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ARUP

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8 October 2018

Dear

Australian Museum Reflectivity statement

Arup have been engaged by Neeson Murcutt on behalf of the Australian Museum to review the potential of glare due to external reflectivity of the proposed designs for the development at the Australian Museum, Sydney.

This letter is intended to accompany the Development Application for the proposed development, in response to Section 3.2.7 of the Sydney DCP 2012. This section seeks to limit reflected glare from sunlight through the following controls:

- General limitation of the specular reflectivity of façade materials to 20%
- Where required, analysis of potential solar glare from the proposed building design

In order to address the more detailed investigation referred by the second point above, this letter comments on the nature of expected reflections and our expectation of their potential to cause glare to drivers, pedestrians and building occupants in the area surrounding the site. The statement is based on desktop studies following the Hassall methodology for detailed glare analysis (see below), and our opinion from experience on numerous previous reflectivity studies.

General

The predominant reflecting elements in the façade are faceted glazing on the north facing elevation and west facing entrance, and potentially reflective cladding on the east facing façade.

The building is contained within a dense urban context and facing parkland with tall vegetation, and view towards the façade from traffic is obscured for locations beyond immediately adjacent streets. We thus expect glare risk to traffic and pedestrians in street locations beyond Park St, William St, College St and Yurong Parkway to be minimal.

For locations in Park St, William St, College St and Yurong Parkway high level desktop study checks have been carried out as noted below.

Methodology

High level checks for specific locations have been carried out in accordance with the methodology developed by Hassall, which derives an Equivalent Veiling Luminance for reflections from a specific point on a reflecting surface towards a specific observer location and view direction.

It considers visibility of the sun in the reflected sky portion, typical luminance of the sun at the reflected altitude, angle of incidence of reflection, surface reflectivity, and angle of reflection direction to view direction. It further stipulates a threshold for this Equivalent Veiling Luminance of 500Cd/m², as a limit for acceptability of reflections in particular considering the visual needs of vehicle drivers.

Arup use spreadsheet calculation and in-house developed software to carry out the Hassall calculation, accounting for local conditions including; buildings, natural terrain and vegetation.

Checks according to the Hassall methodology primarily indicate whether glare risks are present to drivers, but can be read to indicate as well whether pedestrians travelling along the same routes are likely to experience glare.

Outcomes of Checks

1. North Facing Faceted Façade

1.1 William and Park St

The faceted façade only reflects high angle sun from the north towards William and Park Streets. Due to the large angle between the reflected sun and the direction of view of traffic participants, the Equivalent Veiling Luminances calculated for such reflections remain well below the threshold of acceptability stipulated by Hassall, for glazing normal reflectivity assumed up to the maximum value allowed by the Sydney DCP 2012 of 20%.

1.2 Yurong Parkway

Reflections in the direction of Yurong Parkway can theoretically exceed threshold of acceptability per desktop analysis. However, the dense evergreen vegetation present between the affected stretch of Yurong Parkway and the proposed development is, from review on site, assumed to obscure the view of any such reflections.

1.3 Park St

The Equivalent Veiling Luminances for any solar reflections calculated under the viewing angles towards the façade from College St permitted by context and topography remain well below the threshold of acceptability stipulated by Hassall.

1.4 Park St – double reflections

The potential for double reflection between the two different angles of the façade has been considered. Reflections of significant width would only occur close to project north. As such they would come from a high angle sun and be directed downwards. In addition the effective reflectivity would be strongly reduced by two bounces on reflective surfaces with limited reflectivity of 20% or less. For these reasons, double reflections are considered unlikely to produce glare.

1.5 Conclusion

Given the above the faceted component of the north façade is not expected to produce any unacceptable reflected glare towards traffic approaching along the considered roads.

2. Internal Glass Feature Blades Inclined at 45°

2.1 William and Park St

No unacceptable reflections are expected, as the feature elements would only be visible at grazing angles very close to parallel to their surface, so that only a sliver of the surface would lie in the visual field, and reflections would be of the interior of the proposed building rather than of the sky and sun.

2.2 College St

The Equivalent Veiling Luminances for any solar reflections calculated under the viewing angles towards the façade from College St permitted by context and topography remain well below the threshold of acceptability stipulated by Hassall.

2.3 Conclusion

In addition to the above a large component of high angle sun would be reflected by the face glazing before reaching the feature blades. In summary no unacceptable reflected glare is expected for traffic approaching along the considered roads.

3. East Façade

3.1 William St

Assuming the maximum façade reflectivity of 20% allowed by the Sydney City DCP, reflections above the threshold of acceptability stipulated by Hassall can from November through to February, from 5:30-6:30am, for approx. 10min duration.

However, if normal reflectivity is limited to **8%**, reflections remain below the acceptable threshold.

The visibility of the proposed façade is also impeded by trees along Williams St, although these are deciduous and may not provide reliable coverage.

3.2 Conclusion

Due to the potential for reflections causing glare, the reflectivity of the east façade should be limited to 8%. (For reference, 8% is the approximate reflectivity of uncoated single glazing. Metal cladding can be kept well below this reflectivity using a diffusing surface treatment such as a brushed finish or anodising.)

Impact on pedestrians and occupants of neighbouring buildings

For pedestrians moving along roadways, the incidence of reflections from the building is generally similar to the examined road traffic locations. Glare from reflections is therefore expected to occur in similar location as that found for road traffic. Furthermore, pedestrians travel at much slower speeds and are much more easily able to adjust their view to reduce the glare impact of reflections.

Solar reflections off the facades may reach surrounding buildings for limited time periods throughout the day. In general, reflections from façade with normal external reflectance below 20% are much less likely to cause discomfort to occupants of surrounding buildings than facades with strongly reflective glazing. The proposed building is targeting a glass reflectance below 20% in accordance with the Sydney DCP 2012, which will serve to reduce potential glare reflections that may occasionally be produced towards other

buildings. In addition, as the proposed development is low rise in nature, reflections reaching neighbouring buildings from its vertical facades are expected to be minimal.

Viewed from balconies of residential buildings at the corner of Yurong Parkway, occasional flashes of sun reflections may be produced by the internal inclined feature glass 'crystalline blade' elements. These are likely mitigated by the small scale of individual features, reflection off the face glazing, and CBD buildings partly blocking incident sun, and by the proposed scattering (textured) surface finish used on these elements. With these, reflection impact on neighbouring buildings from these elements is expected to be minimal.

Summary

In summary we expect the proposed building to perform well in terms of solar reflectivity, with reflections not expected to cause unacceptable glare according to the Hassall methodology, as long as specular external reflectivity of glazing and cladding at normal incidence is kept within the following limits:

- **East façade: 8%**
- **Remaining glazing: 20%**

Yours sincerely

A handwritten signature in black ink, appearing to read 'Haico Schepers', written in a cursive style.

Haico Schepers
Principal