Rozelle Village
Rozelle Village Pty Ltd
14 February 2012

Solar Reflection Analysis

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Prepared for

Rozelle Village Pty Ltd

Prepared by

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Revision	Revision Date	Details	Authorised	
			Name/Position	Signature
Final	14-Feb-2012		Dennis Grech Technical Director	
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Executive Summary

AECOM has been engaged to analyse the potential solar reflections towards motorists from the proposed Rozelle Village Mixed Use Development. Following inspection of surrounding streets a number of motorist positions were selected as representative of likely contentious locations whereby motorists might be potentially affected by reflected solar glare from the various facades of the Rozelle Village project. Eight observer points, MP_1 to MP_8, were selected for the analysis. The observer points were selected from the perspective of motorists travelling along the three roads bounding the site - Victoria Rd, Darling St and Waterloo St. Specular surfaces are reflective, irrespective of the opacity of the material. As the angle of the incident light exceeds 60°, relative to the surface normal, the surface tends to exhibit mirror-like qualities. The threshold for unacceptable glare is based on Hassall's [1] recommendation of a maximum luminance value at the observer point of 500 cdm^{-2}. Eleven reflecting facades, G_1 to G_{11} were selected for analysis on the basis of their potential to reflect sunlight towards the motorist positions.

Each façade has been considered worst case as if full height glazed curtain wall to simplify the initial analysis. If the initial analysis revealed a potential problem a further analysis was conducted with a more detailed breakdown of the façade articulation.

For those motorist positions (MP1 through to MP8) and glazed facades (G_1 through to G_{11}) where the façade appears to rise well above 20 degrees (up to 50 and 70 or more degrees above the motorist's view point) only the lower portion closest to 20 degrees is considered in calculation as that is most likely to cause glare and anything above that angle will be screened from view by the average car window cut-off angle. Sun-visor cut-off would provide even further protection and is always an option for the motorist.

Analysis shows that for some motorist positions there is no potential for solar reflection from specific facades (refer Table 3 and Figures 6 through to 16 inclusive). Analysis also shows that for the 34 situations analysed the majority of situations where there is reflected solar glare the level of glare is below the maximum acceptable threshold (<500 $cd.m^{-2}$), most being quite low with five having higher values. Two of the five values were excessive; however, one of those situations, the low rise façade parallel to Victoria Road, is negated with vertical louvres.

One situation for motorists heading north-west on Victoria Road (MP_8) mid winter somewhere in the period 1530 to 1550 hours was identified as potentially producing excessive reflected solar glare from glazed façade G_3, the façade facing and parallel to Victoria Road, high-rise building B2 during mid winter. It should be noted however, that the real sun position will be directly adjacent, straight along Victoria Road (308 degrees azimuth and 11 degrees above the horizon) and motorists therefore will be using their sun visors and hands to screen direct views of the sun. The potential for reflected solar glare from G_3 is for a very brief period of time and could be overcome by:

1. Reducing the potential reflection surface to less than 30 percent of the total balcony façade surface, or;
2. Introducing vertical elements that sufficiently shield the potential reflection to the motorist location on Victoria Road. The incident light is at such a low grazing angle to the glass surface that it is almost a perfect mirror towards motorist point MP8, or;
3. Relying on motorists to use sun visors.

A vertical projection of 350mm (in plan view) between units has now been proposed that will shield the 2 degree grazing incident sunlight at this time thus preventing the potential problem for the period and location noted.

1.0 Introduction

AECOM has been engaged to analyse the potential solar reflections from the proposed Rozelle Village Mixed Use Development.

The analysis is based on the following site information:

Site plans and elevations

- PA 110 15 GROUND LEVEL PLAN (23/01/2012)
- PA 111 15 LEVEL1 PLAN (23/01/2012)
- PA 115 14 LEVEL5 PLAN (20/01/2012)
- PA 206 CONTROL SECTION AA (20/01/2012)
- PA 206 CONTROL SECTION CC (20/01/2012)
- FAÇADE BUILDING B1 EAST (18/01/2012)
- FAÇADE BUILDING B2 EAST (18/01/2012)
- PA 208 14 PODIUM ELEVATIONS WATERLOO ST+DARLING ST (20/01/2012)
- PA 209 14 PODIUM ELEVATIONS VICTORIA RD+NORTH-WEST ELEVATION (20/01/2012)

- Glass reflectance data provided by Taylor Thomson Whitting Pty Ltd (at 0° - perpendicular to glass facade) – grey glass for windows 12%, glass for balustrades 8%, white glass 20%.

2.0 Solar charts

The location of the sun at any time of the year can be projected onto a horizontal plane using stereographic projection. The result is a solar sun path chart, (refer Figure 1).

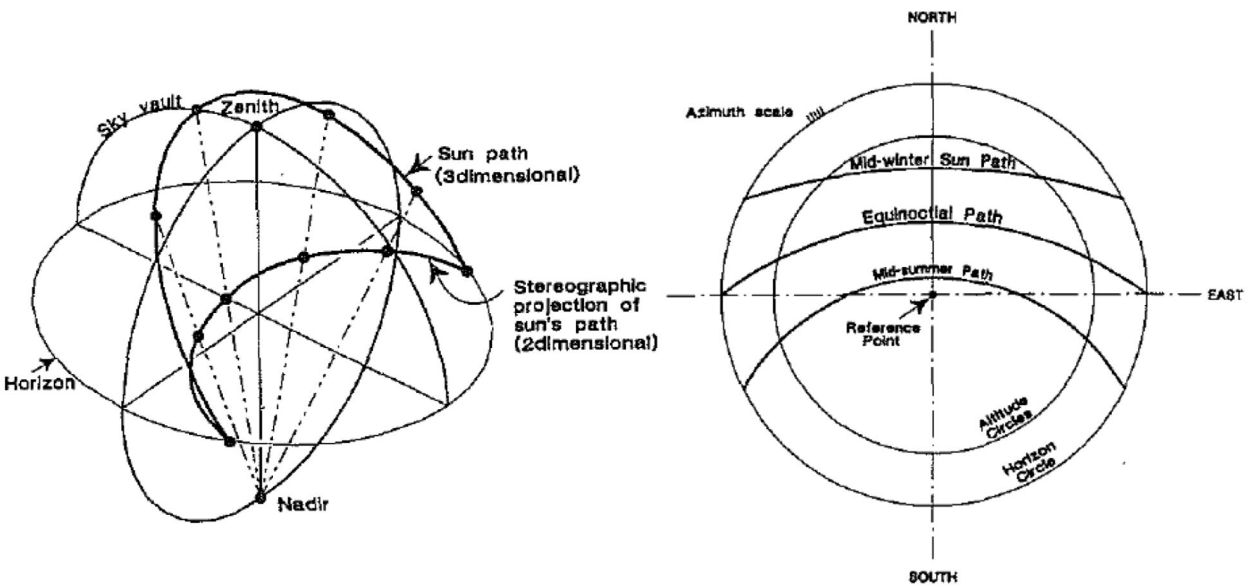

Figure 1: Stereographic projection of the sun's path onto a horizontal plane

Inspection of Figure 2 indicates that the sun paths are shown from December 22 to June 21. The second half of the year has identical sun paths returning to December 22. Therefore the following curves on a solar chart represent identical sun paths:

- December 22
  - 16 January (27 November)
  - 26 February (17 October)
  - 21 March (23 September)
  - 14 April (31 August)
  - 26 May (19 July)
  - June 21

The time lines change curvature during the different halves of the year forming a lazy 8 pattern when the full year is shown on the one graph. Reflection sun charts show the mirror image of the sun's path about the vertical plane of the surface that is being investigated.

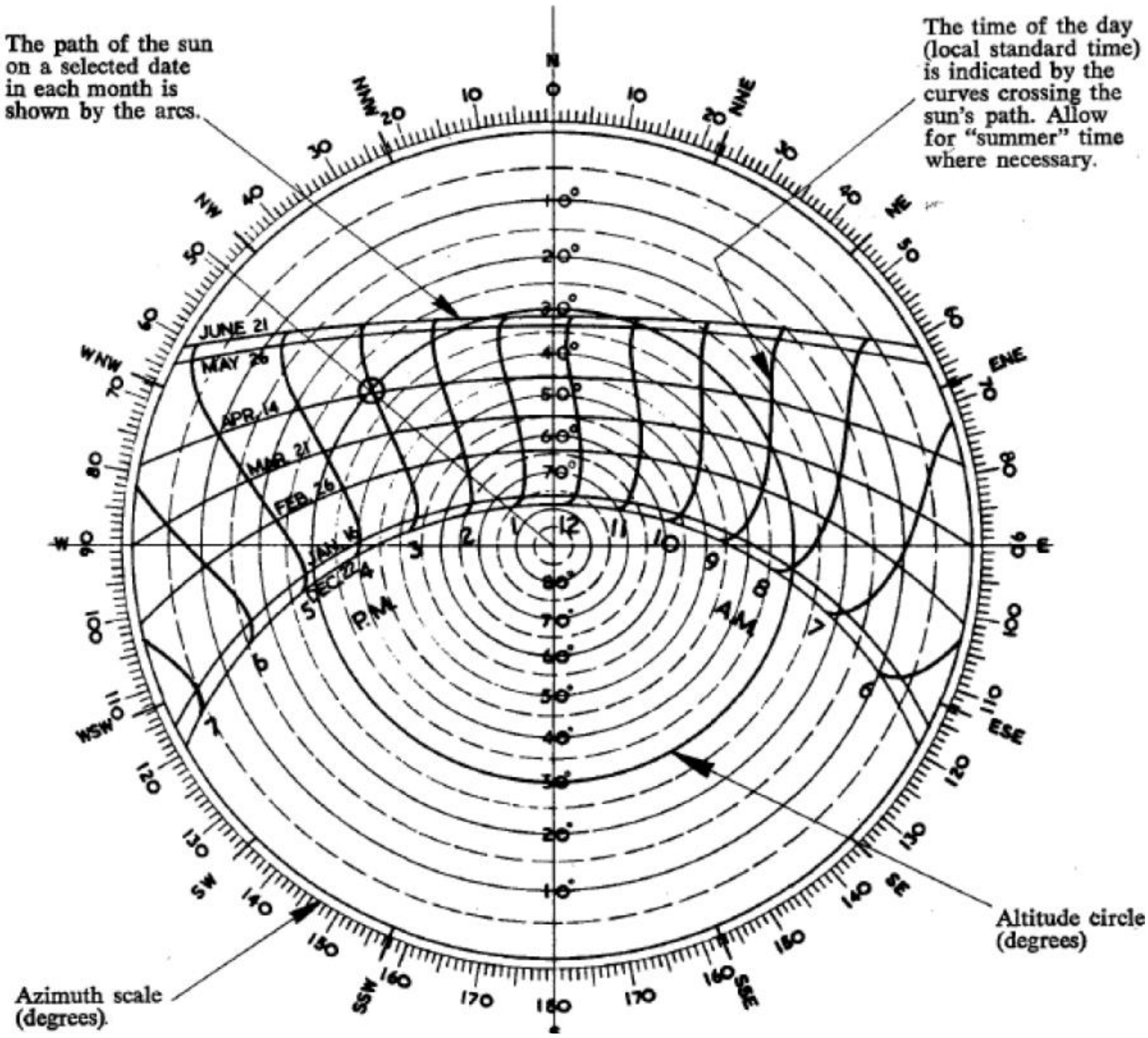

Figure 2: A typical sun chart showing six months, June to December

3.0 Reflection and Specular Surfaces

Specular surfaces are reflective, irrespective of the opacity of the material. As the angle of the incident light exceeds 60°, relative to the surface normal, the surface tends to exhibit mirror-like qualities. Figure 3a indicates that the amount of light reflected by glass increases with incidence angle, creating a mirror effect as shown in Figure 3b. Glass reflectance is generally specified normal to the surface and some quite low reflectance glass is available upon this basis.

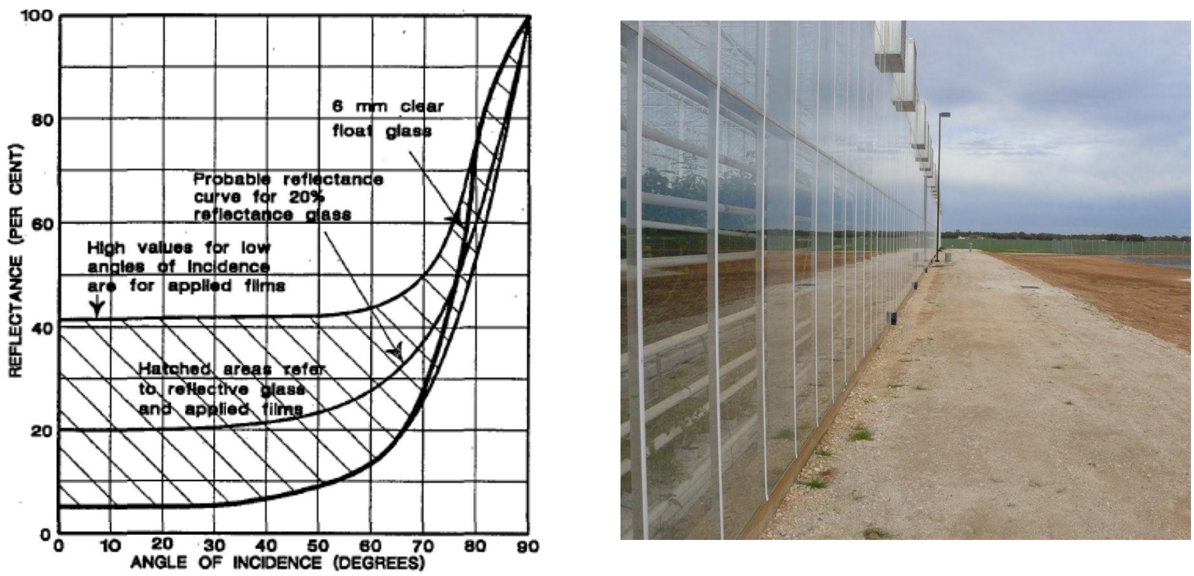

Figure 3: a) Reflectance of various glass surfaces with change in angle of incident light (Hassall, 1991)
b) The higher the angle of incident light the more glass acts like a mirror; also relative to observer's angle of view.

4.0 Methodology for Reflected Sunlight Assessment

The Rozelle site is analysed for solar glare reflected from vertical facades towards selected observer points. The observer points have been selected to represent motorists travelling in specific directions.

4.1 Site Analysis

Following inspection of surrounding streets (refer Appendix A) a number of motorist positions were selected as representative of likely contentious locations whereby motorists might be potentially affected by reflected solar glare from the various facades of the Rozelle Village project. Eight observer points, MP_1 to MP_8, are selected for the analysis in order to provide an overall assessment of reflected solar glare from the site. The observer points are selected from the perspective of motorists travelling along the three roads bounding the site - Victoria Rd, Darling St and Waterloo St. Eleven reflecting facades, G_1 to G_{11}, visible from the motorist locations. The selected facades and observer points are indicated on Figure 4.

Figure 4: Schematic of the site, indicating motorist points MP_1 through to MP_8 and main glazed facades G_1 to G_9.

4.2 Glare Criterion

The threshold for unacceptable glare is based on Hassall's [1] recommendation of a maximum luminance value at the observer point of 500 cdm^{-2}.

4.3 Calculation of the Virtual Sun

A solar chart is a two dimensional representation of the path of the sun throughout the year as indicated in Section 2.0. The orientation of the vertical glass façade is plotted on the sun chart and the sun paths are mirrored about this axis. The reflecting surface of each façade is plotted on a solar chart using the azimuth and altitude angle relative to the observation point. Reflections back to the observation point occur when the path of the virtual sun intersects the plotted façade representation. The particular day and time during which the reflection occurs can be read directly from the intersection on the solar chart. The result does not incorporate daylight savings time.

The position of the virtual sun is calculated according to Figure 5. The algorithms are incorporated into excel spread sheets for rapid calculation. The spreadsheets are a direct interpretation of the manual calculations set out in Hassall (1). The calculations are based on specific motorist lines-of-sight and use the sun path information and the relative angles of the façade reflection representation to determine the likely luminance of the sun's reflected image.

4.4 Luminance Calculations

The veiling luminance calculations are completed for the specific task of driving, for which the observer's viewing direction can be predicted. The direction of view, or bearing as referred to in the calculations, is taken to be along the road in the direction of travel. Veiling luminance is when the amount of light being scattered within the eye of the observer obscures the view as if a veil had been drawn over that person's eyes.

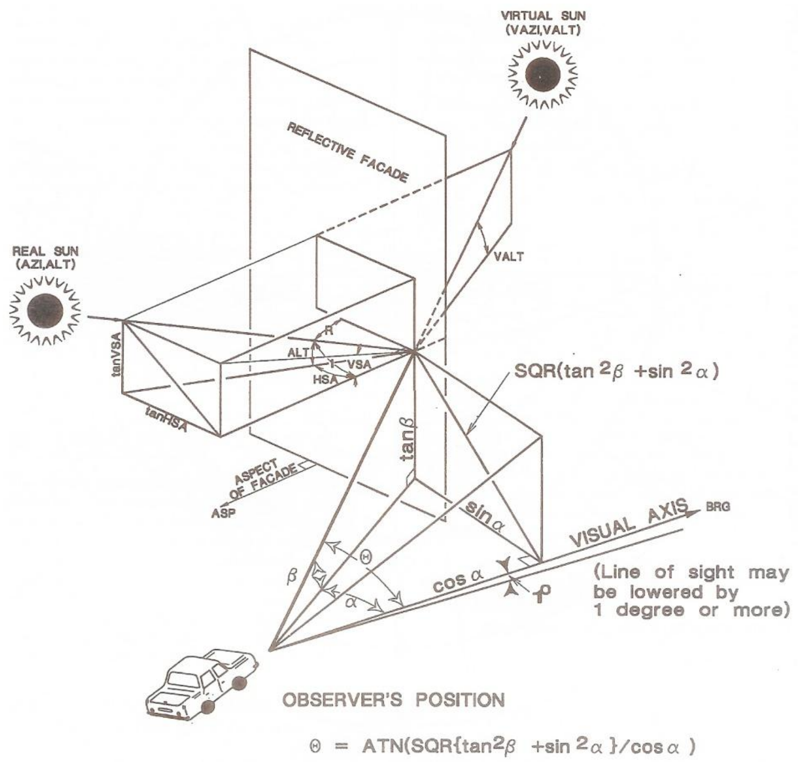

Figure 5: Calculation of the position of the virtual sun relative to a driver's line-of-sight

The glare limit of 500 cd.m^{-2} prescribed in [1] relates to disability glare, that is when the amount of glare (or veiling luminance) affects the ability to see the road. The calculations incorporate both the position of the virtual sun relative to a motorist and the motorist's line of sight along the road. As the visual axis of a motorist moves away from the position of the virtual sun, the magnitude of the calculated luminance decreases. The veiling luminance is calculated using the Holladay Formula [1].

The visible reflectance of the glass types selected for Rozelle is itemised in Table 1. The quoted Viridian data refers to the visible reflectance at 0° incidence of light, that is at normal to the façade plane; the actual glass reflectance will increase with the angle of incident light as discussed in Section 3.0 and is estimated using Figure 3a.

Table 1: Visible reflectance of glass types at 0° incidence

Glass type	Visible reflectance	Facade
Grey (windows)	12%	G_2, G_3 G_5,
Balustrades	8%	G_2, G_3 G_5,
White glass	20%	G_1, G_7, G_{10}, G_{11},
Grey (curtain wall)	12%	G_8, G_9

Each façade has been considered worst case as if full height glazed curtain wall to simplify the initial analysis. If the initial analysis reveals a potential problem a further analysis is conducted with a more detailed breakdown of the façade articulation. For those motorist positions (MP_1 through to MP_8) and glazed facades (G_1 through to G_{11}) where the façade appears to rise well above 20 degrees (up to 50 and 70 or more degrees) only the lower portion closest to 20 degrees (or less) is considered in calculation as that is most likely to cause glare and anything above that angle will be screened from view by the average car window cut-off angle. Sun-visor cut-off would provide even further protection if necessary.

5.0 Results

Solar glare analysis comprises two components:

1. Solar charts, which indicate whether or not there is potential solar reflections towards each an observer point;
2. Luminance calculations, which determine if the luminance of the solar reflection exceeds 500 cd.m^{-2}.

5.1 Solar Chart Results

The solar chart results of Figure 6 to Figure 14 correspond to the observer points MP_1 to MP_8 and the facades G_1 to G_9, which were nominated in Section 4.1.

5.1.1 Glazed façade G_1 aspect 234 degrees (high rise)

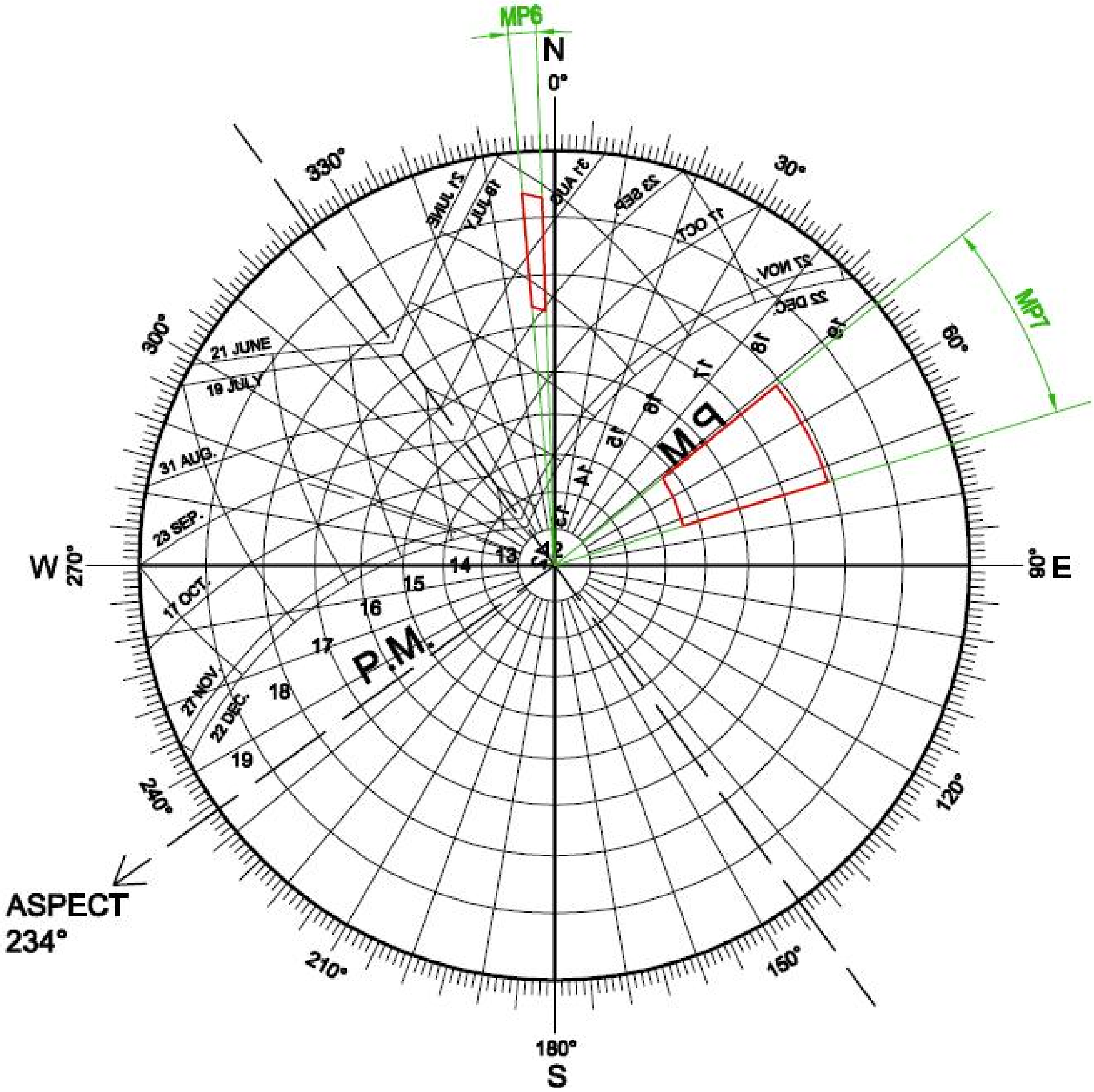

Figure 6: Solar chart result for paper backed Glazed facade G_1, facing Darling Street (MP_6) and Waterloo Streets (MP_7) respectively

5.1.2 Glazed façade G_2 aspect 307 degrees (high rise)

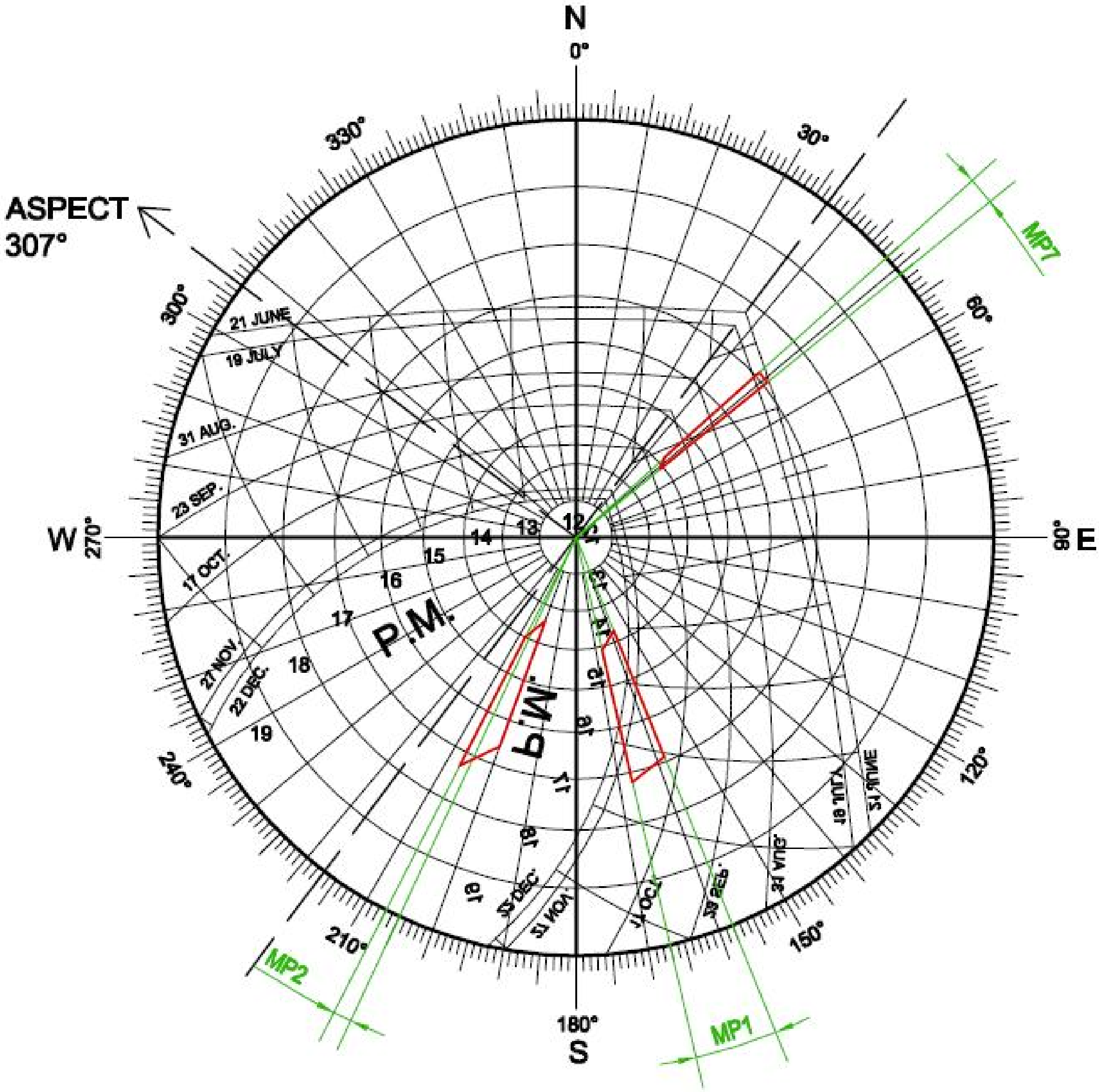

Figure 7: Solar chart results for high-rise Glazed facade G_2, facing NW towards Iron Cove Bridge Victoria Rd (MP_1 and MP_2) plus Waterloo Street (MP_7).

5.1.3 Glazed façade G_3 aspect 36 degrees (high rise)

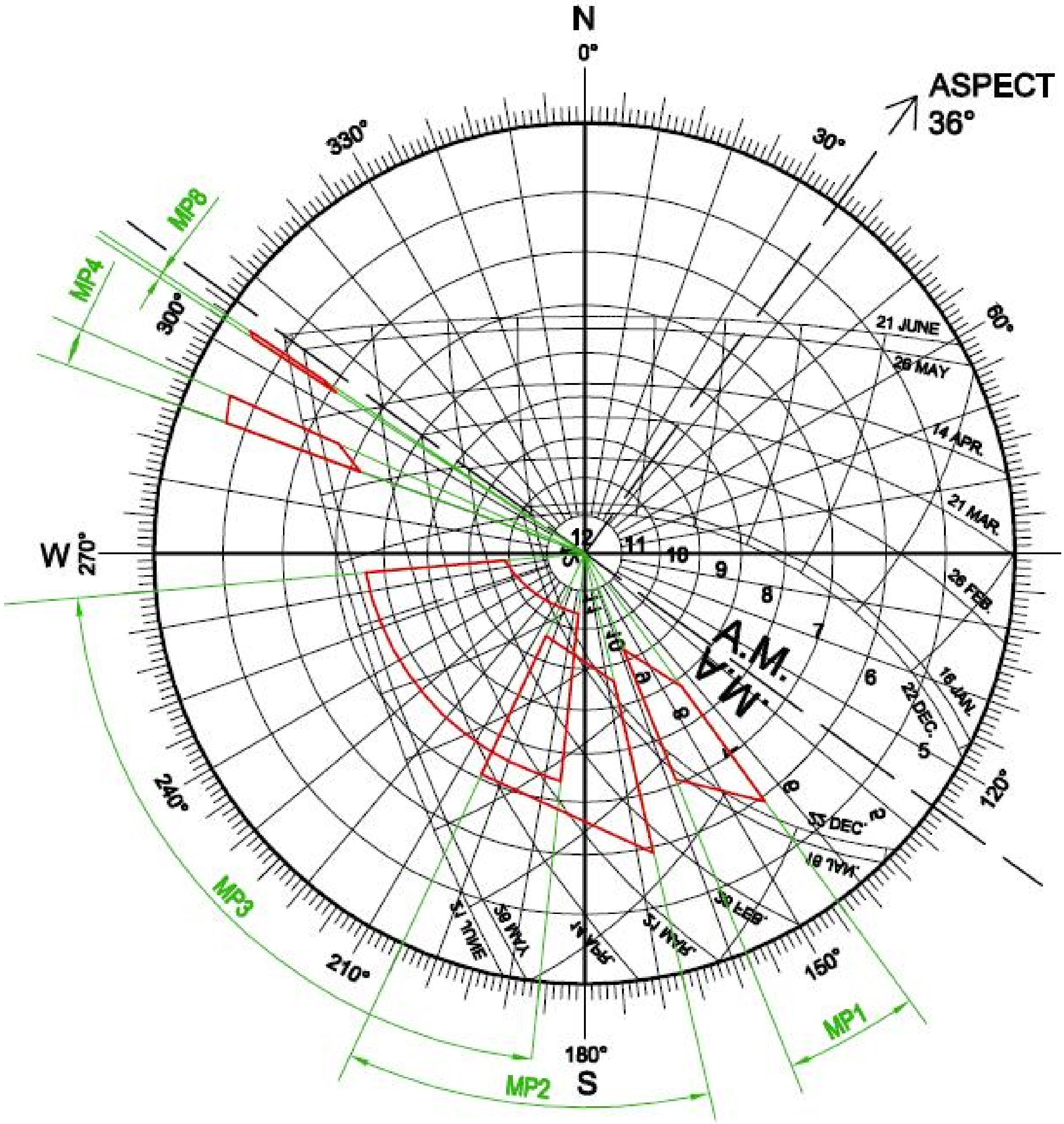

Figure 8: Solar chart results for high-rise Glazed facade G_3, facing Victoria Road (MP_1, MP_3, MP_8) plus Wellington Street (MP_2) and Darling Street (MP_4).

5.1.4 Glazed façade G_4 aspect 37 degrees (low rise)

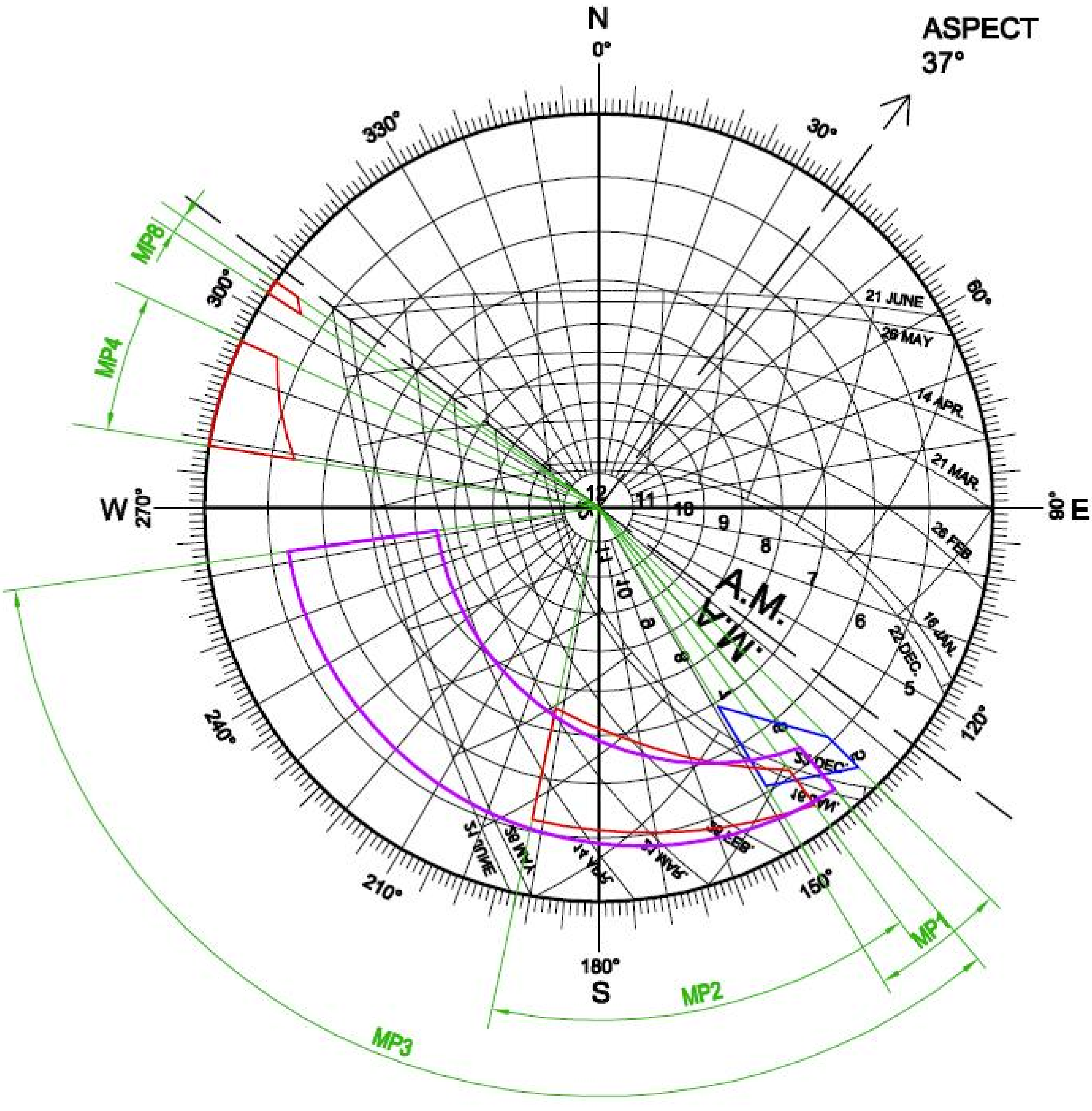

Figure 9: Solar chart results for Glazed facade G_4, facing Victoria Road (MP_1, MP_3, MP_8) plus Wellington Street (MP_2) and Darling Street (MP_4).

5.1.5 Glazed façade G_5 aspect 75 degrees (high rise)

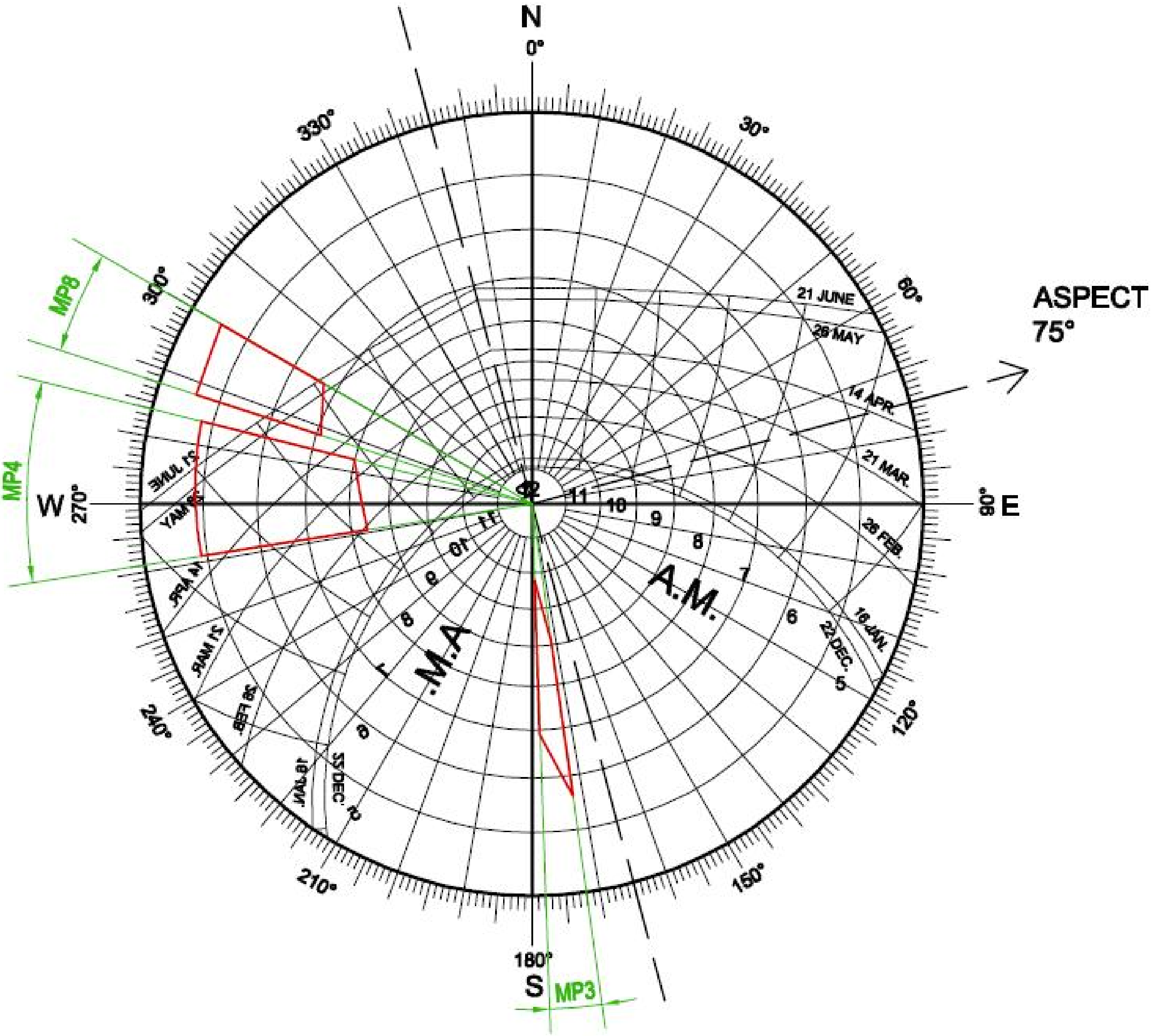

Figure 10: Solar chart results for Glazed facade G_5, facing east towards Victoria Road and Darling Street. (MP_3 and MP_8) plus Darling Street (MP_4).

5.1.6 Glazed façade G_6 aspect 165 degrees (high rise)

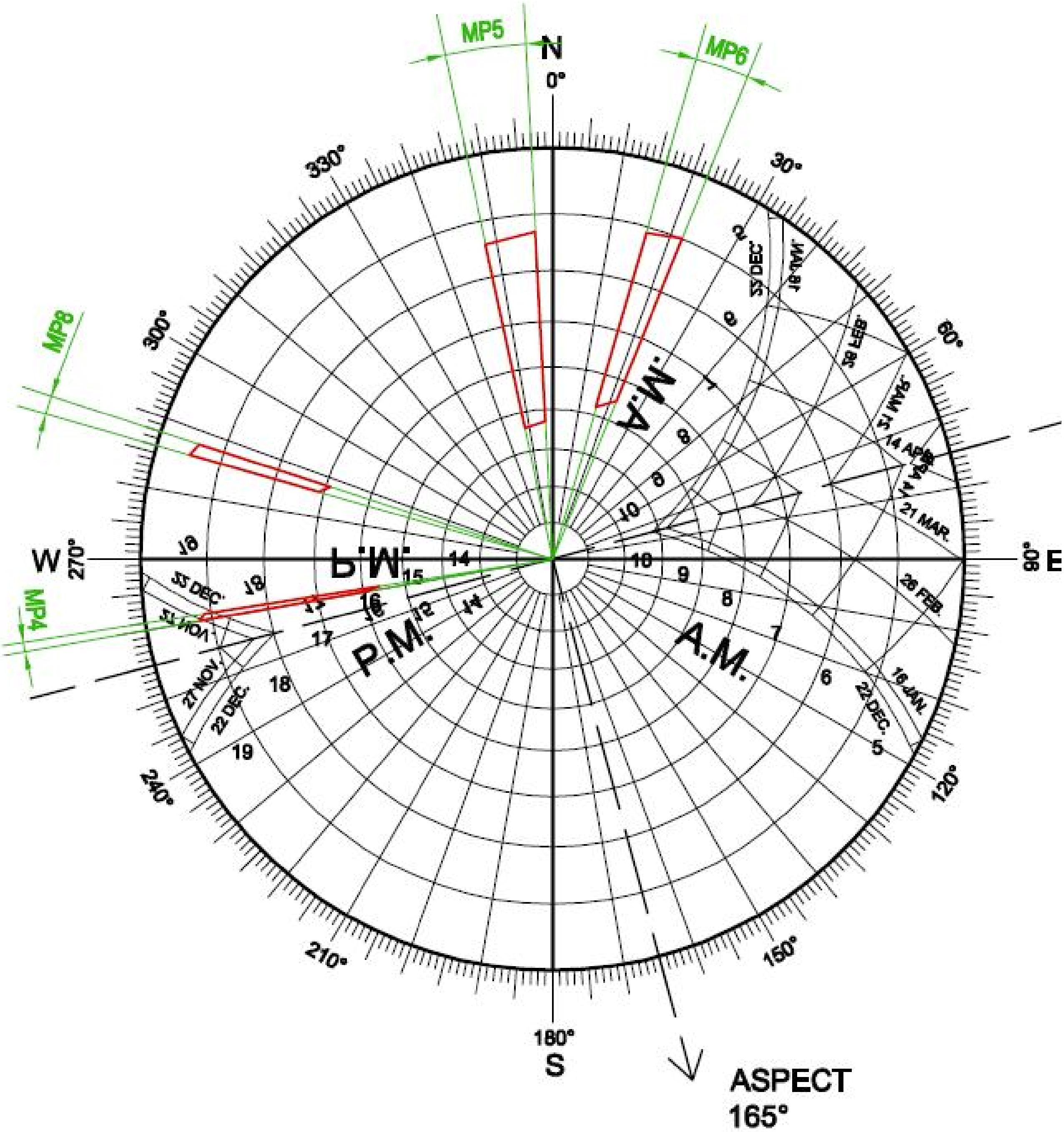

Figure 11: Solar chart results for Glazed facade G_6, facing east towards Victoria Road (MP_8) and Darling Street. (MP_4 and MP_6) plus Belmore Street (MP_5).

5.1.7 Glazed façade G_7 aspect 155 degrees (high rise)

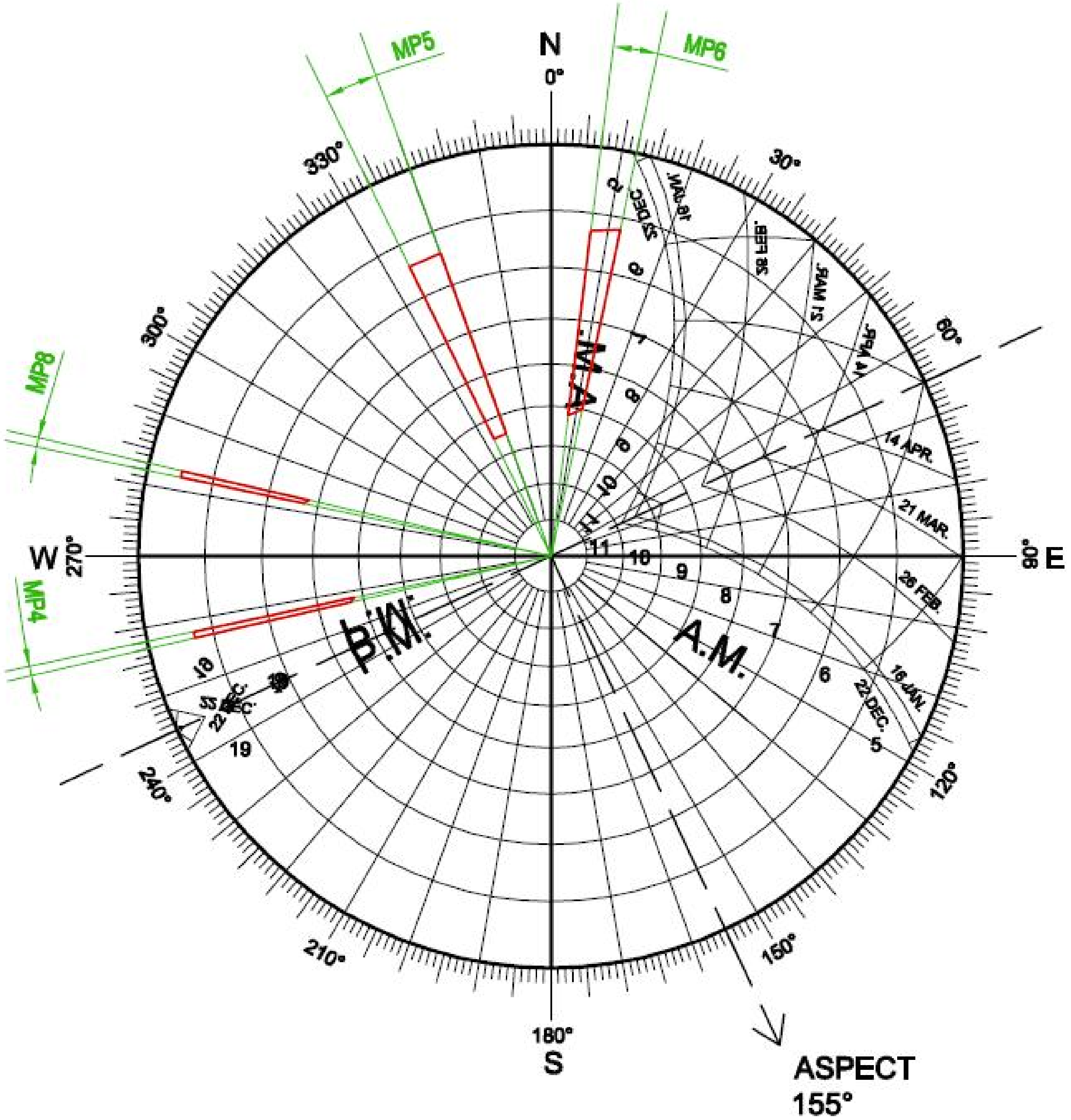

Figure 12: Solar chart results for paper backed Glazed facade G_7, facing SSE towards Darling Street (MP_4 and MP_6), Victoria Road (MP_8) and Belmore Street (MP_5).

5.1.8 Glazed façade G_8 aspect 247 degrees (high rise)

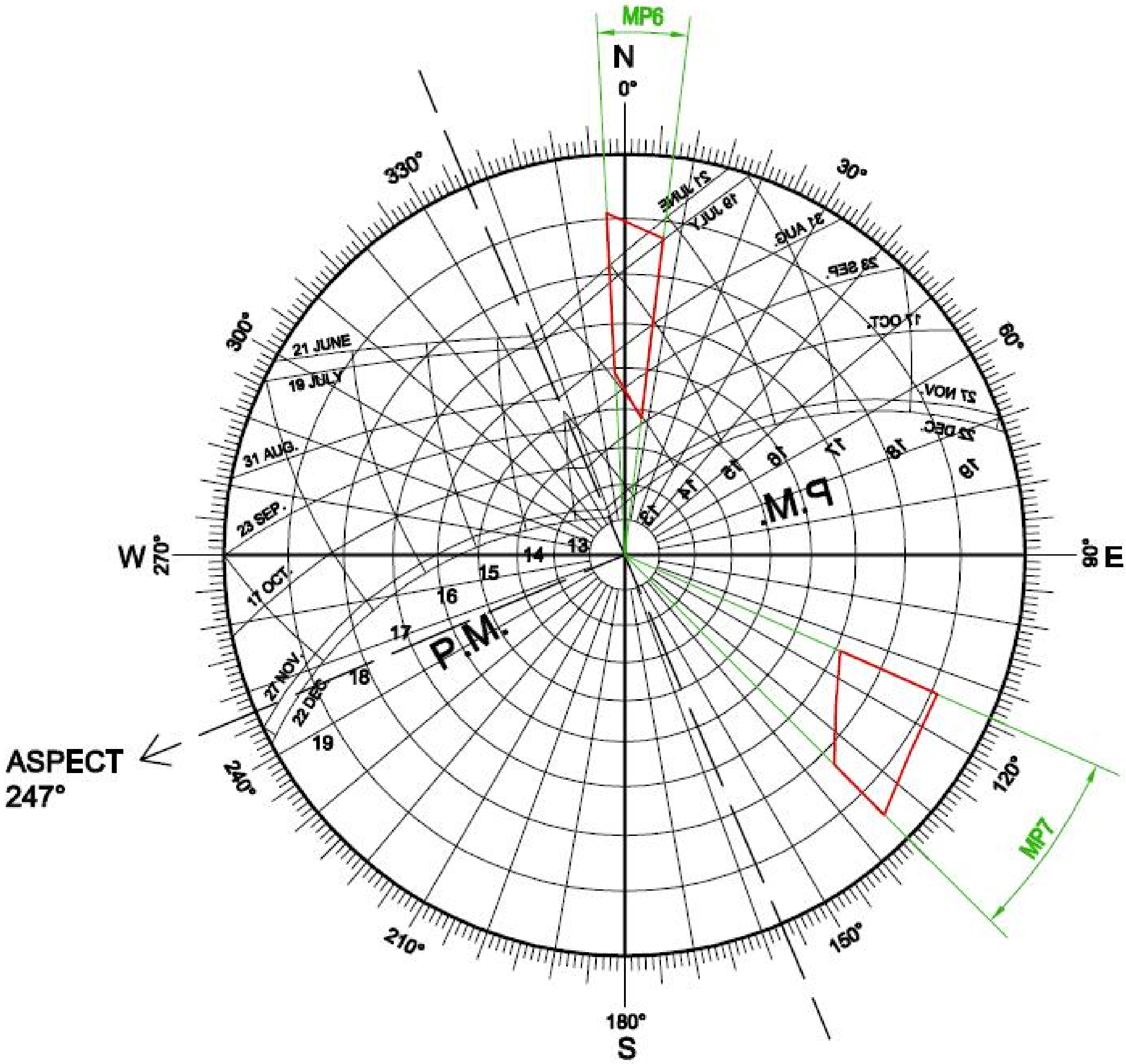

Figure 13: Solar chart results for Glazed facade G_8, facing Waterloo Street at an angle MP_7 and Darling Street (MP_6).

5.1.9 Glazed façade G_9 aspect 337 degrees (high rise)

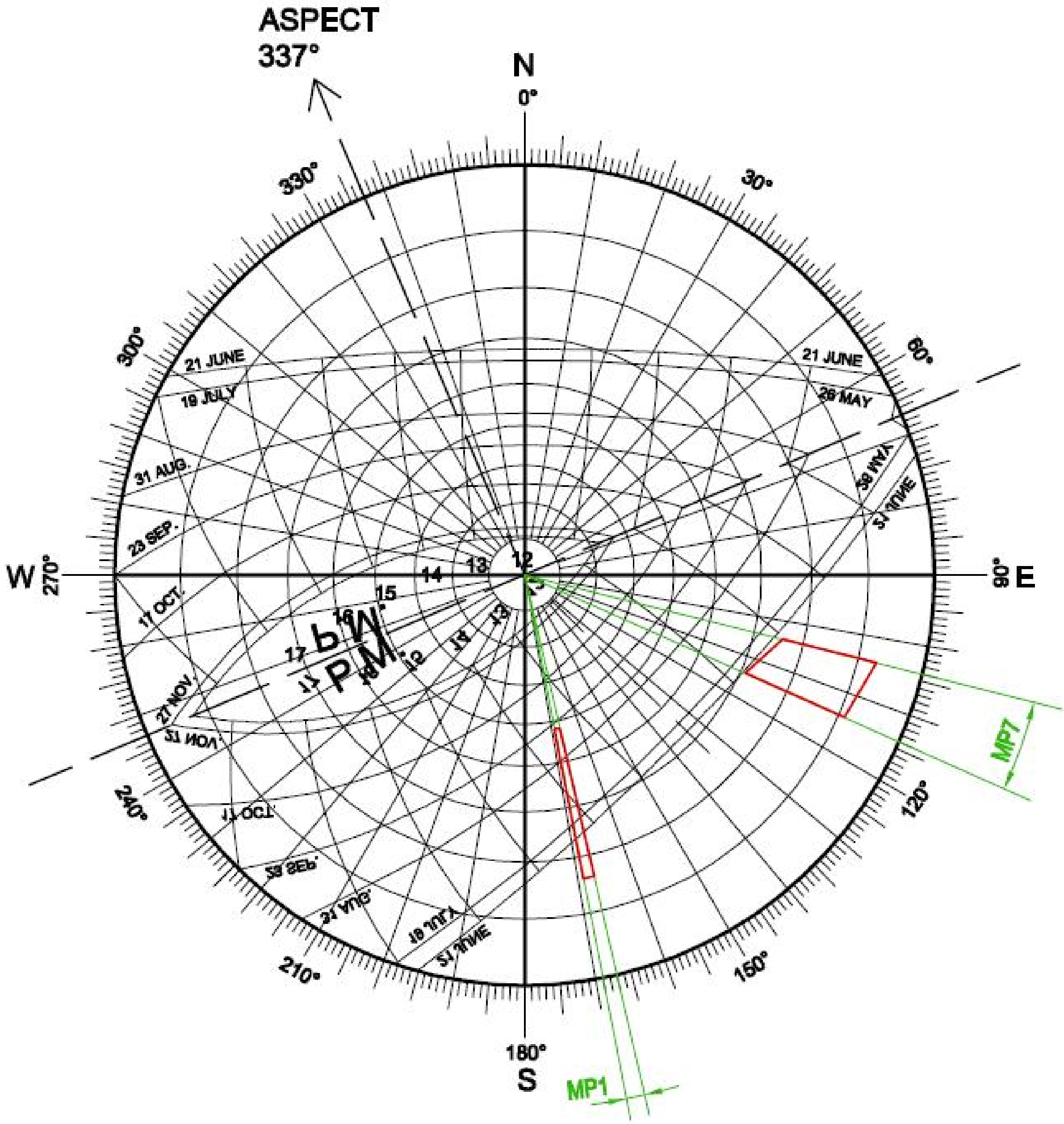

Figure 14: Solar chart results for Glazed facade G_9, facing NNW at an angle to Victoria Road (MP_1) and also to Waterloo Street (MP_7).

5.1.10 Glazed façade G_{10} aspect 342 degrees (high rise)

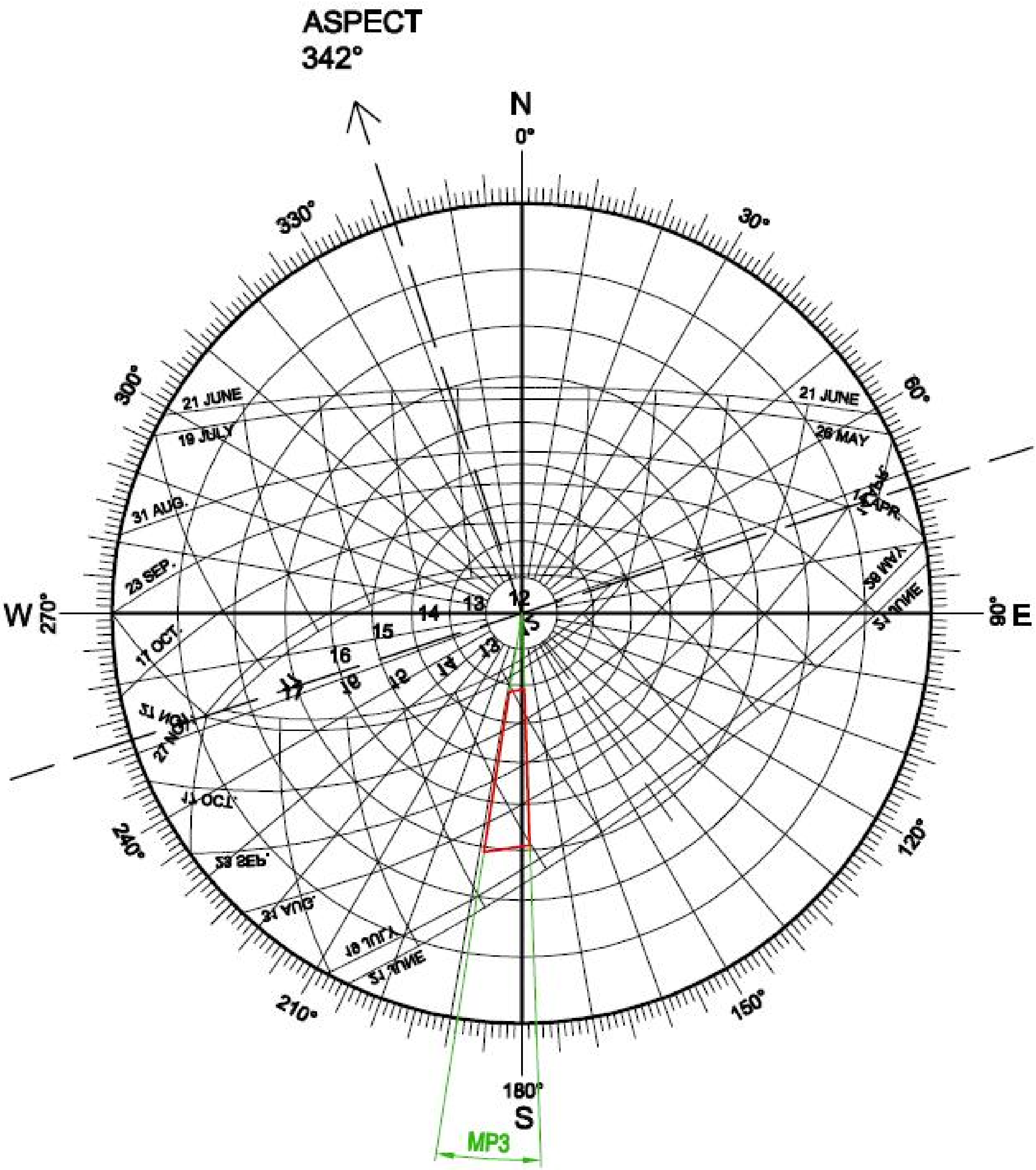

Figure 15: Solar chart results for white Glazed facade G_{10}, facing N at an angle to Victoria Road (MP_3).

5.1.11 Glazed façade G_{11} aspect 118 degrees (high rise)

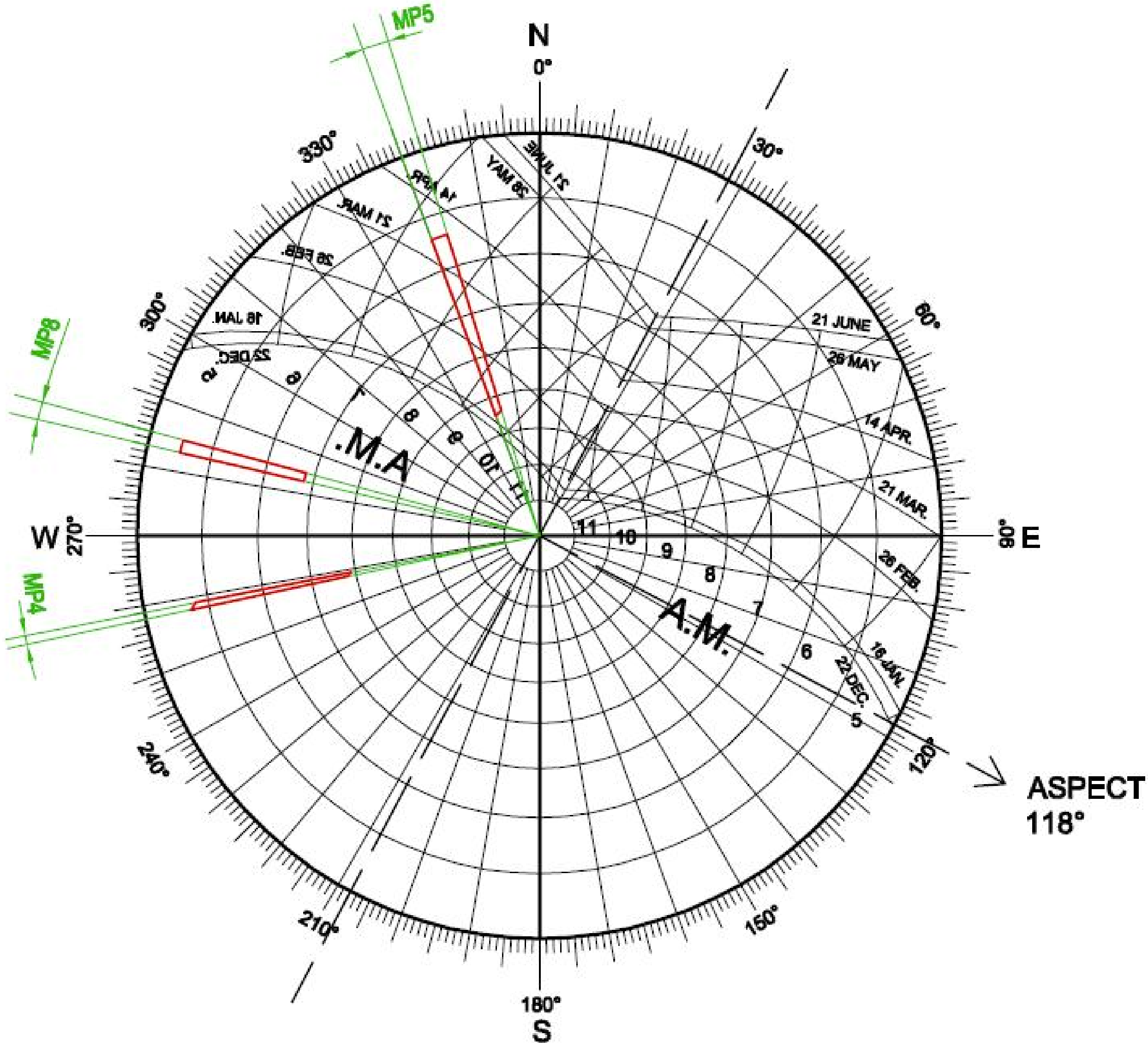

Figure 16: Solar chart results for white Glazed facade G_{11}, facing SSE at an angle to Victoria Road (MP8) and also to darling Street (MP_4 and MP_5).

5.2 Luminance Calculations

Table 2 summarises the presence and magnitude of solar reflections expected at each of the observer locations. The data corresponds to the solar charts plotted in Figure 6 to Figure 16; details of the luminance calculations are provided in Appendix B.

Table 2: Summary of the luminance calculations for observer points MP_1 to MP_8 and Glazed facades G_1 to G11

Observer Location	Facade	Driver viewing direction (BRG)	Presence of solar reflections					
			Months	Time (without daylight savings)	Angle above horizon	Luminance Value ($cd.m^{-2}$)	Acceptable	Comments
MP1 Victoria Rd heading towards City	Glazing 2 high-rise (facing NNW towards Iron Cove bridge along Victoria Rd)	127° (direction towards City)	Begin Nov (mid Feb) thru mid Dec and to Feb	1630 to 1445hrs respectively	30 to 60 deg respectively	43	Yes	Mid November / mid February 1610 hrs sun altitude 31 deg, OK
	Glazing 3 high-rise (parallel to Victoria Rd)		Late Nov (mid Jan) thru mid Dec to Jan	0700 to 0800 hrs	25 to 35 deg respectively	150	Yes	Mid December 0730 hrs sun altitude 30 deg, OK
	Glazing 4 low-rise (parallel to Victoria Rd)		Mid Dec	0600 hrs duration minutes only	10 deg	557 if 100% of façade 12% reflective glass	No if straight curtain wall but yes with vertical louvres.	Mid December 0600 hrs sun altitude 11 deg, However, this articulated façade has perpendicular louvres therefore OK
	Glazing 9 high rise (facing NNW towards Iron Cove bridge along Victoria Rd)		Mid mar (mid Sept) thru mid Jun to Sept	130 to 1420 hrs respectively	48 to 25 deg respectively	34	Yes	Mid June 1415 hrs sun altitude 25 degrees, OK
MP2 Victoria Rd towards City cutting across Victoria Rd	Glazing 2 high-rise (facing NNW towards Iron Cove bridge along Victoria Rd)	205° (turn onto Victoria Rd and cross to turning lanes)	Nil					
	Glazing 3 high-rise (parallel to Victoria Rd)		Mid Apr (end Aug) thru mid Dec to Aug	0730 to 1045 hrs respectively	20 to 65 deg respectively	64	Yes	Mid December 0810 hrs sun altitude 30 deg, OK
	Glazing 4 low-rise (parallel to Victoria Rd)		Early may (late Jul) thru to mid Dec and to July	0900 to 0530 hrs respectively	35 to 5 deg respectively	18	Yes	Early February / late October 0600 hrs sun altitude 8 deg, OK

Table 3 (cont)

Observer Location	Facade	Driver viewing direction (BRG)	Presence of solar reflections: Months	Time (without daylight savings)	Angle above horizon	Luminance Value (cd.m^{-2})	Acceptable	Comments
MP3 Victoria Rd heading towards City in turning lane	Glazing 3 high-rise (parallel to Victoria Rd)	233° (direction towards City)	Mid Jul (late May) thru mid Dec to May	0900 to 1245hrs respectively	35 to 75 deg respectively	63	Yes	Late April / early August 1200 hrs, sun altitude 40 deg, OK
	Glazing 4 low-rise (parallel to Victoria Rd)		Mid Jun thru year to mid Dec	1230 thru to 0530 hrs respectively	45 to 5 deg respectively	5	Yes	Late February / mid October 0630 hrs sun altitude 10 deg, OK
	Glazing 5 high-rise (facing east at an angle to Victoria Rd)		Nil					
	Glazing 10 high rise (N at an angle to Victoria Rd)		Mid Jan (late Nov) thru to late Apr (end July)	1250 to 1430 hrs respectively	70 to 30 deg respectively	37	Yes	Early April / mid August 0630 sun altitude 35 deg, OK
MP4 Darling St heading WSW	Glazing 3 high-rise (parallel to Victoria Rd)	225° (direction WSW)	Begin May (end Jul) thru mid June to Jul	1430 to 1450 hrs respectively	30 to 20 deg respectively	32	Yes	Mid June 1450 hrs sun altitude 20 deg, OK
	Glazing 4 low-rise (parallel to Victoria Rd)		Nil					
	Glazing 5 high-rise (facing east at an angle to Victoria Rd)		Late Feb (mid Oct) thru mid Jun to Oct	0730 to 0945 hrs respectively	45 to 8 deg respectively	9	Yes	Mid June 0820 hrs sun altitude 20 deg, OK
	Glazing 6 high-rise (facing ESE at an angle to Darling Street)		Late Nov (mid Jan) thru mid Dec to Jan	1820 to 1810 hrs respectively	10 deg	249	Yes	Mid December 1810 hrs sun altitude 11 deg, OK
	Glazing 7 high-rise (facing ESE at an angle to Darling Street)		Nil					
	Glazing 11 high-rise (facing SE at an angle to Darling Street)		Nil					

Table 3 (cont)

Observer Location	Facade	Driver viewing direction (BRG)	Presence of solar reflections					
			Months	Time (without daylight savings)	Angle above horizon	Luminance Value (cd.m^{-2})	Acceptable	Comments
MP5 Belmore St turning into Darling St ENE	Glazing 6 high-rise (facing ESE at an angle to Darling Street)	355° (direction towards City)	Nil					
	Glazing 7 high-rise (facing ESE at an angle to Darling Street)		Nil					
	Glazing 11 high-rise (facing SE at an angle to Darling Street)		Late Jan (early Nov) thru to late Mar (late Sept)	0930 to 0730 hrs respectively	55 to 15 deg respectively	21	Yes	Mid June 0915 hrs sun altitude 28 deg, OK
MP6 Darling St heading ENE	Glazing 1 high-rise (facing Waterloo St)	53,5° (direction ENE)	Late Mar to late May (and mid Aug to mid Sept)	1645 to 1545 hrs respectively	10 to 25 deg respectively	26	Yes	Mid August / early April 1600 hrs sun altitude 11 deg, OK
	Glazing 6 high-rise (facing ESE at an angle to Darling Street)		Nil					
	Glazing 7 high-rise (facing ESE at an angle to Darling Street)		Nil					
	Glazing 8 high-rise (facing Waterloo St)		Late Feb (mid Oct) thru mid Jun to Oct	1400 to 1545 hrs respectively	50 to 15 deg respectively	38	Yes	Mid June 1515 hrs sun altitude 16 deg, OK
MP7 Waterloo St heading SSE	Glazing 1 high-rise (facing Waterloo St)	144,5° (direction SSE)	Nil					
	Glazing 2 high-rise (facing NNW towards Iron Cove bridge along Victoria Rd)		Mid Mar (late Sept) thru mid Jun to Sept	1215 to 1130 hrs respectively	60 to 30 deg respectively	8	Yes	Mid July / late May 1330 hrs sun altitude 30 deg, OK
	Glazing 8 high-rise (facing Waterloo St)		Nil					
	Glazing 9 high-rise (facing NNW towards Iron Cove bridge along Victoria Rd)		Nil					

Table 3 (cont)

Observer Location	Facade	Driver viewing direction (BRG)	Presence of solar reflections					Comments
			Months	Time (without daylight savings)	Angle above horizon	Luminance Value (cd.m^{-2})	Acceptable	
MP8 Victoria Rd heading away from the City	Glazing 3 high-rise (parallel to Victoria Rd)	305° (away from City)	Early May (end July) thru mid Jun to Jul	1530 to 1550 hrs respectively	10 to 20 deg respectively	4602	No, but duration minutes only (refer comments)	Mid June 1550 hrs sun altitude 11 deg. It is arguable that the rise up to Darling Street and the buildings and awnings on the left of Victoria Road may well shield this location from this potential effect. The kerb side lane will definitely be shielded. The other consideration is that the sun position will be directly along Victoria road (308 degrees azimuth and 11 degrees above the horizon and motorists therefore will be using their sun visors and hands to screen direct views of the sun which will be adjacent the reflecting surface.
	Glazing 4 low-rise (parallel to Victoria Rd)		Nil					
	Glazing 5 high-rise (facing east at an angle to Victoria Rd)		Late Apr (mid Aug) thru mid Jun to Aug)	0915 to 1010 hrs respectively	20 to 30 deg respectively	150	Yes	Mid June 0915 hrs sun altitude 28 deg
	Glazing 6 high-rise (facing ESE at an angle to Darling Street)		Nil					
	Glazing 7 high-rise (facing ESE at an angle to Darling Street)		Nil					
	Glazing 11 high-rise (facing SE at an angle to Darling Street)		Nil					

6.0 Discussion of Results

6.1 Motorists

Reflected glare reaching motorists travelling on Victoria Rd is important with respect to safety, due to the expected high traffic density and vehicle speed. The results presented in Figure 6 to Figure 16 and Table 2 indicates that most periods of reflected sunlight are relatively short. The low-rise façade (G_4) parallel to Victoria Road has potentially longer periods although with fenestration such as vertical louvres, any potential effect is negated. Figure 17 shows typical angles for sun-visor cut-off at 5 degrees and average window cut-off at 20 degrees.

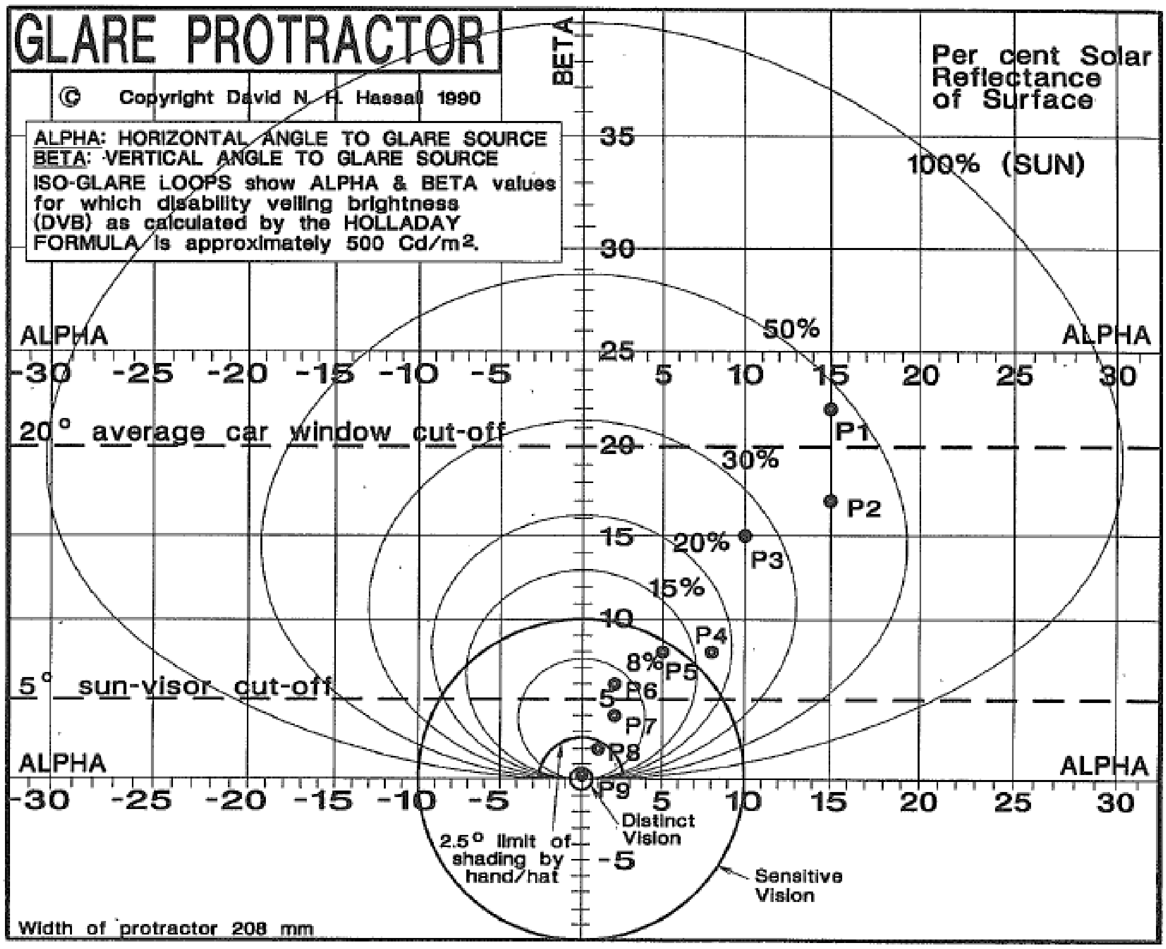

Figure 17: Glare Protractor (Hassall (ref 1) Showing Typical Angles for Sun-visor Cut-off and Average Window Cut-off.

6.1.1 Driving South-East on Victoria Rd (Observer points MP_1 and MP_3)

Motorists travelling south-east on Victoria Rd, or towards the city, will be looking uphill at an angle of approximately four degrees as they approach the development. That is, five degrees of upward slope less one degree for driver view approximately by 60 metres ahead. Their line-of-sight is likely to be towards the reflecting facades due to the two right hand turning lanes onto Darling St.

- There is potential reflected solar glare to motorists at MP_1 from high-rise facades G_2, G_3 and G_9 although the level of glare is below the acceptable threshold (<500 cd.m^{-2}), refer Table 2
- If low-rise façade G_4 was a plain glazed curtain wall there would be unacceptable reflected solar glare (>500 cd.m^{-2}) experienced by motorists at $MP_{1,}$ however, as vertical louvres are provided the potential for reflected solar glare will be negated.

- There is no potential for reflected solar glare to motorists at MP_3 from high-rise facade G_5.
- There is potential reflected solar glare to motorists at MP_3 from high-rise facades G_3 and G_{10} although the level of glare is below the maximum acceptable threshold (<500 cd.m^{-2}), refer Table 2
- If low-rise façade G_4 was a plain glazed curtain wall there would be acceptable reflected solar glare (<500 cd.m^{-2}) experienced by motorists at $MP_{1,}$ however, as vertical louvres are provided any potential for reflected solar glare will be negated.

6.1.2 Driving from Wellington Street (MP_2) Crossing Victoria Road into Turning Lanes towards City (Observer point MP_2)

- There is no potential for reflected solar glare to motorists at MP_2 from high-rise facade G_2.
- There is potential reflected solar glare to motorists at MP_2 from high-rise facades G_3 although the level of glare is below the maximum acceptable threshold (<500 cd.m^{-2}), refer Table 2
- If low-rise façade G_4 was a plain glazed curtain wall there would be acceptable reflected solar glare (<500 cd.m^{-2}) experienced by motorists at $MP_{2,}$ however, as vertical louvres are provided any potential for reflected solar glare will be negated.

6.1.3 Driving North-West on Victoria Rd (Observer Point MP_8)

Motorists travelling north-west on Victoria Rd, or away from the city, will also be looking uphill as they approach the development although their view of the proposed development may be obscured to varying extents depending on which lane of traffic the motorist is located in. The kerb-side lane (afternoon peak period) is likely to have most views obscured by the immediately adjacent buildings and awnings on the left side of Victoria Road.

- No reflections will be experienced from G_4, G_6, G_7 or G_{11}.
- There is potential reflected solar glare to motorists at MP_8 from high-rise facade G_5 although the level of glare is below the maximum acceptable threshold (<500 cd.m^{-2}), refer Table 2
- High-rise façade G_3 if a flat plane of glass would provide momentary unacceptable reflected solar glare (>500 cd.m^{-2}) to motorists at $MP_{8,}$ during a period of a few minutes starting mid May (and late July) at approximately 1530 hours with the actual time of occurrence being slightly later at 1550 hours in mid June. Depending on which lane of traffic the motorist is located in the immediately adjacent buildings and awnings on the left side of Victoria Road may screen views of G_3. A proposed vertical projection of 350mm (in plan) between units will be sufficient to shield the 2 degree grazing angle of incident sunlight preventing this particular situation arising at this time. Note that it is most likely that motorists will be using their sun visors as the sun position will be directly along Victoria Road (308 degrees azimuth and 11 degrees above the horizon.

6.1.4 Driving South-West on Darling St (Observer Point MP_4)

Motorists travelling south-west on Darling St are likely to pause at the traffic lights at the corner of Victoria Rd and Darling St, prior to either turning left onto Victoria Rd or continuing along Darling St. A right hand turn onto Victoria Rd is not allowed and consequently the driver's visual axis will not be directly towards the reflecting façade on Victoria Rd.

- There is no potential for reflected solar glare to motorists at MP_4 from facades G_4, G_7 or G_{11}.
- There is potential reflected solar glare to motorists at MP_4 from high-rise facades G_3, G_5 and G_6 although the level of glare is below the maximum acceptable threshold (<500 cd.m^{-2}), refer Table 2

6.1.5 Driving North on Belmore St (Observer Point MP_5)

Motorists travelling north on Belmore St are approaching the traffic lights at the intersection of Waterloo St and Darling Street.

- No reflections will be experienced from G_6, or G_7.
- There is potential reflected solar glare to motorists at MP_5 from high-rise facade G_{11} although the level of glare is below the maximum acceptable threshold (<500 cd.m^{-2}), refer Table 2

6.1.6 Driving North-East on Darling St (Observer Point MP_6)

Motorists travelling north-east on Darling St are approaching the traffic lights at the intersection of Waterloo St and Darling Street.

- No reflections will be experienced from G_6, or G_7.
- There is potential reflected solar glare to motorists at MP_6 from high-rise facades G_1 and G_8 although the level of glare is below the maximum acceptable threshold (<500 $cd.m^{-2}$), refer Table 2

6.1.7 Driving South on Waterloo St (Observer Point MP_7)

Motorists travelling north-east on Darling St are approaching the traffic lights at the intersection of Waterloo St and Darling Street.

- No reflections will be experienced from G_1, G_8, or G_9.
- There is potential reflected solar glare to motorists at MP_7 from high-rise facade G_2 although the level of glare is below the maximum acceptable threshold (<500 $cd.m^{-2}$), refer Table 2

6.2 Recommendations

The only potentially contentious situation is the momentary flash of reflected solar glare to motorists heading north-west on Victoria Road mid winter somewhere in the period 1530 to 1550 hours. The potential reflected solar glare would be from glazed façade G3, the façade facing and parallel to Victoria Road, high-rise building B2. mid winter somewhere during the period 1530 to 1550 hours, although the real sun position will be directly along Victoria road (308 degrees azimuth and 11 degrees above the horizon and motorists therefore will be using their sun visors and hands to screen direct views of the sun.

The potential for reflected solar glare can be reduced three ways:

1. Reducing the potential reflection surface to less than 30 percent of the total façade surface
2. Introducing vertical elements that sufficiently shield the potential reflection to the motorist location on Victoria Road. The incident light is at such a low grazing angle to the glass surface that it is almost a perfect mirror towards motorist point MP_8. A small protrusion would resolve the issue;
3. Relying on motorists to use sun visors.

6.3 Conclusions

Following inspection of surrounding streets a number of motorist positions (MP_1 through to MP_8) were selected as representative of likely contentious locations whereby motorists might be potentially affected by reflected solar glare from the various facades of the Rozelle Village project.

Analysis shows that for some motorist positions there is no potential for solar reflection from specific facades (refer Table 2 and Figures 6 through to 16 inclusive). Analysis also shows that for the majority of situations where there is reflected solar glare the level of glare is below the maximum acceptable threshold (<500 $cd.m^{-2}$).

One situation for motorists heading north-west on Victoria Road (MP_8) mid winter somewhere in the period 1530 to 1550 hours could potentially produce excessive reflected solar glare from glazed façade G_3, the façade facing and parallel to Victoria Road, high-rise building B2 during mid winter, however, a vertical projection of 350mm (in plan view) between units has now been proposed that will shield the 2 degree grazing incident sunlight at this time thus preventing the potential problem for the period and location noted.

7.0 References

1. Reflectivity, Dealing with Rogue Solar Reflections, D N H Hassall, 1991

Appendix A - Potential Motorist Views

Original site investigation of surrounding streets and potential views for motorists.

Motorist Position: Victoria Road after cnr Terry Street

Motorist Position: Victoria Road before cnr Crystal Street

Motorist Position MP1: Victoria Road before cnr Wellington Street

Motorist Position MP8: Victoria Road heading NW

Motorist Position MP4: Darling Street cnr Victoria Road (no right turn)

Motorist Position MP6: Darling Street heading NE

Appendix B - Calculations in Tables 3 to 20

Veiling luminance calculations towards Motorist Positions (MPx).

Table 3 MP1 Victoria Road from G2

1	**Location:**	MP1 Victoria Road from G2	Calcs
	Month:	Mid November/ mid February	
	Time:	1610 hrs	
	Façade Aspect (ASP):	307	
	Direction of View (BRG) :	127	
	Sun position:		
	AZI	269	
	ALT	31	
2	**Solar Power (w/m2):**	815	
3	**Luminous Efficacy (lm/w):**	125	
4	**Solar Illumination(lux):**	101875	
5	**Solar Position relative to Façade:**		
		HAS (deg)	-38
		VSA (deg)	37.3
		I (deg)	47.5
6	**Virtual Sun position:**		
		VALT(deg)	31
		VAZI(deg)	165
		VAZI(deg) absolute	165
7	**Glare position relative to observer:**		
		Alpha (deg)	38
		Beta (deg)	31
		Theta (deg)	47.5
8	**Reflectivity of glass:**		
		At normal (%)	12
		At angle of incidence	
		47.5	14
9	**Fraction of façade spectrally reflective:**		1.0
10	**Illumination at observer's eye due to glare source in plane normal to line of sight (lux):**	9633	
11	**Equivalent veiling luminance - Holladay formula (cd/m2):**	43	
12	**Provisional limit to veiling luminance of 500 cd/m2 is situation acceptable?**	**Yes**	

Table 4 MP1 Victoria Road from G3

1	**Location:**	MP1 Victoria Road from G3	Calcs
	Month:	Mid December	
	Time:	0730 hrs	
	Façade Aspect (ASP):	36	
	Direction of View (BRG) :	127	
	Sun position:		
	AZI	100	
	ALT	30	
2	**Solar Power (w/m2):**	800	
3	**Luminous Efficacy (lm/w):**	125	
4	**Solar Illumination(lux):**	100000	
5	**Solar Position relative to Façade:**		
		HAS (deg)	64
		VSA (deg)	52.8
		I (deg)	67.7
6	**Virtual Sun position:**		
		VALT(deg)	30
		VAZI(deg)	-208
		VAZI(deg) absolute	152
7	**Glare position relative to observer:**		
		Alpha (deg)	25
		Beta (deg)	30
		Theta (deg)	38.3
8	**Reflectivity of glass:**		
		At normal (%)	12
		At angle of incidence	
		67.7	28
9	**Fraction of façade spectrally reflective:**		1.0
10	**Illumination at observer's eye due to glare source in plane normal to line of sight (lux):**	21975	
11	**Equivalent veiling luminance - Holladay formula (cd/m2):**	150	
12	**Provisional limit to veiling luminance of 500 cd/m2 is situation acceptable?**	**Yes**	

Table 5 MP1 Victoria Road from G4

1	**Location:**	MP1 Victoria Road from G4	Calcs
	Month:	Mid December	
	Time:	0600 hrs	
	Façade Aspect (ASP):	37	
	Direction of View (BRG) :	127	
	Sun position:		
	AZI	110	
	ALT	11	
2	**Solar Power (w/m2):**	515	
3	**Luminous Efficacy (lm/w):**	117	
4	**Solar Illumination(lux):**	60255	
5	**Solar Position relative to Façade:**		
		HAS (deg)	73
		VSA (deg)	33.6
		I (deg)	73.3
6	**Virtual Sun position:**		
		VALT(deg)	11
		VAZI(deg)	-216
		VAZI(deg) absolute	144
7	**Glare position relative to observer:**		
		Alpha (deg)	17
		Beta (deg)	11
		Theta (deg)	20.2
8	**Reflectivity of glass:**		
		At normal (%)	12
		At angle of incidence	
		73.3	40
9	**Fraction of façade spectrally reflective:**		1.0
10	**Illumination at observer's eye due to glare source in plane normal to line of sight (lux):**	22625	
11	**Equivalent veiling luminance - Holladay formula (cd/m2):**	557	
12	**Provisional limit to veiling luminance of 500 cd/m2 is situation acceptable?**	**No**	

Table 6 MP1 Victoria Road from G9

1	**Location:**	MP1 Victoria Road from G9	Calcs
	Month:	Mid June	
	Time:	1415 hrs	
	Façade Aspect (ASP):	337	
	Direction of View (BRG) :	127	
	Sun position:		
	AZI	326	
	ALT	25	
2	**Solar Power (w/m2):**	725	
3	**Luminous Efficacy (lm/w):**	125	
4	**Solar Illumination(lux):**	90625	
5	**Solar Position relative to Façade:**		
		HAS (deg)	-11
		VSA (deg)	25.4
		I (deg)	27.2
6	**Virtual Sun position:**		
		VALT(deg)	25
		VAZI(deg)	168
		VAZI(deg) absolute	168
7	**Glare position relative to observer:**		
		Alpha (deg)	41
		Beta (deg)	25
		Theta (deg)	46.8
8	**Reflectivity of glass:**		
		At normal (%)	12
		At angle of incidence	
		27.2	12
9	**Fraction of façade spectrally reflective:**		1.0
10	**Illumination at observer's eye due to glare source in plane normal to line of sight (lux):**	7438	
11	**Equivalent veiling luminance - Holladay formula (cd/m2):**	34	
12	**Provisional limit to veiling luminance of 500 cd/m2 is situation acceptable?**	**Yes**	

Table 7 MP2 Wellington Street from G3

1	**Location:**	MP2 Wellington Street from G3	Calcs
	Month:	Mid December	
	Time:	0810 hrs	
	Façade Aspect (ASP):	36	
	Direction of View (BRG) :	205	
	Sun position:		
	AZI	76	
	ALT	30	
2	**Solar Power (w/m2):**	800	
3	**Luminous Efficacy (lm/w):**	125	
4	**Solar Illumination(lux):**	100000	
5	**Solar Position relative to Façade:**		
		HAS (deg)	40
		VSA (deg)	37.0
		I (deg)	48.4
6	**Virtual Sun position:**		
		VALT(deg)	30
		VAZI(deg)	-184
		VAZI(deg) absolute	176
7	**Glare position relative to observer:**		
		Alpha (deg)	-29
		Beta (deg)	30
		Theta (deg)	40.8
8	**Reflectivity of glass:**		
		At normal (%)	12
		At angle of incidence	
		48.4	14
9	**Fraction of façade spectrally reflective:**		1.0
10	**Illumination at observer's eye due to glare source in plane normal to line of sight (lux):**	10603	
11	**Equivalent veiling luminance - Holladay formula (cd/m2):**	64	
12	**Provisional limit to veiling luminance of 500 cd/m2 is situation acceptable?**	**Yes**	

Table 8 MP2 Wellington Street from G4

1	**Location:**	MP2 Wellington Street from G4	Calcs
	Month:	Early Feb / late October	
	Time:	0600 hrs	
	Façade Aspect (ASP):	37	
	Direction of View (BRG) :	205	
	Sun position:		
	AZI	105	
	ALT	8	
2	**Solar Power (w/m2):**	400	
3	**Luminous Efficacy (lm/w):**	90	
4	**Solar Illumination(lux):**	36000	
5	**Solar Position relative to Façade:**		
		HAS (deg)	68
		VSA (deg)	20.6
		I (deg)	68.2
6	**Virtual Sun position:**		
		VALT(deg)	8
		VAZI(deg)	-211
		VAZI(deg) absolute	149
7	**Glare position relative to observer:**		
		Alpha (deg)	-56
		Beta (deg)	8
		Theta (deg)	56.4
8	**Reflectivity of glass:**		
		At normal (%)	12
		At angle of incidence	
		68.2	28
9	**Fraction of façade spectrally reflective:**		1.0
10	**Illumination at observer's eye due to glare source in plane normal to line of sight (lux):**	5581	
11	**Equivalent veiling luminance - Holladay formula (cd/m2):**	18	
12	**Provisional limit to veiling luminance of 500 cd/m2 is situation acceptable?**	**Yes**	

Table 9 MP3 Victoria Road from G3

1	**Location:**	MP3 Victoria Road from G3	Calcs
	Month:	Late April / early August	
	Time:	1200 hrs	
	Façade Aspect (ASP):	36	
	Direction of View (BRG) :	233	
	Sun position:		
	AZI	0	
	ALT	40	
2	**Solar Power (w/m2):**	950	
3	**Luminous Efficacy (lm/w):**	125	
4	**Solar Illumination(lux):**	118750	
5	**Solar Position relative to Façade:**		
		HAS (deg)	-36
		VSA (deg)	46.0
		I (deg)	51.7
6	**Virtual Sun position:**		
		VALT(deg)	40
		VAZI(deg)	-108
		VAZI(deg) absolute	252
7	**Glare position relative to observer:**		
		Alpha (deg)	19
		Beta (deg)	40
		Theta (deg)	43.6
8	**Reflectivity of glass:**		
		At normal (%)	12
		At angle of incidence	
		51.7	18
9	**Fraction of façade spectrally reflective:**		1.0
10	**Illumination at observer's eye due to glare source in plane normal to line of sight (lux):**	15481	
11	**Equivalent veiling luminance - Holladay formula (cd/m2):**	81	
12	**Provisional limit to veiling luminance of 500 cd/m2 is situation acceptable?**	**Yes**	

Table 10 MP3 Victoria Road from G4

1	**Location:**	MP3 Victoria Road from G4	Calcs
	Month:	Late February / mid October	
	Time:	0630 hrs	
	Façade Aspect (ASP):	37	
	Direction of View (BRG) :	233	
	Sun position:		
	AZI	95	
	ALT	10	
2	**Solar Power (w/m2):**	500	
3	**Luminous Efficacy (lm/w):**	117	
4	**Solar Illumination(lux):**	58500	
5	**Solar Position relative to Façade:**		
		HAS (deg)	58
		VSA (deg)	18.4
		I (deg)	58.5
6	**Virtual Sun position:**		
		VALT(deg)	10
		VAZI(deg)	-201
		VAZI(deg) absolute	159
7	**Glare position relative to observer:**		
		Alpha (deg)	-74
		Beta (deg)	10
		Theta (deg)	74.2
8	**Reflectivity of glass:**		
		At normal (%)	12
		At angle of incidence	
		58.5	18
9	**Fraction of façade spectrally reflective:**		1.0
10	**Illumination at observer's eye due to glare source in plane normal to line of sight (lux):**	2857	
11	**Equivalent veiling luminance - Holladay formula (cd/m2):**	5	
12	**Provisional limit to veiling luminance of 500 cd/m2 is situation acceptable?**	**Yes**	

Table 11 MP3 Victoria Road from G10

1	**Location:**	MP3 Victoria Road from G10	Calcs
	Month:	Early April / mid August	
	Time:	0630 hrs	
	Façade Aspect (ASP):	342	
	Direction of View (BRG) :	233	
	Sun position:		
	AZI	321	
	ALT	35	
2	**Solar Power (w/m2):**	875	
3	**Luminous Efficacy (lm/w):**	125	
4	**Solar Illumination(lux):**	109375	
5	**Solar Position relative to Façade:**		
		HAS (deg)	-21
		VSA (deg)	36.9
		I (deg)	40.1
6	**Virtual Sun position:**		
		VALT(deg)	35
		VAZI(deg)	183
		VAZI(deg) absolute	183
7	**Glare position relative to observer:**		
		Alpha (deg)	-50
		Beta (deg)	35
		Theta (deg)	58.2
8	**Reflectivity of glass:**		
		At normal (%)	20
		At angle of incidence	
		40.1	22
9	**Fraction of façade spectrally reflective:**		1.0
10	**Illumination at observer's eye due to glare source in plane normal to line of sight (lux):**	12667	
11	**Equivalent veiling luminance - Holladay formula (cd/m2):**	37	
12	**Provisional limit to veiling luminance of 500 cd/m2 is situation acceptable?**	**Yes**	

Table 12 MP4 Darling Street from G3

1	**Location:**	MP4 Darling Street from G3	Calcs
	Month:	Mid June	
	Time:	1450 hrs	
	Façade Aspect (ASP):	36	
	Direction of View (BRG) :	225	
	Sun position:		
	AZI	320	
	ALT	20	
2	**Solar Power (w/m2):**	650	
3	**Luminous Efficacy (lm/w):**	117	
4	**Solar Illumination(lux):**	76050	
5	**Solar Position relative to Façade:**		
		HAS (deg)	284
		VSA (deg)	56.3
		I (deg)	76.8
6	**Virtual Sun position:**		
		VALT(deg)	20
		VAZI(deg)	-428
		VAZI(deg) absolute	-68
7	**Glare position relative to observer:**		
		Alpha (deg)	-293
		Beta (deg)	20
		Theta (deg)	68.4
8	**Reflectivity of glass:**		
		At normal (%)	12
		At angle of incidence	
		76.8	53
9	**Fraction of façade spectrally reflective:**		1.0
10	**Illumination at observer's eye due to glare source in plane normal to line of sight (lux):**	14822	
11	**Equivalent veiling luminance - Holladay formula (cd/m2):**	32	
12	**Provisional limit to veiling luminance of 500 cd/m2 is situation acceptable?**	**Yes**	

Table 13 MP4 Darling Street from G5

1	**Location:**	MP4 Darling Street from G5	Calcs
	Month:	Mid June	
	Time:	0820 hrs	
	Façade Aspect (ASP):	75	
	Direction of View (BRG) :	225	
	Sun position:		
	AZI	40	
	ALT	20	
2	**Solar Power (w/m2):**	650	
3	**Luminous Efficacy (lm/w):**	117	
4	**Solar Illumination(lux):**	76050	
5	**Solar Position relative to Façade:**		
		HAS (deg)	-35
		VSA (deg)	24.0
		I (deg)	39.7
6	**Virtual Sun position:**		
		VALT(deg)	20
		VAZI(deg)	-70
		VAZI(deg) absolute	290
7	**Glare position relative to observer:**		
		Alpha (deg)	65
		Beta (deg)	20
		Theta (deg)	66.6
8	**Reflectivity of glass:**		
		At normal (%)	12
		At angle of incidence	
		39.7	13
9	**Fraction of façade spectrally reflective:**		1.0
10	**Illumination at observer's eye due to glare source in plane normal to line of sight (lux):**	3925	
11	**Equivalent veiling luminance - Holladay formula (cd/m2):**	9	
12	**Provisional limit to veiling luminance of 500 cd/m2 is situation acceptable?**	**Yes**	

Table 14 MP4 Darling Street from G6

1	**Location:**	MP4 Darling Street from G6	Calcs
	Month:	Mid December	
	Time:	1810 hrs	
	Façade Aspect (ASP):	165	
	Direction of View (BRG) :	225	
	Sun position:		
	AZI	249	
	ALT	11	
2	**Solar Power (w/m2):**	515	
3	**Luminous Efficacy (lm/w):**	117	
4	**Solar Illumination(lux):**	60255	
5	**Solar Position relative to Façade:**		
		HAS (deg)	84
		VSA (deg)	61.8
		I (deg)	84.1
6	**Virtual Sun position:**		
		VALT(deg)	11
		VAZI(deg)	-99
		VAZI(deg) absolute	261
7	**Glare position relative to observer:**		
		Alpha (deg)	36
		Beta (deg)	11
		Theta (deg)	37.4
8	**Reflectivity of glass:**		
		At normal (%)	12
		At angle of incidence	
		84.1	73
9	**Fraction of façade spectrally reflective:**		1.0
10	**Illumination at observer's eye due to glare source in plane normal to line of sight (lux):**	34929	
11	**Equivalent veiling luminance - Holladay formula (cd/m2):**	249	
12	**Provisional limit to veiling luminance of 500 cd/m2 is situation acceptable?**	**Yes**	

Table 15 MP5 Belmore Street from G11

1	**Location:**	MP5 Belmore Street from G11	Calcs
	Month:	Late March / late September	
	Time:	0740 hrs	
	Façade Aspect (ASP):	118	
	Direction of View (BRG) :	355	
	Sun position:		
	AZI	75	
	ALT	19	
2	**Solar Power (w/m2):**	635	
3	**Luminous Efficacy (lm/w):**	117	
4	**Solar Illumination(lux):**	74295	
5	**Solar Position relative to Façade:**		
		HAS (deg)	-43
		VSA (deg)	25.2
		I (deg)	46.3
6	**Virtual Sun position:**		
		VALT(deg)	19
		VAZI(deg)	-19
		VAZI(deg) absolute	341
7	**Glare position relative to observer:**		
		Alpha (deg)	-14
		Beta (deg)	19
		Theta (deg)	23.4
8	**Reflectivity of glass:**		
		At normal (%)	20
		At angle of incidence	
		46.3	23
9	**Fraction of façade spectrally reflective:**		1.0
10	**Illumination at observer's eye due to glare source in plane normal to line of sight (lux):**	15677	
11	**Equivalent veiling luminance - Holladay formula (cd/m2):**	285	
12	**Provisional limit to veiling luminance of 500 cd/m2 is situation acceptable?**	**Yes**	

Table 16 MP6 Darling Street from G1

1	**Location:**	MP6 Darling Street from G1	Calcs
	Month:	Mid August / early April	
	Time:	1640 hrs	
	Façade Aspect (ASP):	234	
	Direction of View (BRG) :	53.5	
	Sun position:		
	AZI	292	
	ALT	11	
2	**Solar Power (w/m2):**	515	
3	**Luminous Efficacy (lm/w):**	117	
4	**Solar Illumination(lux):**	60255	
5	**Solar Position relative to Façade:**		
		HAS (deg)	58
		VSA (deg)	20.1
		I (deg)	58.7
6	**Virtual Sun position:**		
		VALT(deg)	11
		VAZI(deg)	-4
		VAZI(deg) absolute	356
7	**Glare position relative to observer:**		
		Alpha (deg)	302.5
		Beta (deg)	11
		Theta (deg)	58.1
8	**Reflectivity of glass:**		
		At normal (%)	20
		At angle of incidence	
		58.7	28
9	**Fraction of façade spectrally reflective:**		1.0
10	**Illumination at observer's eye due to glare source in plane normal to line of sight (lux):**	8908	
11	**Equivalent veiling luminance - Holladay formula (cd/m2):**	26	
12	**Provisional limit to veiling luminance of 500 cd/m2 is situation acceptable?**	**Yes**	

Table 17 MP6 Darling Street from G8

1	**Location:**	MP6 Darling Street from G8	Calcs
	Month:	Mid June	
	Time:	1515 hrs	
	Façade Aspect (ASP):	247	
	Direction of View (BRG) :	53.5	
	Sun position:		
	AZI	314	
	ALT	16	
2	**Solar Power (w/m2):**	590	
3	**Luminous Efficacy (lm/w):**	117	
4	**Solar Illumination(lux):**	69030	
5	**Solar Position relative to Façade:**		
		HAS (deg)	67
		VSA (deg)	36.3
		I (deg)	67.9
6	**Virtual Sun position:**		
		VALT(deg)	16
		VAZI(deg)	0
		VAZI(deg) absolute	360
7	**Glare position relative to observer:**		
		Alpha (deg)	306.5
		Beta (deg)	16
		Theta (deg)	55.1
8	**Reflectivity of glass:**		
		At normal (%)	12
		At angle of incidence	
		67.9	29
9	**Fraction of façade spectrally reflective:**		1.0
10	**Illumination at observer's eye due to glare source in plane normal to line of sight (lux):**	11457	
11	**Equivalent veiling luminance - Holladay formula (cd/m2):**	38	
12	**Provisional limit to veiling luminance of 500 cd/m2 is situation acceptable?**	**Yes**	

Table 18 MP7 Waterloo Street from G2

1	**Location:**	MP7 Waterloo Street from G2	Calcs
	Month:	Mid July/ late May	
	Time:	1330 hrs	
	Façade Aspect (ASP):	307	
	Direction of View (BRG) :	144.5	
	Sun position:		
	AZI	26	
	ALT	30	
2	**Solar Power (w/m2):**	800	
3	**Luminous Efficacy (lm/w):**	125	
4	**Solar Illumination(lux):**	100000	
5	**Solar Position relative to Façade:**		
		HAS (deg)	-281
		VSA (deg)	71.6
		I (deg)	80.4
6	**Virtual Sun position:**		
		VALT(deg)	30
		VAZI(deg)	408
		VAZI(deg) absolute	408
7	**Glare position relative to observer:**		
		Alpha (deg)	263.5
		Beta (deg)	30
		Theta (deg)	-84.4
8	**Reflectivity of glass:**		
		At normal (%)	12
		At angle of incidence	
		80.4	60
9	**Fraction of façade spectrally reflective:**		1.0
10	**Illumination at observer's eye due to glare source in plane normal to line of sight (lux):**	5851	
11	**Equivalent veiling luminance - Holladay formula (cd/m2):**	8	
12	**Provisional limit to veiling luminance of 500 cd/m2 is situation acceptable?**	**Yes**	

Table 19 MP8 Victoria Road G3

1	**Location:**	MP8 Victoria Road G3	Calcs
	Month:	Mid June	
	Time:	1550 hrs	
	Façade Aspect (ASP):	36	
	Direction of View (BRG) :	305	
	Sun position:		
	AZI	308	
	ALT	11	
2	**Solar Power (w/m2):**	515	
3	**Luminous Efficacy (lm/w):**	117	
4	**Solar Illumination(lux):**	60255	
5	**Solar Position relative to Façade:**		
		HAS (deg)	272
		VSA (deg)	79.6
		I (deg)	88.0
6	**Virtual Sun position:**		
		VALT(deg)	11
		VAZI(deg)	-416
		VAZI(deg) absolute	-56
7	**Glare position relative to observer:**		
		Alpha (deg)	-361
		Beta (deg)	11
		Theta (deg)	11.0
8	**Reflectivity of glass:**		
		At normal (%)	12
		At angle of incidence	
		88.0	95
9	**Fraction of façade spectrally reflective:**		1.0
10	**Illumination at observer's eye due to glare source in plane normal to line of sight (lux):**	56181	
11	**Equivalent veiling luminance - Holladay formula (cd/m2):**	4602	
12	**Provisional limit to veiling luminance of 500 cd/m2 is situation acceptable?**	**No**	

Table 20 MP8 Victoria Road G5

1	**Location:**	MP8 Victoria Road from G5	Calcs
	Month:	Mid June	
	Time:	0915 hrs	
	Façade Aspect (ASP):	75	
	Direction of View (BRG) :	305	
	Sun position:		
	AZI	28	
	ALT	28	
2	**Solar Power (w/m2):**	770	
3	**Luminous Efficacy (lm/w):**	125	
4	**Solar Illumination(lux):**	96250	
5	**Solar Position relative to Façade:**		
		HAS (deg)	-47
		VSA (deg)	37.9
		I (deg)	53.0
6	**Virtual Sun position:**		
		VALT(deg)	28
		VAZI(deg)	-58
		VAZI(deg) absolute	302
7	**Glare position relative to observer:**		
		Alpha (deg)	-3
		Beta (deg)	28
		Theta (deg)	28.1
8	**Reflectivity of glass:**		
		At normal (%)	12
		At angle of incidence	
		53.0	14
9	**Fraction of façade spectrally reflective:**		1.0
10	**Illumination at observer's eye due to glare source in plane normal to line of sight (lux):**	11881	
11	**Equivalent veiling luminance - Holladay formula (cd/m2):**	150	
12	**Provisional limit to veiling luminance of 500 cd/m2 is situation acceptable?**	**Yes**	