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Solar Reflectivity Assessment for Altis Bankstown

Bankstown, Sydney, Australia

CPP 17939

Prepared for:

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Document Control

REVISION HISTORY				
DATE	REVISION	PREPARED	CHECKED	APPROVED
29-April-2024	Interim Report R00D00	Pallava Kodali CFD Project Engineer pkodali@cppwind.com	Roberto Neto CFD Project Engineer rneto@cppwind.com	Matt Glanville Vice President BD mglanville@cppwind.com

BASIS OF REPORT – CLIENT PROVIDED DOCUMENTATION			
DOCUMENT DATE	PROVIDED DATE	DRAWING NAME	FILENAME
-----	20-March-2024	PA030557DA-PTW-AR-AA-M-A-1000-PA030557DA-PTW-AR-PO-M-A-1000	PA030557DA-PTW-AR-AA-M-A-1000-PA030557DA-PTW-AR-PO-M-A-1000.ifc
20-March-2024	21-March-2024	BARINGS COMPASS CENTRE	240320_DA ArchitecturalDrawings.pdf
------	09-April-2024	E-LAB ESD Report DA1 Barings Compass Centre 01_39-40	E-LAB ESD Report DA1 Barings Compass Centre 01_39-40.pdf

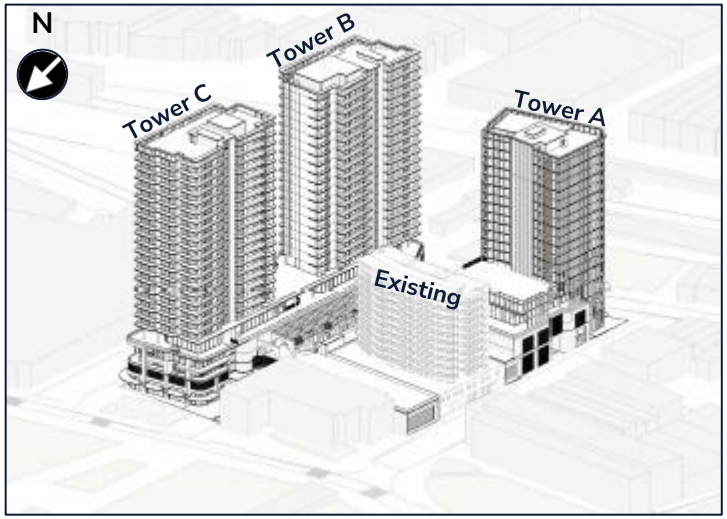
Site Context

Site relative to the nearest mapped streets

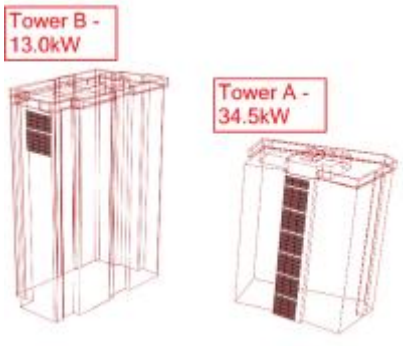
- The proposed development is located in the Bankstown CBD, approximately 100 meters to the north of Bankstown station.
- The site is bounded by The Mall Rd to the north, The Appian Way to the east, North Terrace to the south and Fetherstone St to the west.
- The surrounding terrain is comprised primarily of low-rise suburban development with some larger commercial towers.

Site Description

- The proposed project is a mixed-use development located in Bankstown, comprising two 24-storey and single 19-storey tower on a shared podium.
- Windows and railings account for most of the façade glazing. Vertical solar panels on towers A and B also contribute to solar reflection and were considered in the simulation.
- Tower A façade in particular is almost made entirely of glazed elements. However, vertical fins that extrude about 0.5 meters of the façade provide significant protection against solar rays.
- As the project buildings are taller than most of their neighbouring buildings, little blockage of solar rays is provided to the upper levels.



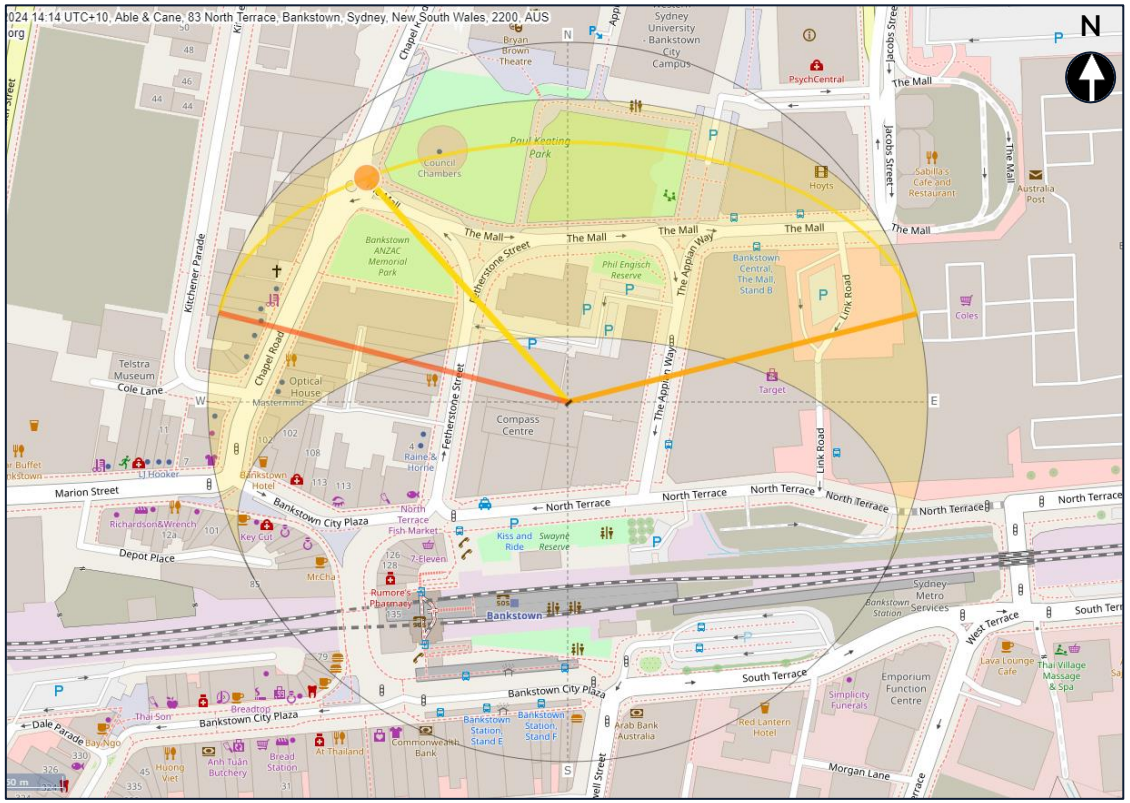
Project buildings



Solar panels

Facades example

Assessment Methodology



Sun Path Diagram for the site

This report assesses the potential for disability glare for solar reflection from the proposed development onto surrounding roadways taking into consideration:

- Seasonal and diurnal solar paths (sun altitude and azimuth) at Altis Bankstown project altitude, and the relative angle of the incident and reflected solar rays.
- An assumed specular reflectivity coefficient of 20%, for the external glazing is used by default in the baseline calculations, (allowance is made for reflectivity coefficients of glazing to increase with increasing incident angle.)
- Receiver locations of interest, the alignment of adjoining public roadways being of particular interest, and
- Architectural Drawings provided.

Assessment Criteria

CPP provide the following assessment in accordance with our professional experience and available planning guidelines in Australia.

CPP regularly conduct solar reflectivity studies in Australia to predict the potential for solar rays to generate rogue specular reflections from the building glazing onto surrounding roadways for planning approval. The need to assess reflective glare on façade material is becoming more recognised worldwide, however local building codes that we have identified do not provide specific, quantitative, guidance regarding allowable reflectivity.

Typical provisions in Australian development control plans are:

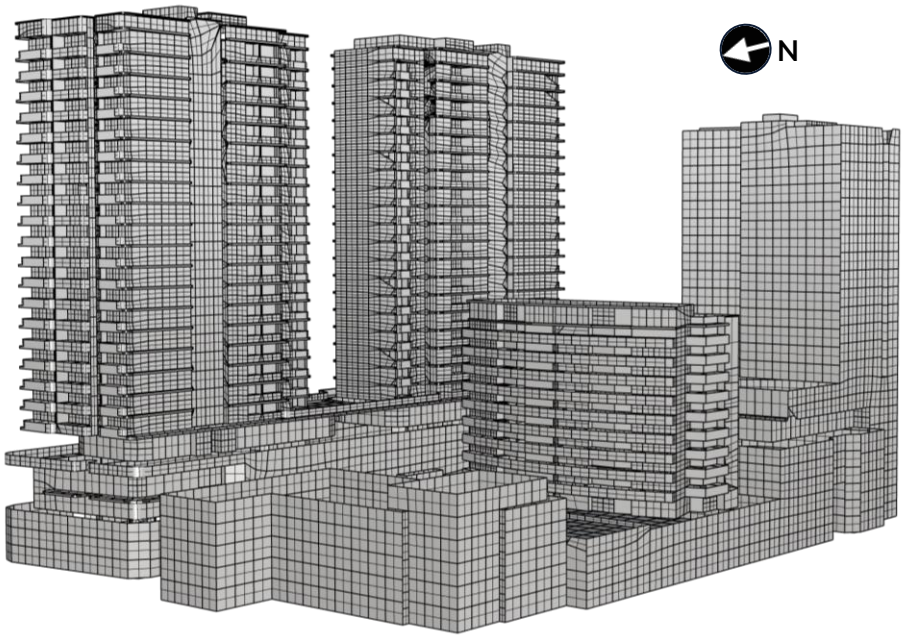
- A Reflectivity Report that analyses potential solar glare from the proposed building design may be required for tall buildings; and
- Generally, light reflectivity from building materials used on facades must not exceed 20%

It is assumed that 20% applied to the specular component of reflections, defined as the percentage of solar reflection when light strikes and reflects normal to the façade plane. This limit was adopted in the baseline calculations of this assessment as the proposed building's facades predominantly comprise of glazing.

In this report CPP use a methodology developed by Hassall (1991), and the concept of veiling luminance and contrast when quantifying the potential for hazard rogue specular solar reflections from the proposed development onto selected surrounding roadway receiver locations. Hassall suggests a veiling luminance limit of 500 cd/m2 for motor vehicle drivers as calculated from the Holladay formula. Proprietary software was used to calculate veiling luminance values at expected maximum impact locations of vehicles travelling in the directions described.

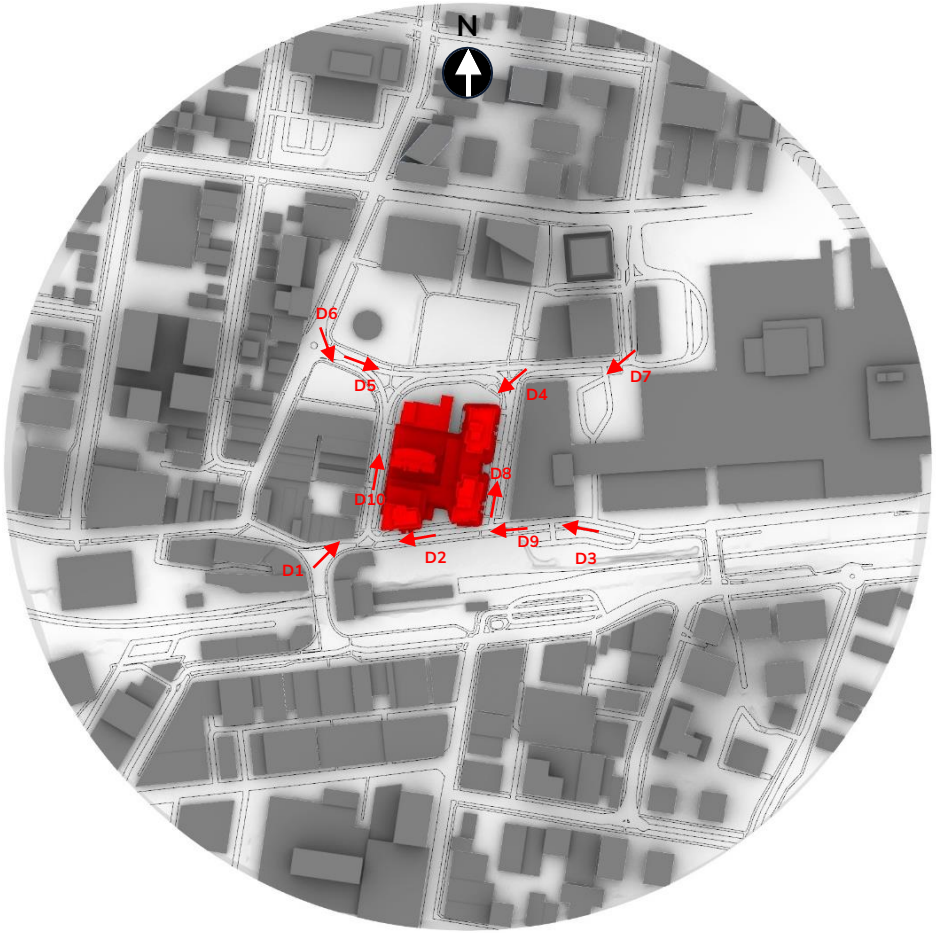
Façade Modelling

- The buildings' façades were discretized into a finite number of quadrilateral surfaces, with edges no bigger than 3 meters. This is a marginally conservative modelling approach in terms of veiling luminance magnitude generated by specular reflections.
- Although the entire façade was discretized, results only include regions made of glazed materials.
- Surfaces were modelled as entirely reflective, and thus non reflective surfaces were not included.
- Total number of surfaces modelled : 16782



All modelled facades

Receiver Locations



All high-risk receiver locations

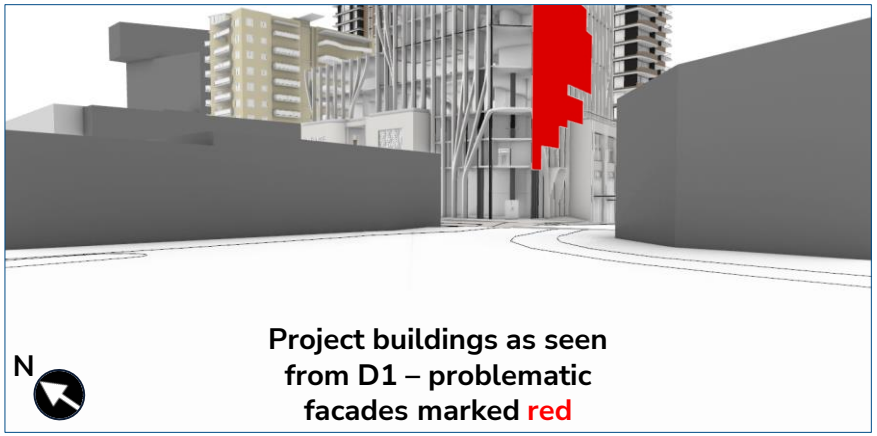
The receptors represent potential risk areas where driver visual acuity may be jeopardised by reflected solar glare. A driver distraction such as Disability Glare presents a vehicular hazard and thereby risk of a traffic impact incident on the busy motorway. The arrows represent the most likely orientation of the driver's line of sight based on their probable speed and complexity of the road/manoeuvre ahead. Receiver locations were assessed for drivers at locations:

- D1: drivers travelling northeast bound on Bankstown City Plaza road.
- D2: west-southwest bound on North Terrace road.
- D3: west-northwest bound on North Terrace road.
- D4: southwest bound on the Appian Way.
- D5: east-southeast bound on the Mall road.
- D6: south-southeast bound on Chapel Road
- D7: southwest bound on Jacobs Street
- D8: north-northeast bound on the Appian Way covering potential change in traffic direction in the future.
- D9: west-southwest bound on North Terrace road.
- D10: north-northeast bound on the Fetherstone Street

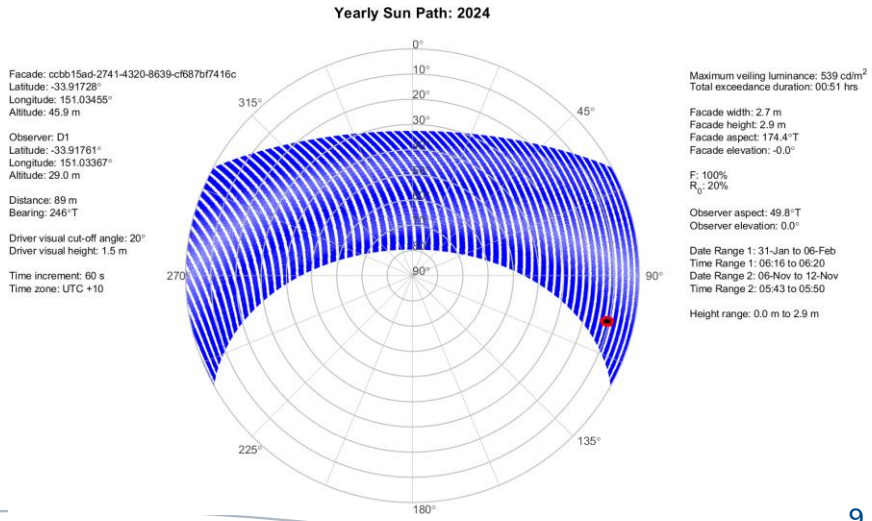
Solar Reflectivity Results for Receiver D1

BANKSTOWN CITY PLAZA ROAD

- Early morning reflections off the facades coloured in red were shown to potentially cause levels of disability glare exceeding the 500 cd/m^2 threshold for motorists travelling eastbound and north-eastbound on Bankstown City Plaza road (Location 1). These reflections last for 5-10 minutes per day between 5 am and 8 am year-round. **The simulation does not consider spandrels that extend vertically on either side of these problematic facades, the issues shown here are likely to be mitigated by the existing spandrels that act as fins.**
- The highest reflection off the south façades occurs for low lying early morning sun (right side of the sun path diagram). Reflection off the façade indicated in the diagram is occurring in winter months (bottom of the sun path diagram).
- Red colour in the sun path figures of indicates glare which exceeds the threshold criteria, and any yellow indicates glare that is present but below the threshold.
- To identify exceeding levels of glare, all facades that cannot be seen by the driver are automatically rejected



Project buildings as seen from D1 – problematic facades marked red



Solar Reflectivity Results for Receiver D2

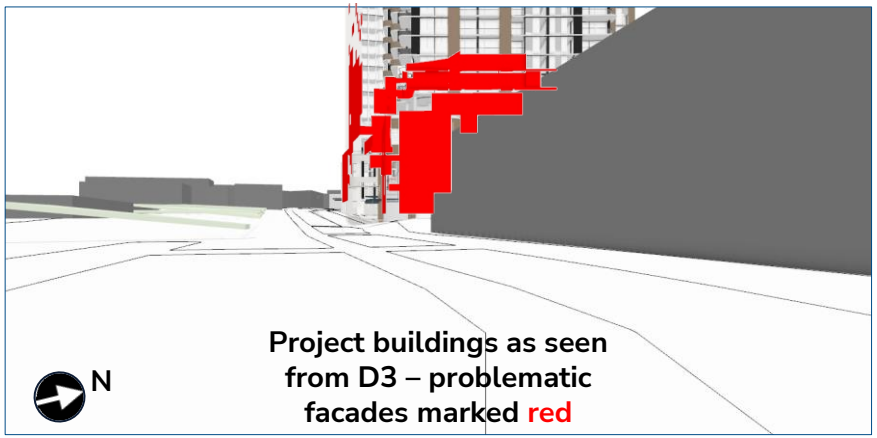
WEST-SOUTHWEST BOUND ON NORTH TERRACE ROAD

- The motorists at this location driving along this road are far more likely to experience visual impairment directly from the sun and not from the reflections off project buildings' facades.
- To identify exceeding levels of glare, all facades that cannot be seen by the driver are automatically rejected

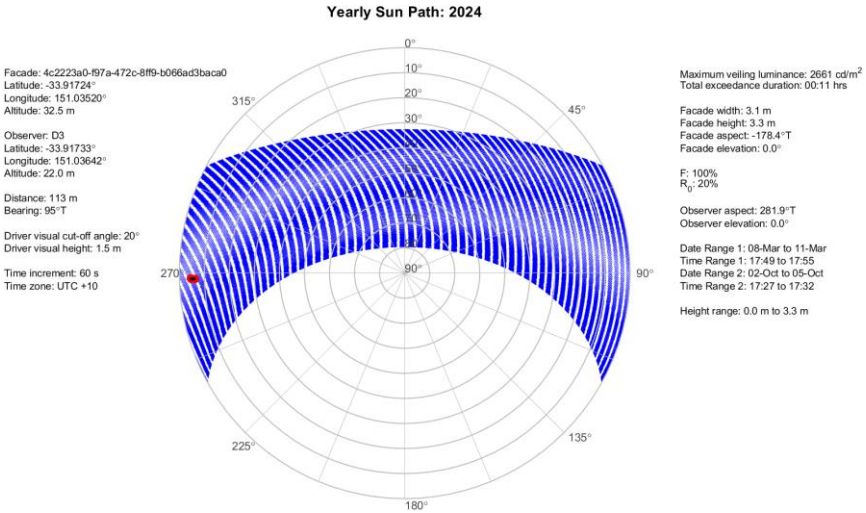
Solar Reflectivity Results for Receiver D3

WEST-NORTHWEST BOUND ON NORTH TERRACE ROAD

- Evening/morning reflections off the facades coloured in red were shown to potentially cause levels of disability glare exceeding the 500 cd/m^2 threshold for motorists travelling west-northwest bound on North Terrace road (Location 3). These reflections last for up to 5 minutes per day between 5 pm and 6 pm between March and April and between 5 am and 7 am in January and February. And symmetrically about the solstice dates for the other half of the year.The facades have not been found to cause problems in other months.
- The highest reflection off the southeast through south façades occurs for low lying evening sun (left side of the sun path diagram). Reflection off the façade indicated in the diagram is occurring in autumn/summer months (bottom of the sun path diagram).
- Red colour in the sun path figures of indicates glare which exceeds the threshold criteria, and any yellow indicates glare that is present but below the threshold.
- To identify exceeding levels of glare, all facades that cannot be seen by the driver are automatically rejected



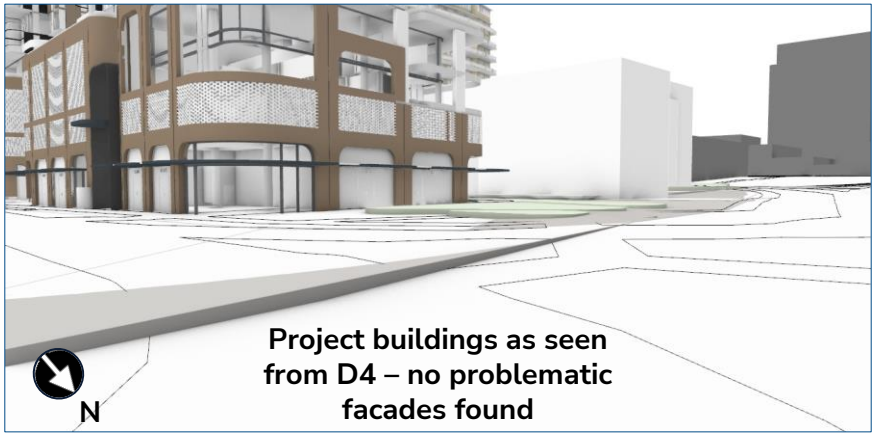
Project buildings as seen from D3 – problematic facades marked red



Solar Reflectivity Results for Receiver D4

SOUTHWEST BOUND ON THE APPIAN WAY

- The motorists at this location driving along this road are far more likely to experience visual impairment directly from the sun and not from the reflections off project buildings' facades.
- To identify exceeding levels of glare, all facades that cannot be seen by the driver are automatically rejected

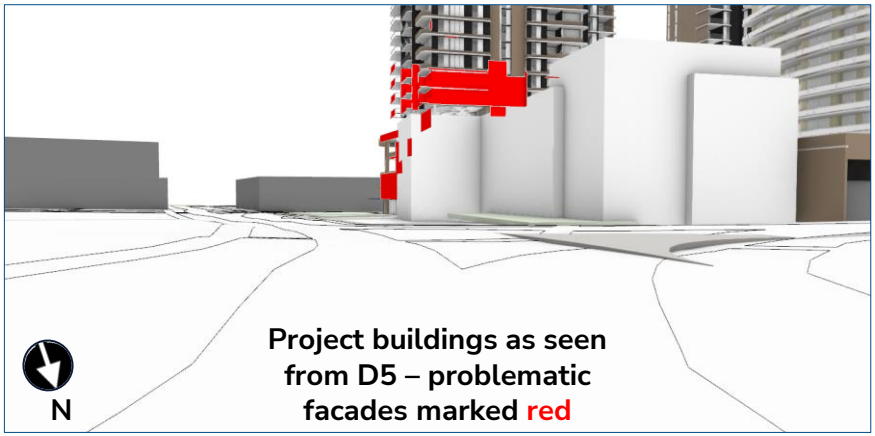


Project buildings as seen from D4 – no problematic facades found

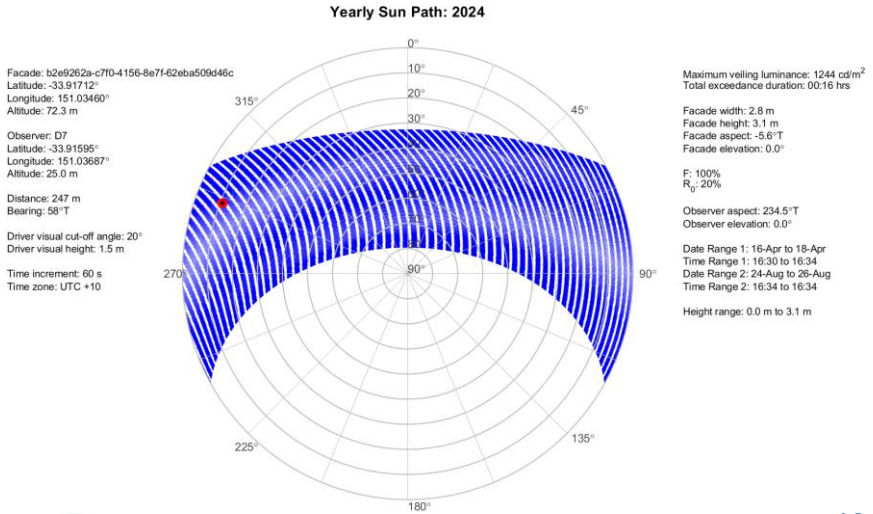
Solar Reflectivity Results for Receiver D5

EAST-SOUTHEAST BOUND ON THE MALL ROAD

- Early morning and evening reflections off the facades coloured in red were shown to potentially cause levels of disability glare exceeding the 500 cd/m^2 threshold for motorists travelling east-southeast bound on the Mall road (Location 5). These reflections last for up to 5 minutes per day between 5 pm and 6 pm between January and March and between 5 am and 7 am in September, October, and November. And symmetrically about the solstice dates for the other half of the year. The facades have not been found to cause problems in other months.
- The highest reflection off the southeast through south façades occurs for low lying morning sun (right side of the sun path diagram). Reflection off the façade indicated in the diagram is occurring in summer/spring months (top of the sun path diagram).
- Red colour in the sun path figures of indicates glare which exceeds the threshold criteria, and any yellow indicates glare that is present but below the threshold.
- To identify exceeding levels of glare, all facades that cannot be seen by the driver are automatically rejected



Project buildings as seen from D5 – problematic facades marked red



Solar Reflectivity Results for Receiver D6

SOUTH-SOUTHEAST BOUND ON CHAPEL ROAD

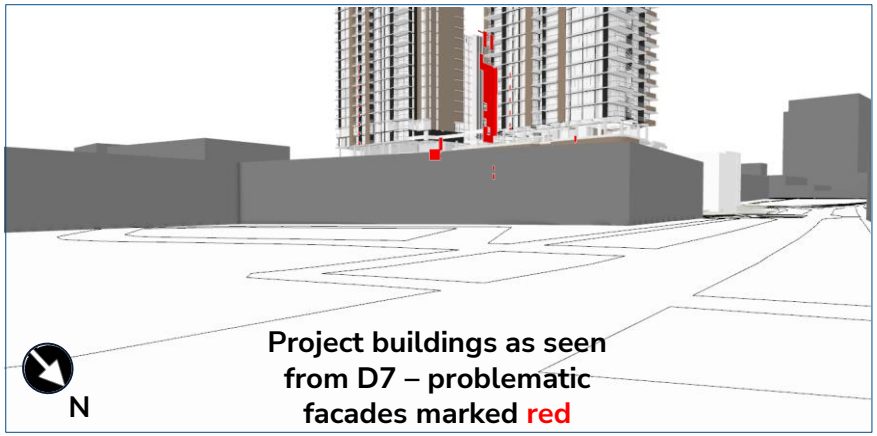
- The motorists at this location driving along this road are far more likely to experience visual impairment directly from the sun and not from the reflections off project buildings' facades.
- To identify exceeding levels of glare, all facades that cannot be seen by the driver are automatically rejected

Project buildings as seen from D6 – no problematic facades found

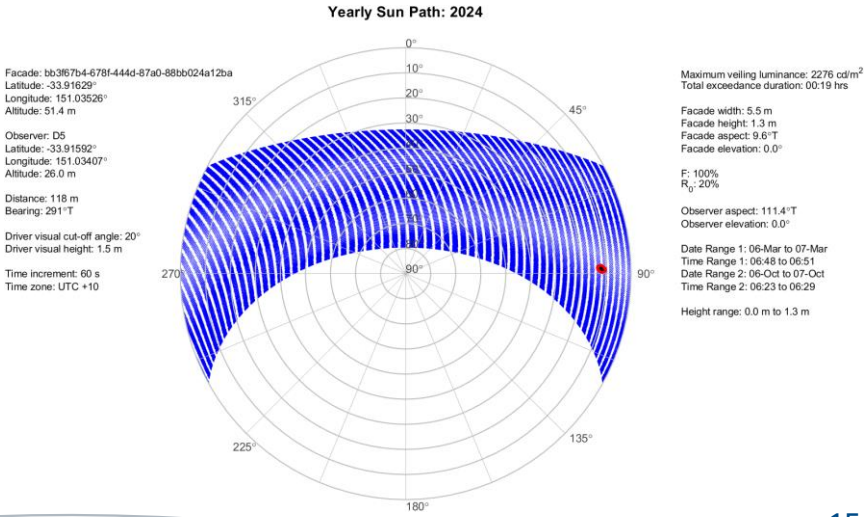
Solar Reflectivity Results for Receiver D7

SOUTHWEST BOUND ON JACOBS STREET

- Evening reflections off the facades coloured in red were shown to potentially cause levels of disability glare exceeding the 500 cd/m^2 threshold for motorists travelling southwest bound on Jacobs Street (Location 7). These reflections last for up to 3 minutes per day around 4:30 pm and 6 pm in mid-late March and mid-late April and up to 5 minutes a day around 5:30 pm in October and November. And symmetrically about the solstice dates for the other half of the year. The facades have not been found to cause problems in other months.
- The highest reflection off the southeast through south façades occurs for low lying evening sun (left side of the sun path diagram). Reflection off the façade indicated in the diagram is occurring in autumn months (top of the sun path diagram).
- Red colour in the sun path figures of indicates glare which exceeds the threshold criteria, and any yellow indicates glare that is present but below the threshold.
- To identify exceeding levels of glare, all facades that cannot be seen by the driver are automatically rejected



Project buildings as seen from D7 – problematic facades marked red



Solar Reflectivity Results for Receiver D8

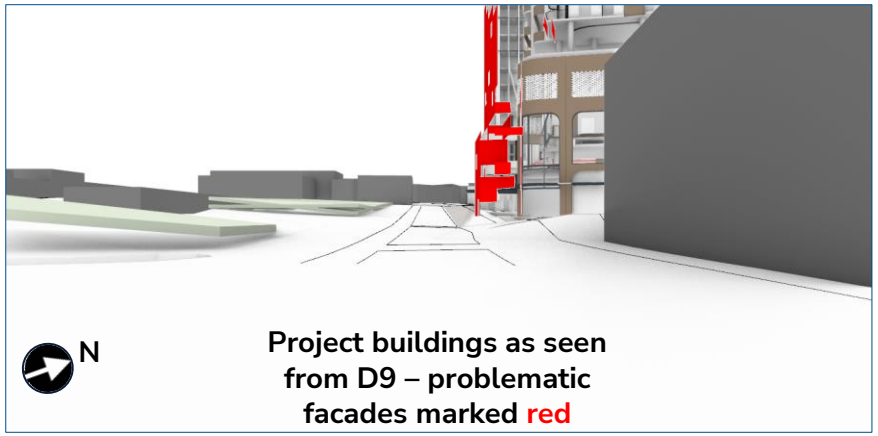
NORTH-NORTHEAST BOUND ON THE APPIAN WAY

- The motorists at this location driving along this road are far more likely to experience visual impairment directly from the sun and not from the reflections off project buildings' facades.
- To identify exceeding levels of glare, all facades that cannot be seen by the driver are automatically rejected

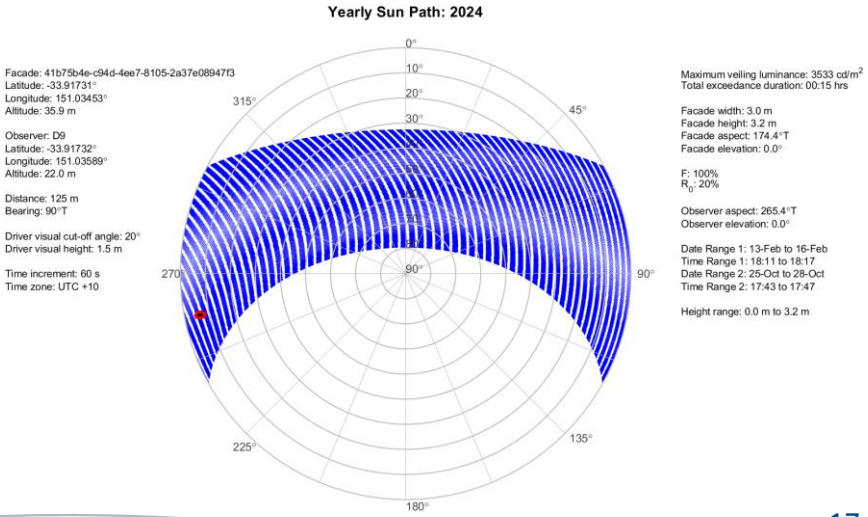
Solar Reflectivity Results for Receiver D9

WEST-SOUTHWEST BOUND ON NORTH TERRACE ROAD

- Morning/evening reflections off the facades coloured in red were shown to potentially cause levels of disability glare exceeding the 500 cd/m^2 threshold for motorists travelling southwest bound on Jacobs Street (Location 7). These reflections last for up to 5 minutes per day around 6:15 am/pm in mid-late February and up to 5 minutes a day around 6 am between September and November. And symmetrically about the solstice dates for the other half of the year. The facades have not been found to cause problems in other months.
- The highest reflection off the southeast through south façades occurs for low lying evening sun (left side of the sun path diagram). Reflection off the façade indicated in the diagram is occurring in autumn/summer months (bottom of the sun path diagram).
- Red colour in the sun path figures of indicates glare which exceeds the threshold criteria, and any yellow indicates glare that is present but below the threshold.
- To identify exceeding levels of glare, all facades that cannot be seen by the driver are automatically rejected



Project buildings as seen from D9 – problematic facades marked red



Solar Reflectivity Results for Receiver D10

NORTH-NORTHEAST BOUND ON THE FETHERSTONE STREET

- The motorists at this location driving along this road are far more likely to experience visual impairment directly from the sun and not from the reflections off project buildings' facades.
- To identify exceeding levels of glare, all facades that cannot be seen by the driver are automatically rejected

Project buildings as seen from D10 – no problematic facades found

Mitigation

- It is recommended that all red highlighted facades have a **maximum reflectivity coefficient of 10%.**
- Glancing reflections observed on the south facades (image 1) may be mitigated by the existing spandrels acting as vertical fins. Based on the angle of reflection identified, the fins are typically recommended to have vertical fins placed with a minimum ratio of D ~ 0.1 x W, where W is the horizontal distance between vertical fins of depth D. Since the existing spandrel features already have a ratio of about 0.46, **further mitigation may not be necessary**, and the driver is likely to be safe from glare incidents.
- Areas marked within the purple rectangle in image 1 and 2 remain problematic even at 5% reflectance glass. **These facades are recommended to be inset into the wall further** (allowing a rim that is at least 10% of the façade length) to mitigate this.
- The black region in image 3 is occupied by the solar panels, which did not reveal problems even at conservative 20% reflectance simulation. At the typical **solar panel** reflectance values between 0.5% and 5%, these **are unlikely to cause problems**.
- The facades to the left of the mentioned solar panels on image 3 show high glare values for motorists driving along D7 as shown in page 15. However, similar to the south facades, the existing spandrels are likely to mitigate this glare, therefore **no further mitigation is required**.
- The balcony railings enclosed by the green rectangle in image 2 have short glare events across very small façade areas. Although they do not cause a major issue, it is recommended to push them inwards if possible, increasing the glare protection provided by the balcony floor.

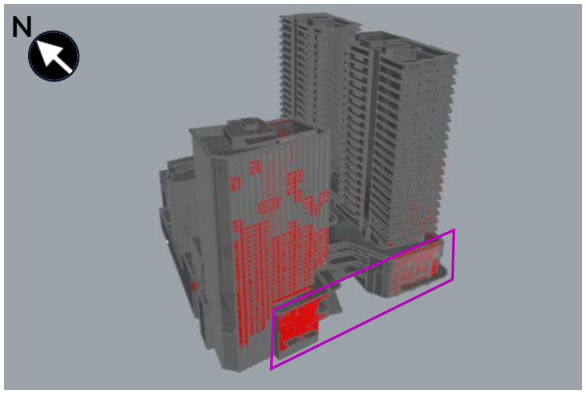


Image 1- South facades

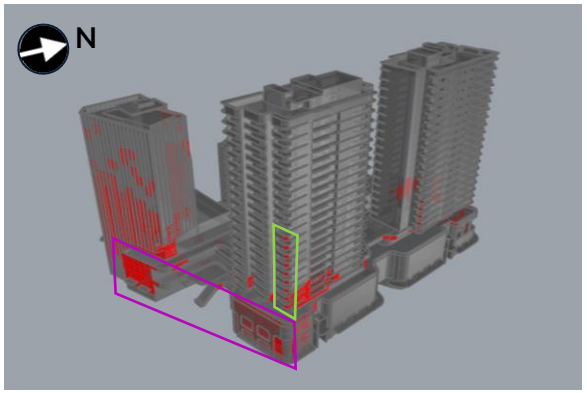


Image 2- East facades

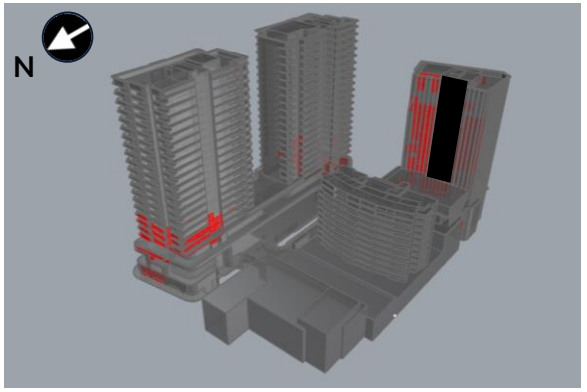


Image 3- North and west facades

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Conclusions

CPP have conducted an assessment for the potential for solar disability glare on motorists surrounding the proposed Altis Bankstown in Bankstown, Sydney.

- *Façade zones have been identified in this report (façade red zones) where the reflectivity coefficient of the glass need to be less than 10%.*
- *The problematic balcony railings are recommended to be pushed inwards to avoid the short-lived glare incidents on these thin sections of the railings.*
- *Some lower podium facades are likely to remain problematic even at 5% glazing and a different material that is not specular/reflective is recommended. These facades can also be inset into the wall further (allowing a rim that is at least 10% of the façade length) to mitigate this.*
- *Glancing reflections have been identified requiring vertical fins placed with a minimum ratio of $D \sim 0.1 \times W$, where W is the horizontal distance between vertical fins of depth D. The vertical spandrel features existing on the south facades are likely to achieve this improvement without further physical mitigation.*

It is expected the proposed development as currently configured, and with recommendations contained in this report, will not produce significant disability glare onto vehicles travelling toward the development.

References

Hassall (1991), "Reflectivity, Dealing with Rogue Solar Reflections", Faculty of Architecture, University of NSW.