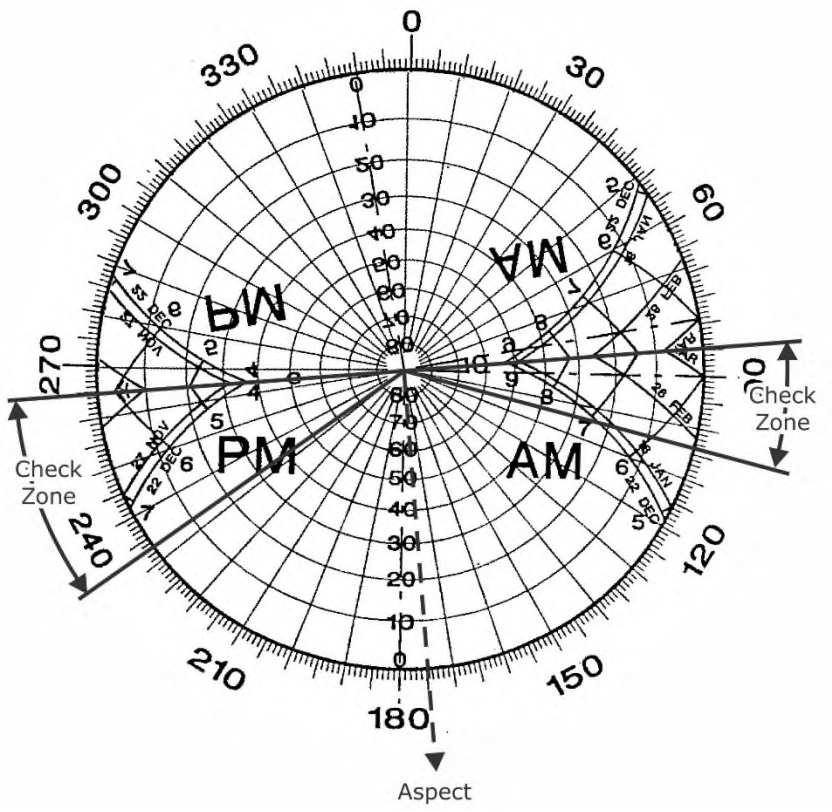

Figure B.7: Sun Chart for the 175° Aspect

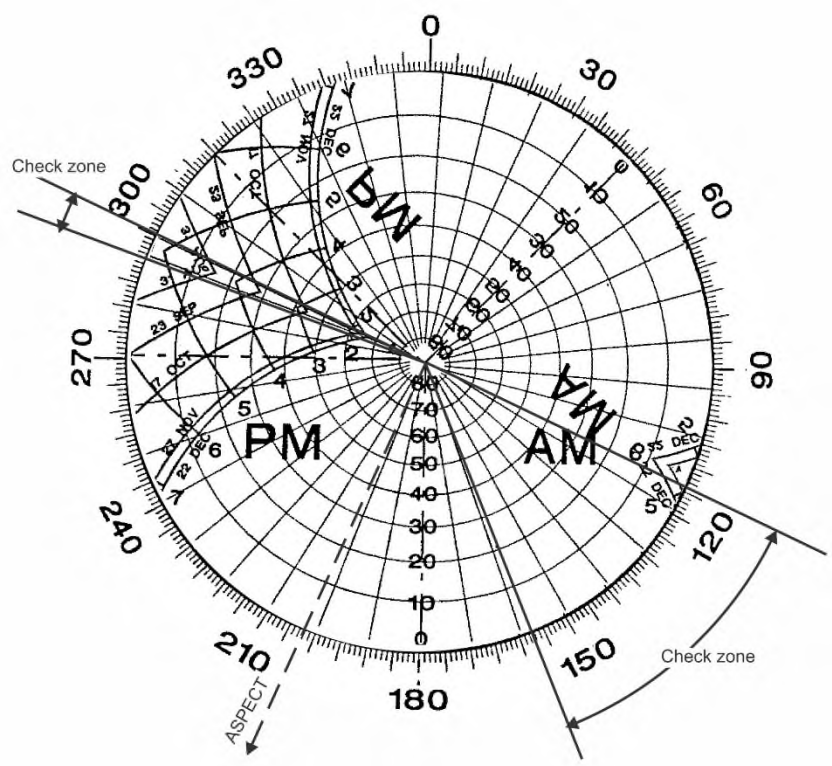

Figure B.8: Sun Chart for the 202° Aspect

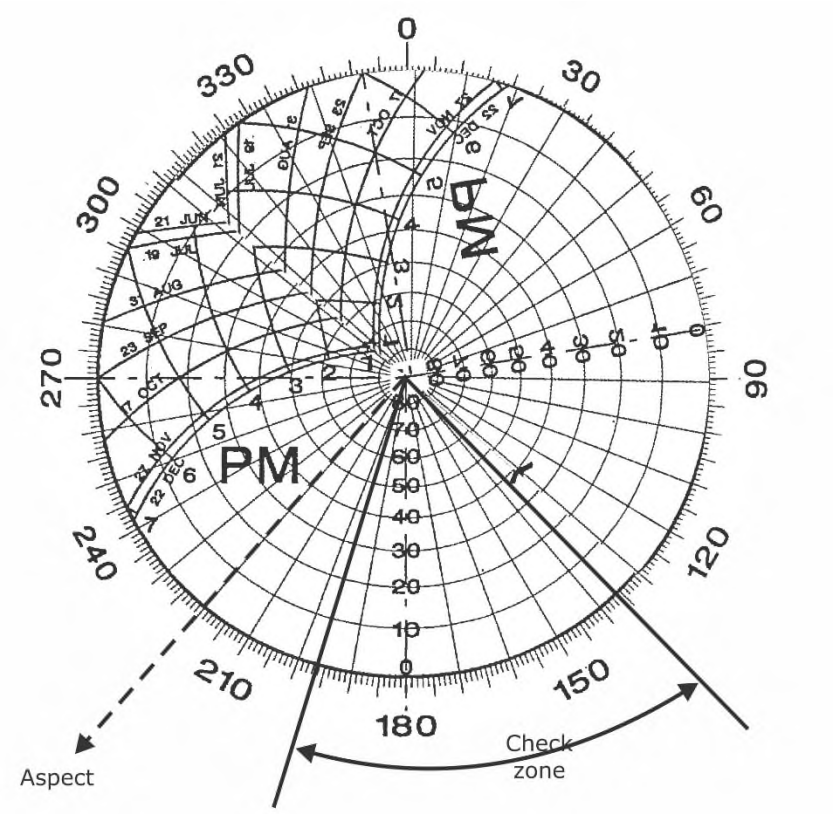

Figure B.9: Sun Chart for the 220° Aspect

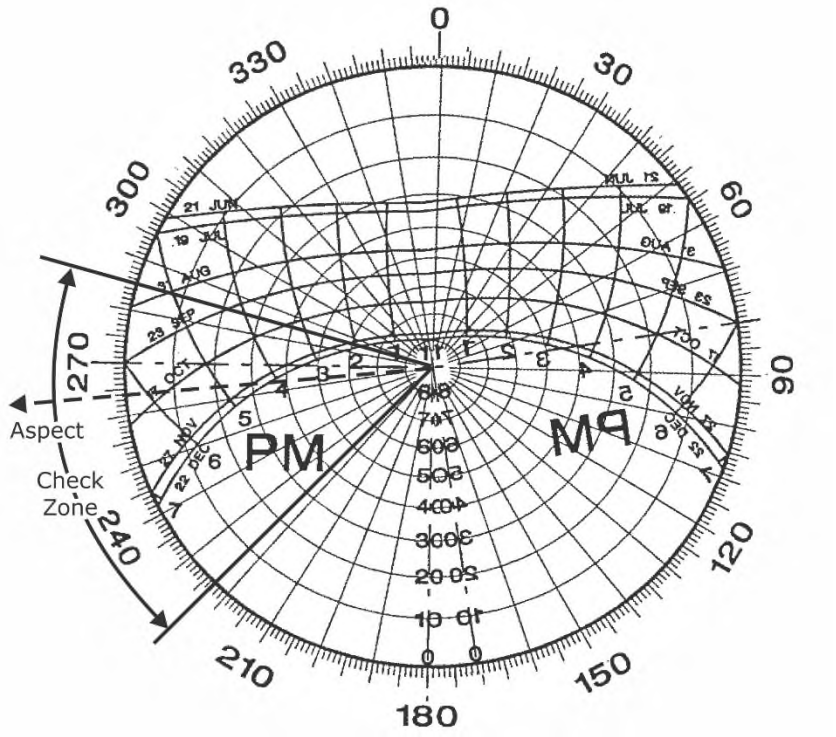

Figure B.10: Sun Chart for the 265° Aspect

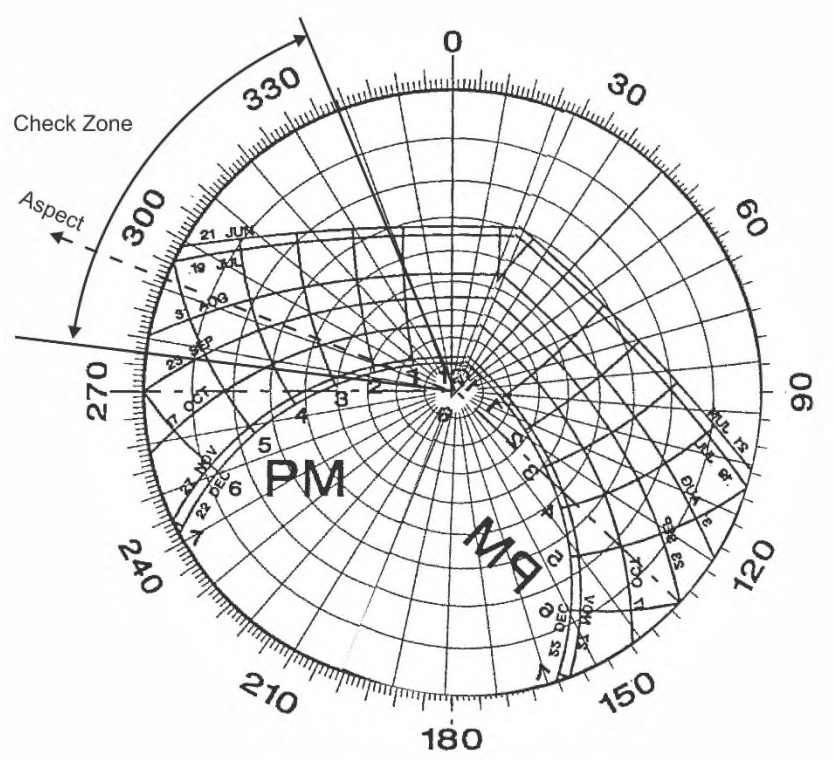

Figure B.11: Sun Chart for the 292° Aspect

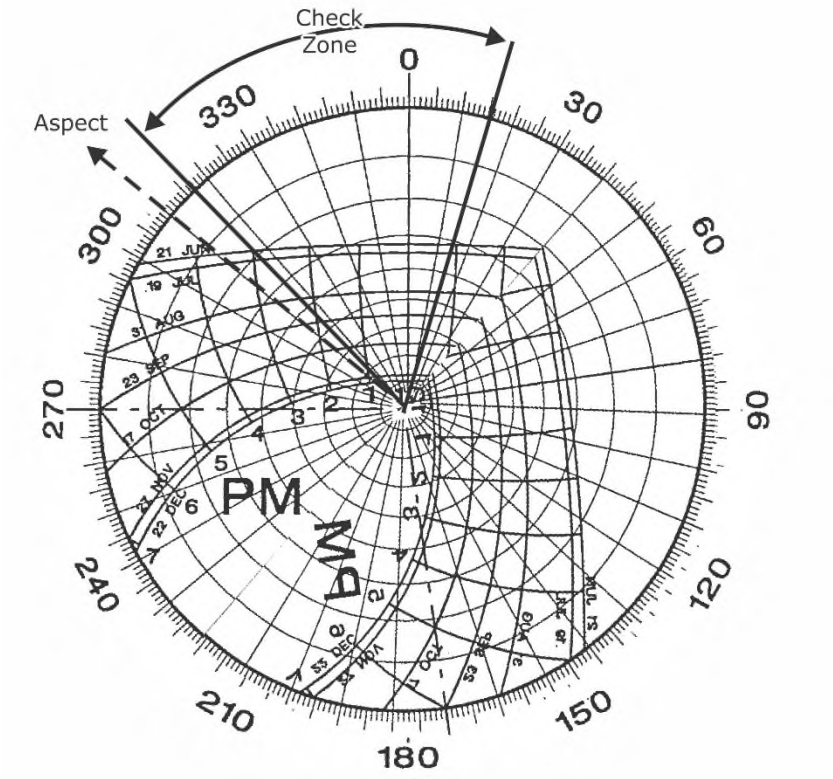

Figure B.12: Sun Chart for the 310° Aspect

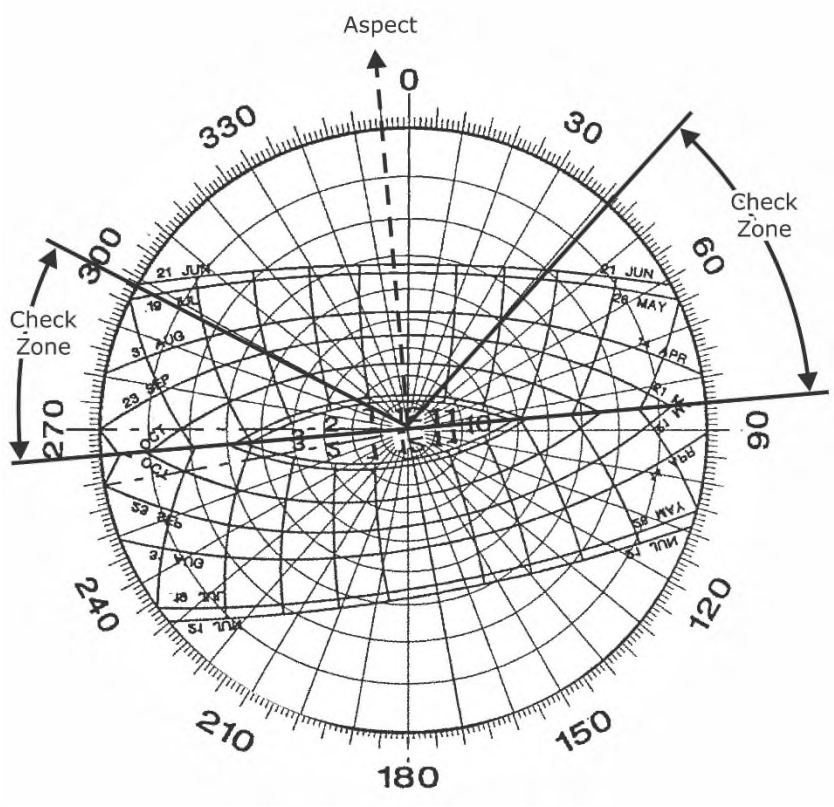

Figure B.13: Sun Chart for the 355° Aspect

APPENDIX C STANDARD SUN CHART FOR THE REGION

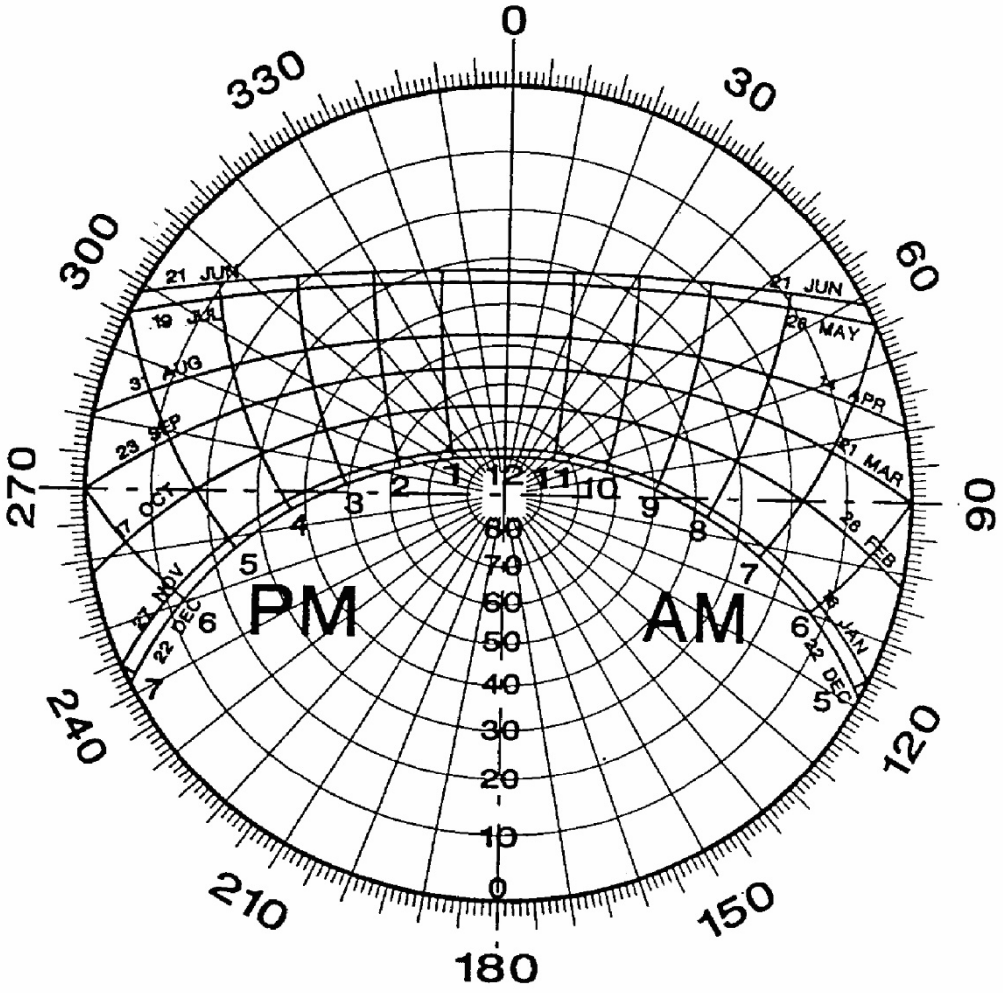

Figure C.1: Standard Sun Chart for the Sydney Region