STAR Project

Assessment of Reflected Solar Glare from Glazed Facade Pirrama Road

Tabcorp

8 September 2008

Assessment of Reflected Solar Glare from Glazed Facade Pirrama Road

Prepared for

Tabcorp

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ABN 22 004 873 634

8 September 2008

60045227

Quality Information

Document Assessment of Reflected Solar Glare from Glazed Facade Pirrama Road

Ref 60045227

Date 8 September 2008

Prepared by Tim Shotbolt

Reviewed by Dennis Grech

Revision History

Revision	Revision Date	Details	Authorised	
			Name/Position	Signature
	08/09/2008	DA		

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Executive Summary

Bassett Consulting Engineers have been engaged by Tabcorp to undertake an assessment of the potential for reflected solar glare from the STAR project. The STAR project proposes an inclined plane glass façade and canopy facing Pirrama Road, Pyrmont.

There will be reflected sunlight towards different locations and in some instances the glazing will be as a mirror due to the orientation of the glazing and the angle of incidence of the sunlight.

This preliminary analysis shows that to critical driver location OP2, there will be some solar reflection mid morning from the canopy structure during certain periods of the year, the intensity of which will be assisted by choice of a glass with the least reflectivity. Likewise, the lower the reflectivity of the glass the less intense the solar reflection towards pedestrians at OP3 during the middle of summer.

There will be short periods of intense solar reflection from the canopy glazing towards observer positions OP4 and OP5 regardless of the glazing reflective properties due to the angle of incidence of solar radiation. Position OP5, residential, will also experience lower intensity reflection from the façade glazing which will be directly related to the reflection properties of the chosen glass.

There are no views of STAR project from observer positions OP6 and OP8. There will be no reflection from the glazed façade towards OP7, however, there will be a brief exposure towards midday at certain times of the year of intense reflection from the canopy glazing.

It is recommended that the glazing have the lowest possible reflection properties whilst also having a low solar heat gain co-efficient and a low UV transmission. Viridian Enviroshield ITO Grey 33 has a reflectivity of 5 percent as well as having low UV transmission and a low solar heat gain co-efficient.

1.0 Description

The STAR project proposes an inclined plane glass façade and canopy facing Pirrama Road, Pyrmont. The new proposed façade is shown below in Figure 1

Highly reflective glass will produce solar reflection problems. Glass generally has a low reflectance for

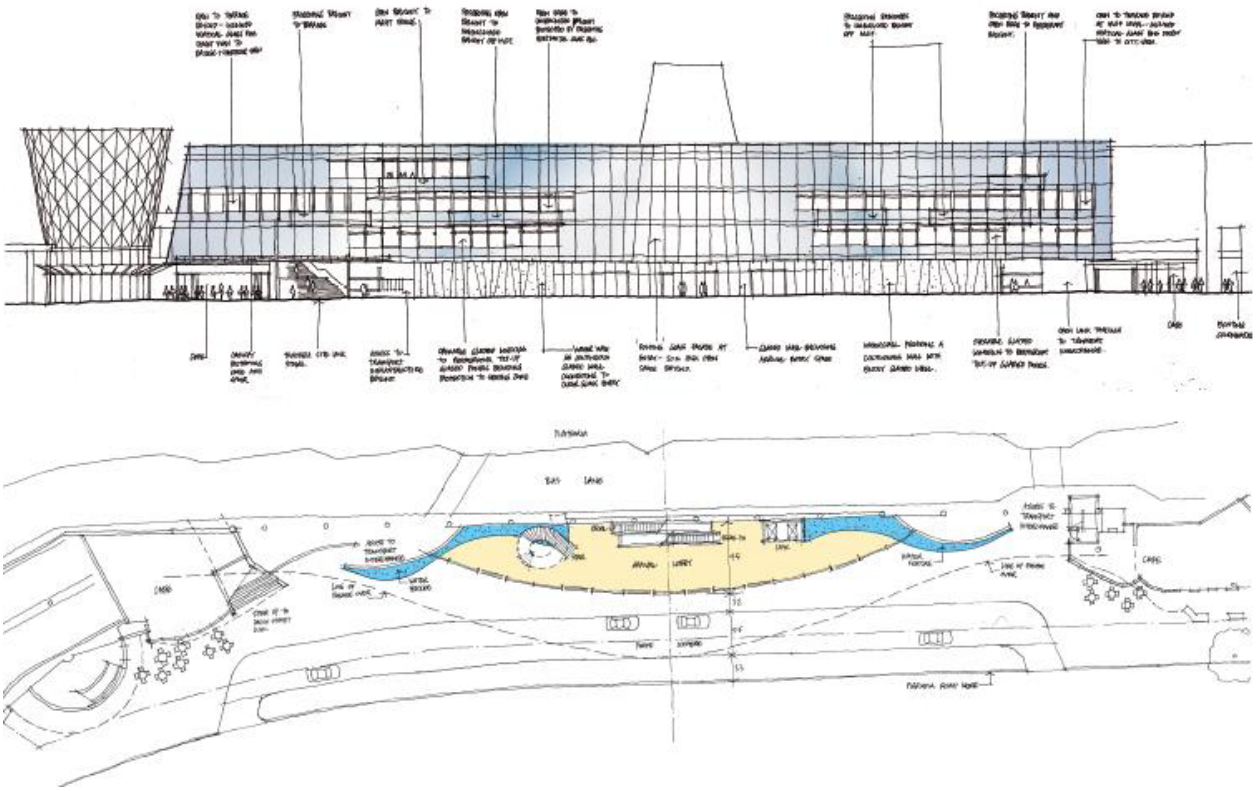

Figure 1 STAR project proposed new façade and canopy glazing facing Pirrama Road

incident radiation normal to the glass unless it has a surface treatment. However, as the angle of incidence changes, glass can become a mirror. Assuming only low reflectance glass is used than as the angle of incidence increases above 60 degrees the surface will still have mirror like properties, refer Figure 2.

The most important aspect is solar reflection and disability glare to drivers. Due to the complexity of analysis of a curved sloping surface, an inverted truncated cone shape, some approximations are required for the purpose of preliminary analysis. Some simplifications to approximate equivalent straight flat sections of façade are shown in Figure 6

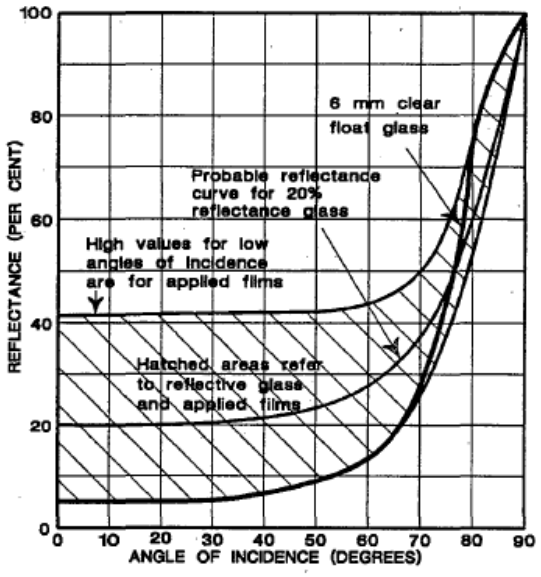

Figure 2 Reflection characteristics of glass (Hassall 1991)

2.0 Surroundings

An inspection of the precinct, observation points OP1 to OP8 at pedestrian and driver height, Figure 3, revealed potential locations for views of STAR project which are analysed in the report below.

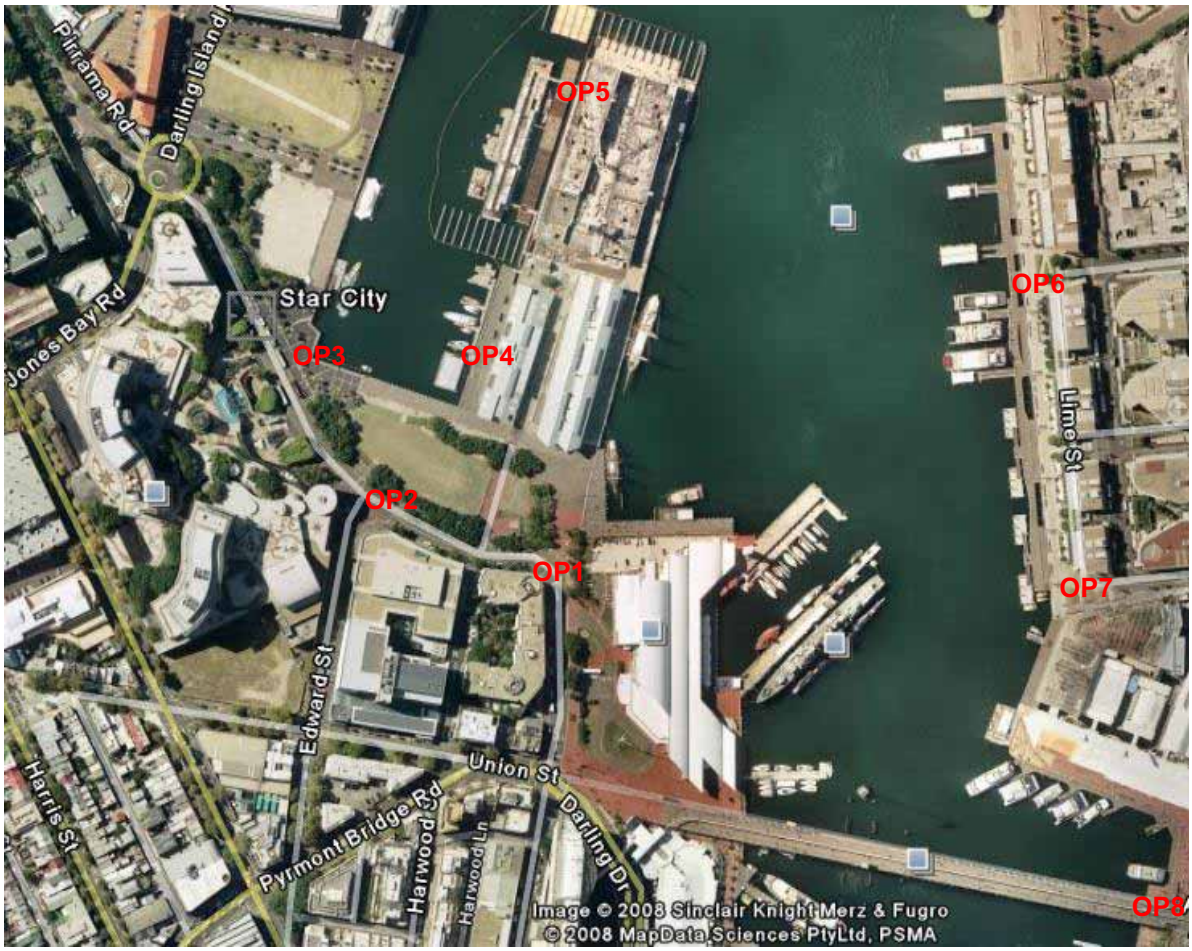

Figure 3 STAR project and location of observer points OP1 to OP8

Figure 4 Driver view at OP1

3.0 Analysis

3.1 Observation Point 1 (OP1)

Figure 4 Driver view at OP1

As drivers head north-west round the bend in Pirrama Road adjacent Pier 7, the view of the new proposed glass façade will be obscured by the dense foliage as seen in Figure 4

Figure 5 Driver view at OP2

3.2 Observation Point 2 (OP2)

A critical point for drivers will be the approach to the junction of Pirrama Road and Edward Street, designated as observer point OP2 and shown in Figure 5.

The simplifications shown in Figure 6 indicate the aspect of the glazing facing the driver to be 79 degrees. The average inclination of the glass is ((78+51)/2) 64.5 degrees.

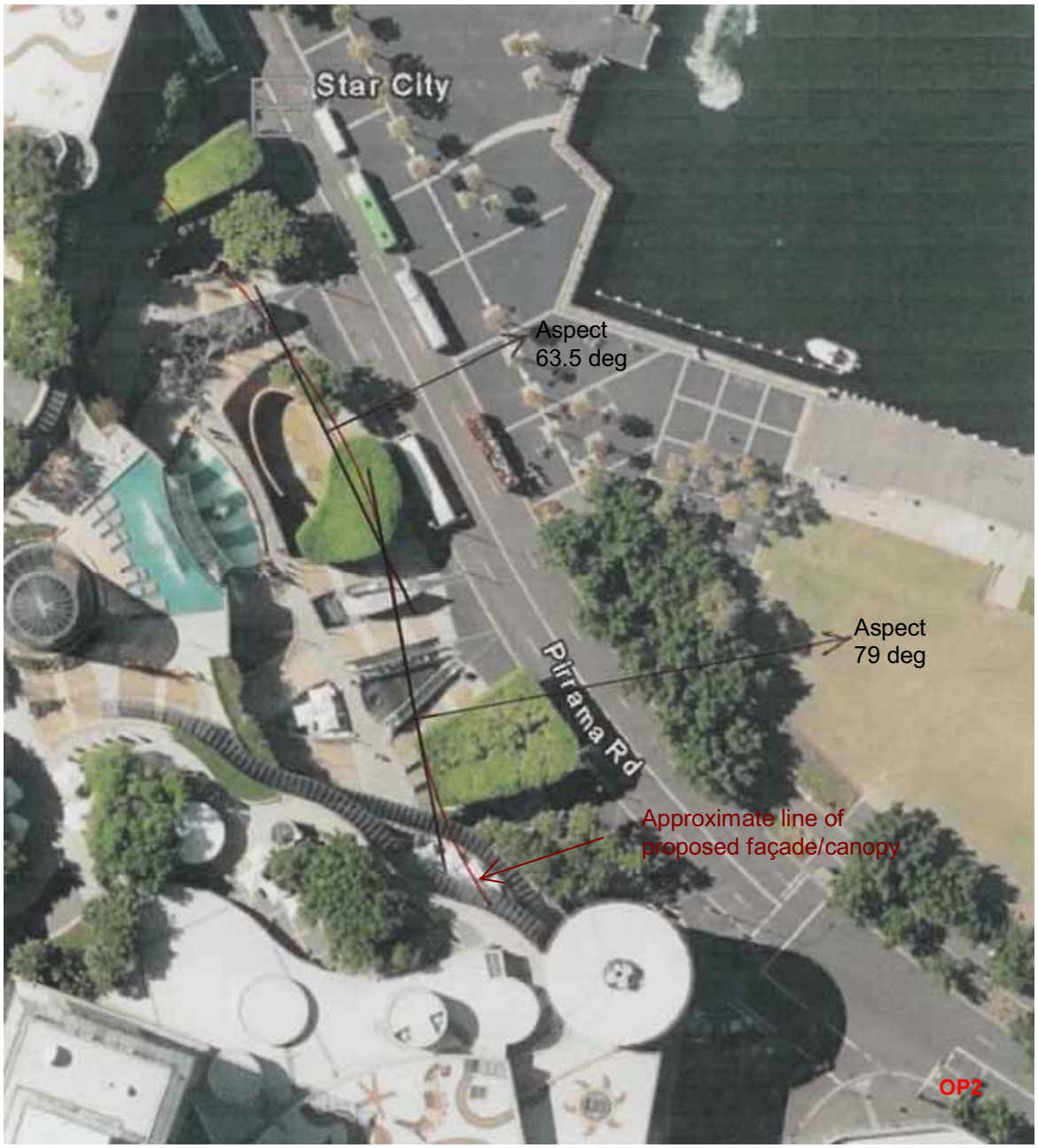

Figure 6 Observer point OP2 relative to STAR new proposed glass facade

Plotting this information on a reflection protractor copied from Hassall 1991, Figure 7 indicates that there will be solar reflections from late April to end of July between 1030 and 1130 hours. The angle of incident radiation will not be in the critical 60 degrees and over zone which means the glass will reflect some light but not be as dazzling as a mirror surface. Curvature of the glass will have the advantage of reducing the overall size of the reflected sun image but it will also mean whilst driving toward the STAR project the glare will continue for a longer period than if it was a flat plane.

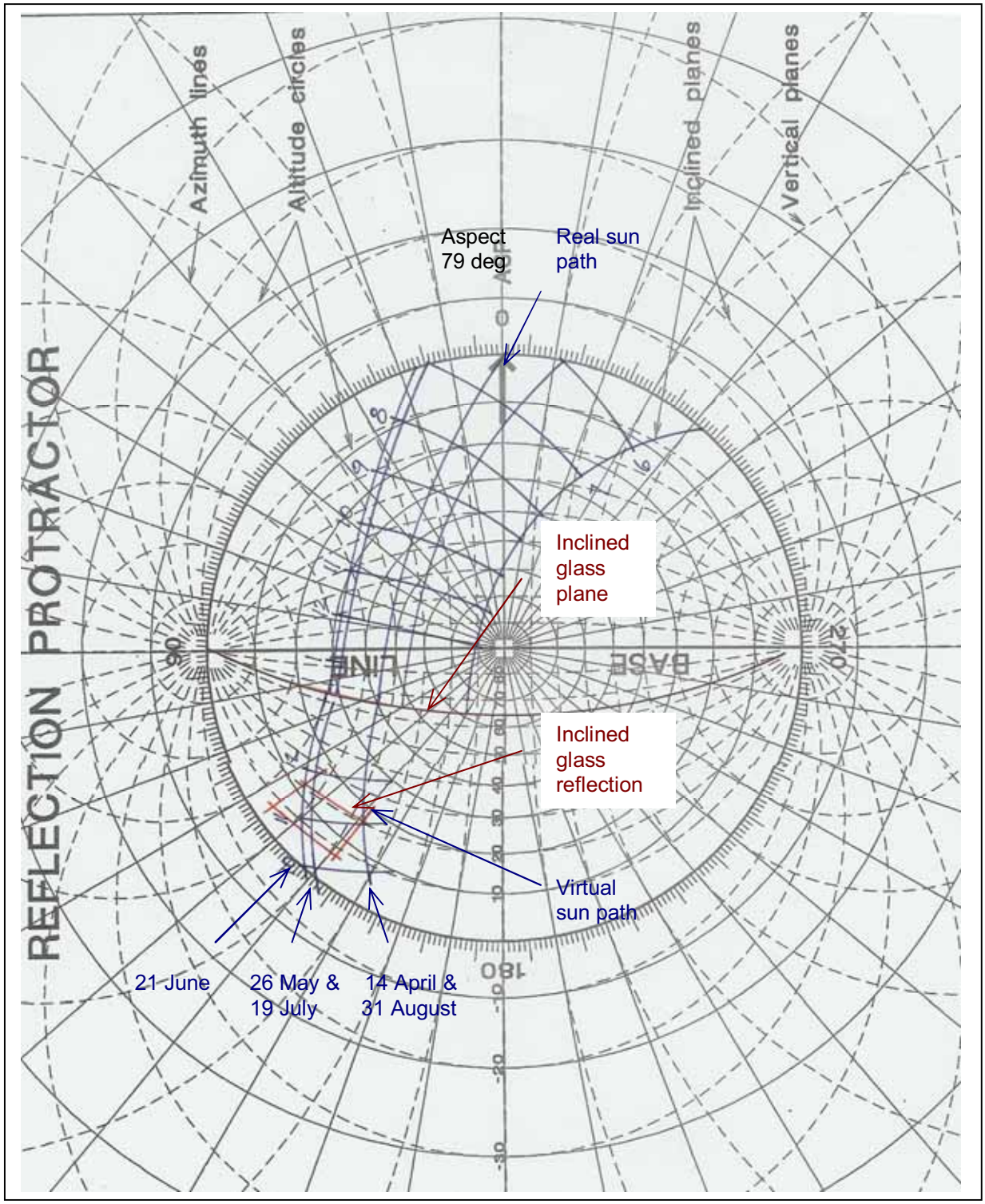

Figure 7 Solar reflection from an inclined surface – from glass façade/canopy towards driver at location OP2.

3.3 Observation Point 3 (OP3)

Again, simplifying the canopy glass façade aspect towards OP3 as an average aspect of 63.5 degrees with an inclination of 51 degrees (worst case), Figure 8 shows that there will be reflections towards this point from mid October to late February between 1030 and 1300 hours (not allowing for daylight savings). The angle of incident radiation will not be in the critical 60 degrees and over zone which means the glass will reflect some light but not be a dazzling mirror. The assumption in this analysis is that the manicured trees in front of the casino, Figure 9, will be sacrificed as part of the new proposed facades/canopy arrangement.

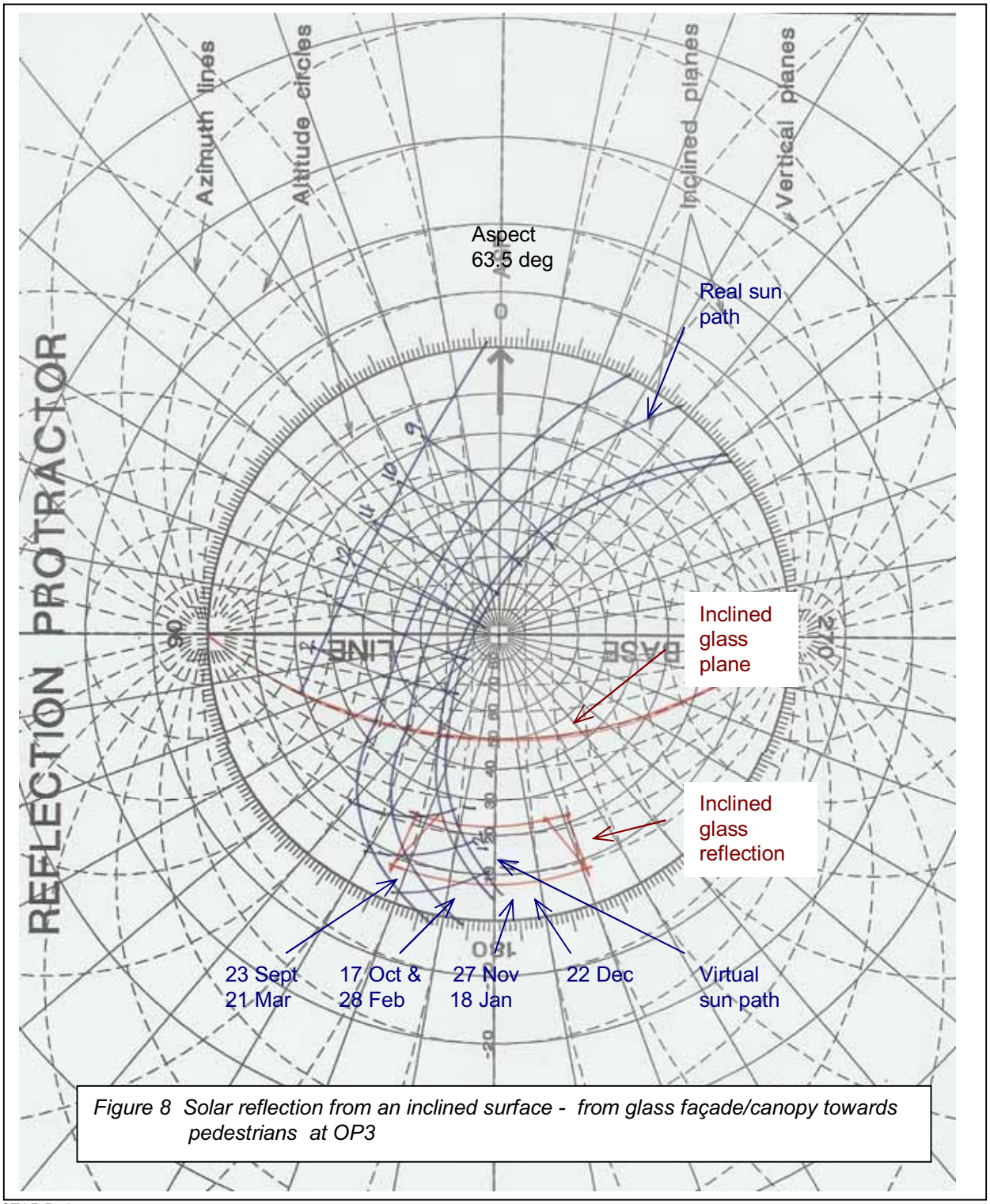

Figure 8 Solar reflection from an inclined surface - from glass façade/canopy towards pedestrians at OP3

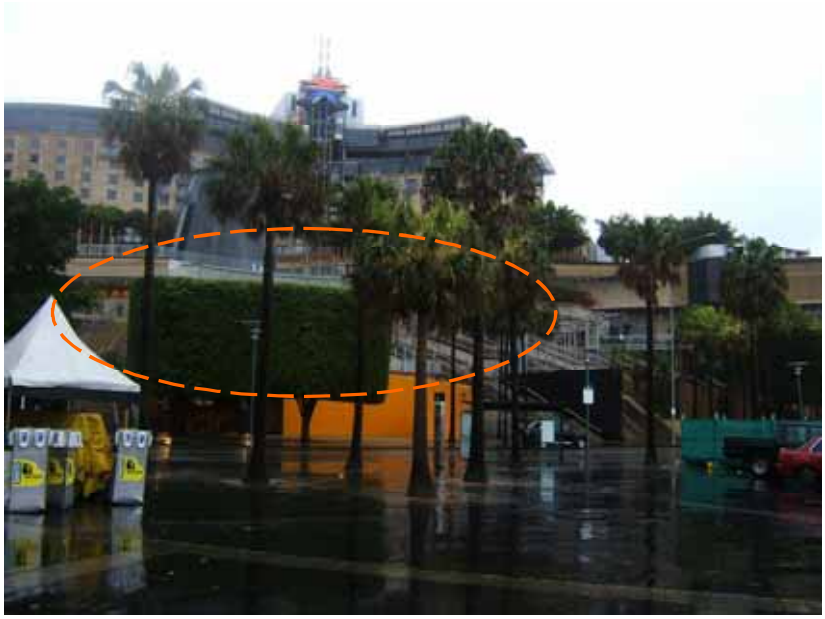

Figure 9 Casino from pedestrian observer position OP3

3.4 Observation Point 4 (OP4)

Towards pedestrian location OP4, Figure 10, there will be some reflected sunlight from late September to late November and again early February to mid March between 1030 and 1130 hours , refer Figure 11, and during this period the angle of incident radiation will be in the critical 60 degrees and over zone which means the glass will act like a mirror. The curvature of the glass will reduce the overall size of the reflected sun image. As the distance from the reflecting surface increases the angular size appears less and is less disturbing than if the view was much closer.

Figure 10 Pedestrian location OP4

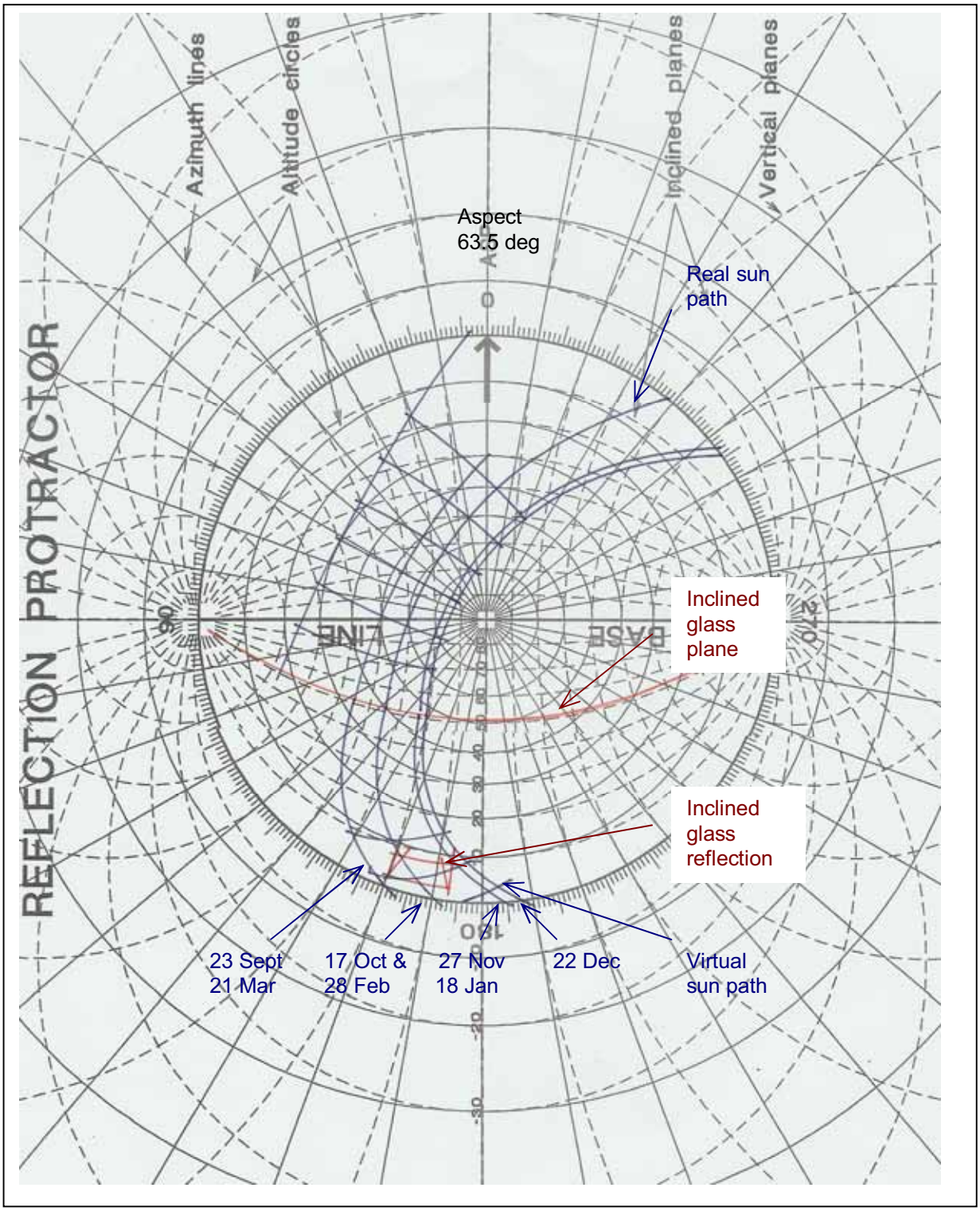

Figure 11 Solar reflection from an inclined surface - from glass façade/canopy towards pedestrians at OP4

3.5 Observation Point 5 (OP5)

Location OP5 represents the centre of the new residential development, Wharfs 8 and 9, with a view towards STAR as shown in Figure 12. During December at approximately 1100 to 1115 hours (no allowance for daylight savings) there will be solar reflection from the canopy glazing. The angle of incidence will be in the critical 60 degrees and over zone which means the glass will reflect an intense image of the sun.

Figure 12 Observer point OP5 below residential apartments

For the remainder of the façade, which is closer to the vertical, there will be reflection off this area towards OP5 between the end of August and the end of October as well as mid February to mid April between 0630 and 0730 hours (no allowance for daylight savings time), refer Figure 13. However, the sun will be close to perpendicular to the glazing and therefore the strength of the reflection will be determined by the reflection properties of the selected glass. A low reflective glass would be an advantage.

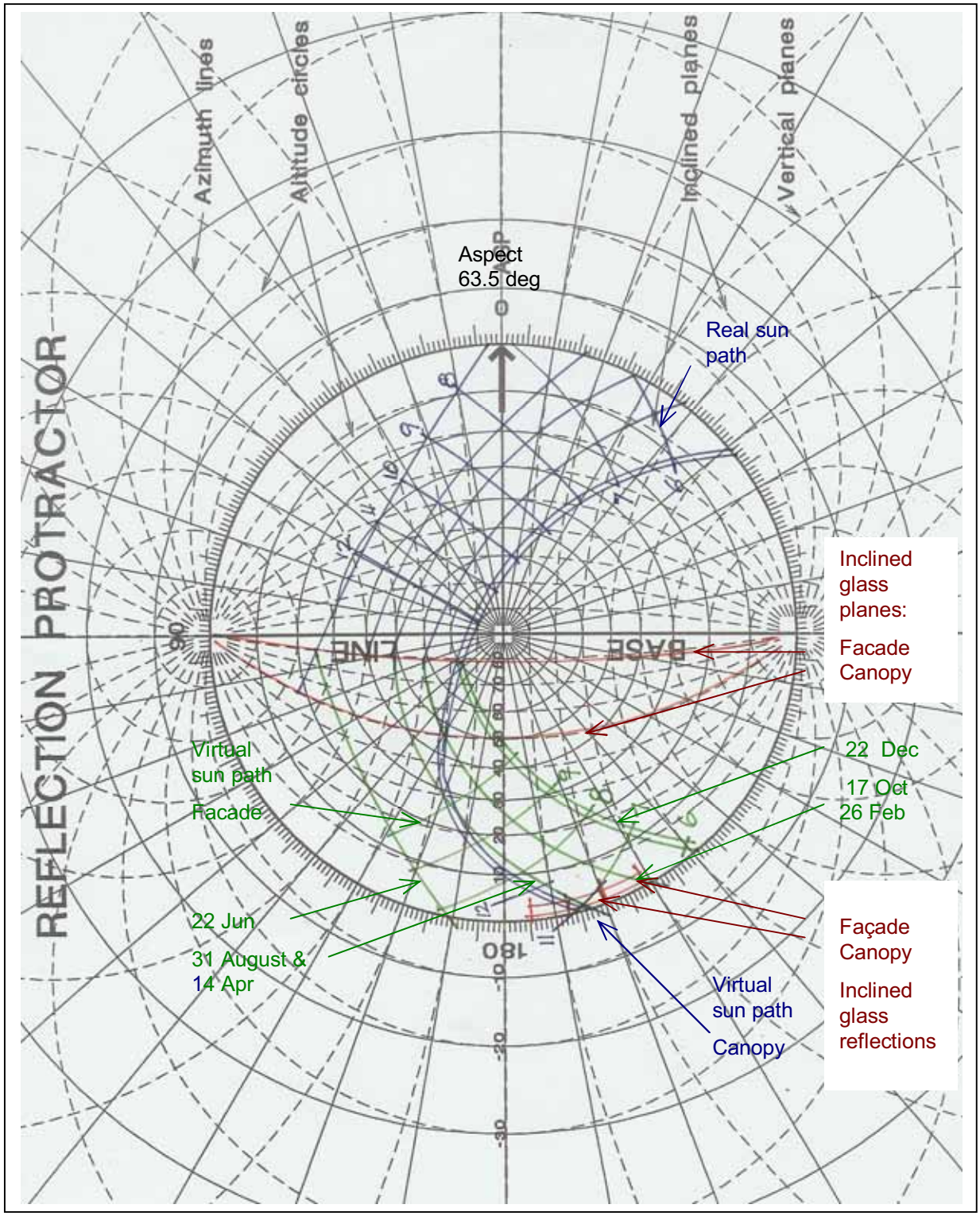

Figure 13 Solar reflection from an inclined surface - from glass façade/canopy towards residential location at OP5 and from remainder of glass facade

3.6 Observation Point 6 (OP6)

Figure 14 View of casino for pedestrian at observer position OP6

3.7 Observation Point 7 (OP7)

Figure 15 View of casino from observer position OP7

Figure 15 provides a pedestrian view from observer position OP7 which is at the end of King Street. Figure 16 shows that there is no reflection from the façade area that is inclined at approximately 80 degrees, however, there would be solar reflection from the canopy area from the beginning of June to end of August and from mid April to mid July from 1130 to 1200 hours

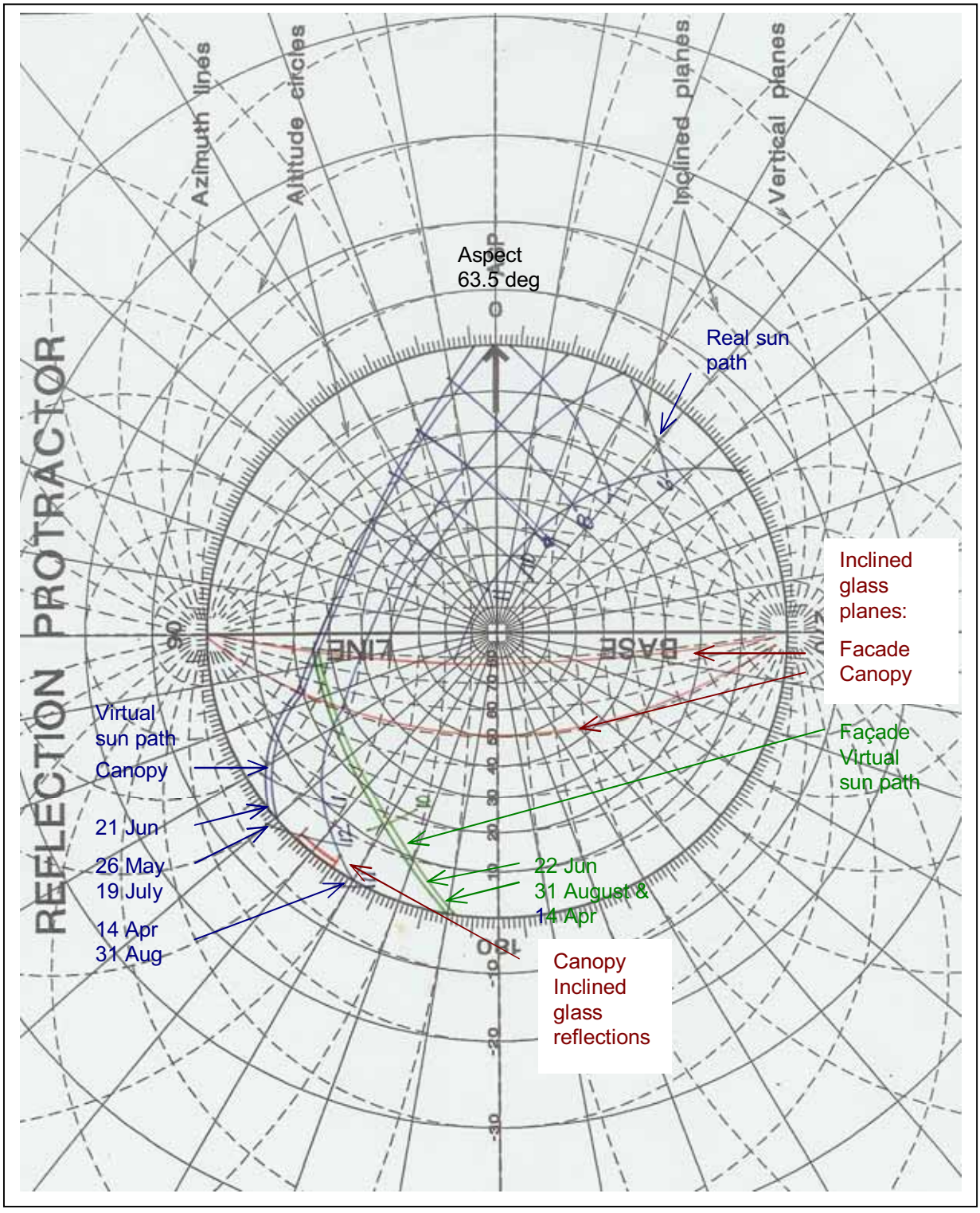

Figure 16 Solar reflection from an inclined surface - from glass façade/canopy towards pedestrians at OP7 and from remainder of glass façade.

(no allowance for daylight savings time). The reflections off the canopy will be in the critical 60 degrees and over zone albeit a very small angular size viewed from position OP7.

3.8 Observation Point 8 (OP8)

Figure 17 Pedestrian view of the casino from observer position OP8

Figure 17 indicates no pedestrian view from observer position OP8.

4.0 Conclusions

The glass needs to have as low reflection characteristic as possible. This preliminary analysis shows that to critical driver location OP2, there will be some solar reflection mid morning from the canopy structure, the intensity of which will be assisted by choice of a glass with the least reflectivity. Likewise, the lower the reflectivity of the glass the less intense the solar reflection towards pedestrians at OP3 during the middle of summer.

There will be short periods of intense solar reflection from the canopy glazing towards observer positions OP4 and OP5 regardless of the glazing reflective properties due to the angle of incidence of solar radiation. Position OP5, residential, will also experience lower intensity reflection from the façade glazing which will be directly related to the reflection properties of the chosen glass.

There are no views of STAR project from observer positions OP6 and OP8. There will be no reflection from the glazed façade towards OP7, however, there will be a brief exposure towards midday of intense reflection from the canopy glazing.

5.0 Recommendation

Glazing to have the lowest possible reflection properties whilst also having a low solar heat gain co-efficient and a low UV transmission. Viridian Enviroshield ITO Grey 33 has a reflectivity of 5 percent as well as having low UV transmission and a low solar heat gain co-efficient.

6.0 References

Hassall D N H, 1991
Faculty of Architecture, University of New South Wales
REFLECTIVITY DEALING WITH ROGUE SOLAR REFLECTIONS

http://www.viridianglass.com/products/downloads/Viridian%20Glass%20Performance%20Data.pdf