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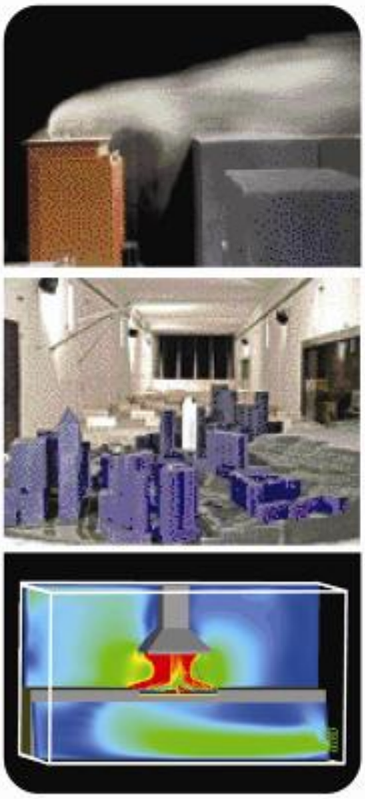
**FINAL REPORT**



Reflectivity Assessment for:

# UTS THOMAS STREET BUILDING

Ultimo, NSW, Australia

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December 2011

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**Introduction**

Cermak Peterka Petersen Pty. Ltd. has been engaged by the University of Technology, Sydney to provide an assessment of the reflectivity impact of the proposed Thomas Street Building. This report is in accordance with the Director-General's Requirements Section 75F of the Environmental Planning and Assessment Act 1979, Major Project 09 0_213. In particular item 7 Reflectivity:

"Analysis of the Reflectivity impacts of the façade, including solar glare on occupants of nearby buildings, public areas and roadways. New buildings should not result in glare that causes discomfort or threatens the safety of pedestrians or drivers".

The site is rectangular in shape and has street frontages to Thomas Street to the north and Jones Street to the west, Figure 1.

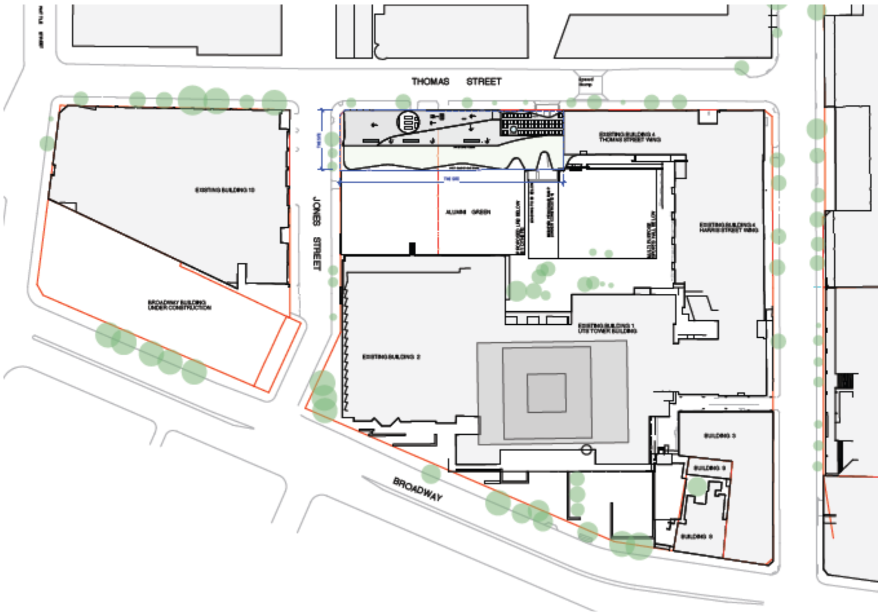


Figure 1: Location of the proposed Thomas Street Building.

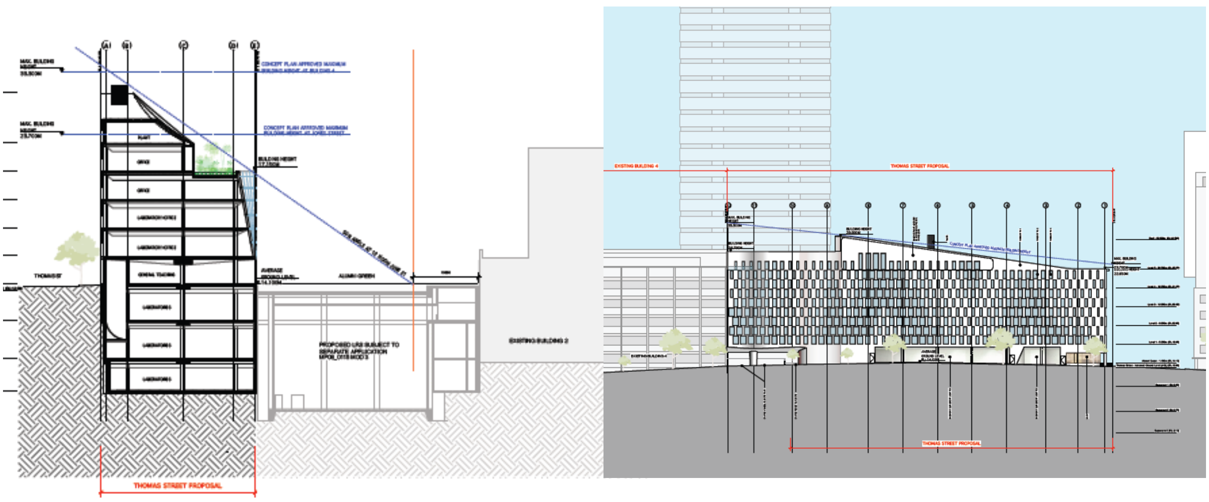

Figure 2: Section looking east, and north elevation views of the proposed Thomas Street Building.

Alumni Green is to the south of the site. The new building will house new facilities for the Faculty of Science, extending the current faculty space in Building 4. The building will have a maximum height of approximately 33 m with the majority of the building being limited to four storeys above ground.

The facade is a lightweight framed system that is supported by the building's concrete frame. The facade is penetrated by window frames typically 350 mm deep. The façade material is a lightweight infill element and a number of material options are being considered including GRC, shotcrete, and a site applied render system.

The Thomas Street Building is located within a diverse range of building types and uses of similar height and massing. Significant institutions in close proximity to the building include the UTS Tower (Building 1) and other mid-rise campus buildings, the ABC headquarters, Sydney Institute of TAFE and the One Central Park development under construction on the south side of Broadway.

**Reflectivity Considerations**

In addition to the Director-General's Requirements, reference is made in this report to the Central Sydney DCP 1996, Part 4 Environmental Management – Section 4.5 Reflectivity, specifically:

> 4.5.1 New buildings and facades should not result in glare that causes discomfort or threatens safety of pedestrians or drivers.
>
> 4.5.2 Visible light reflectivity from building materials used on the facades of new buildings should not exceed 20%.

Some other Australian Councils also require that all exterior façade elements have a reflectivity coefficient of 20% or less. This is defined as the percentage solar reflection when light strikes and reflects normal to the façade element. When incident solar rays strike near parallel to the façade plane it is known that the reflectivity of all glazing types increases as described in Appendix 1.

The following reflectivity assessment identifies potential for glancing reflections to impact upon passing motorists taking into consideration:

- Seasonal and diurnal solar paths (sun altitude and azimuth) at the Ultimo latitude and the relative angle between incident solar rays and façade orientation.
- Reflectivity coefficients of the external glazing being used.
- Receiver locations of interest; the alignment of adjoining public roads and Alumni Green being of particular interest.

Where the combination of these factors suggests there is potential for hazardous rogue reflections to impact on surrounding areas, the potential magnitude of reflections can be quantified and compared with acceptability criterion described in Appendix 2.

CPP use in part methodology developed by Hassall (1991) and the concept of veiling glare and contrast when quantifying the potential for hazard rogue reflections onto surrounding receiver locations. In many instances the potential for a façade to generate rogue reflections can be eliminated without the need for calculation by taking into account the above factors as well as shading offered by surrounding building massing.

**Reflectivity Impact Results**

The building is reasonably well shaded by surrounding buildings described above. The most likely motorist impacts are on Thomas Street.

The greatest potential for the proposed development to generate reflections onto Thomas Street is morning solar rays glancing off the north façade of the building with reflections toward the west of the site, Figure 3. Maximum Threshold Increment (TI) reflectivity values exceeding 20% were calculated to occur around 8 am in the months on either side of the winter solstice lasting until the equinox.

Figure 3: Solar reflections off the northern façade onto Thomas Street.

The limited width of the punch windows on the north façade can be used to limit these reflections. The maximum window width noted is approximately 1.5 m. It is proposed to recess the windows by a minimum 150 mm behind the façade line which will intercept the highest glancing incident angles.

Similar morning reflections off the Alumni Green façade onto Jones Street will have less impact on passing motorist. In this instance a driver's line of sight will be perpendicular to the potential glare source producing low TI values. The location of Alumni Green to the south of the site will limit the potential for glancing solar reflections to impact upon the users of this space.

Other building materials such as the metal framing and masonry products being considered are not directly quantified by the methodology adopted in this report. By definition, diffuse reflections have a greater scatter of reflected angles with lower concentration of reflected light in any given direction and are generally less likely to cast hazardous distant glare reflections than glazing. It is recommended all exterior cladding elements on the Thomas Street Building should have a reflectivity coefficient of less than 20% as required by Sydney City Council.

**Conclusions**

The reflectivity assessment addresses the Director-General's Requirements Section 75F of the Environmental Planning and Assessment Act 1979, Major Project 09 0_213, item 7 Reflectivity. Reference is also made in this report to the Central Sydney DCP 1996 whereby a maximum reflectivity coefficient of 20% is recommended for all façade materials.

The form of the building and shielding provided by surrounding developments will minimise glare impacts upon surrounding motorways. In summary, with the recommendations contained in this report, the proposed development will be acceptable in terms of reflectivity impact.

**References**

Australia/New Zealand Standard AS/NZS 1158.1.1:2005 "Lighting for Roads and Public Spaces" Part 1.1: Vehicular Traffic (Category V) lighting – Performance and design requirements".

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

**Appendix 1: Reflectivity Considerations**

When incident solar rays strike near parallel to the façade plane (large incident angle of typically greater than 70°), it is known that the reflectivity of all glazing types increases dramatically towards the properties of a mirror, Figure 4.

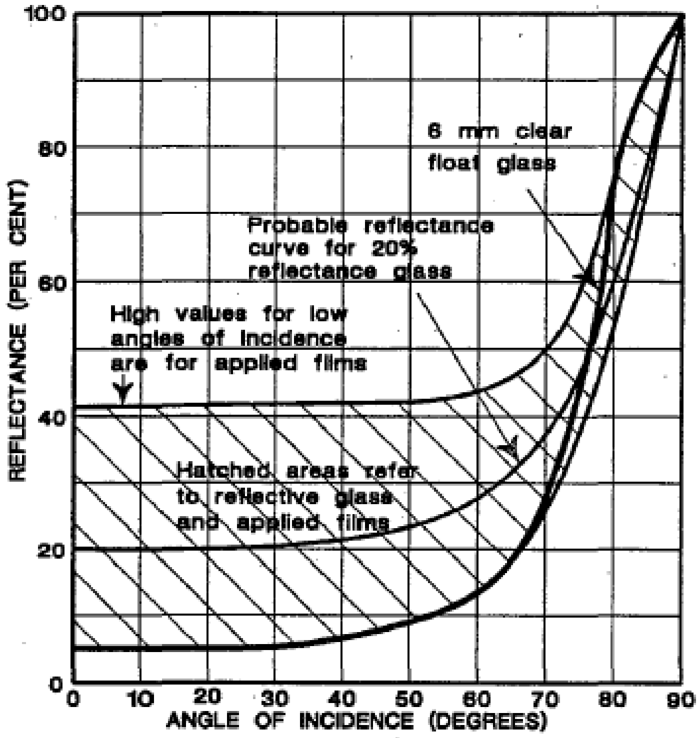


Figure 4: Façade Reflectivity versus angle of incidence (Hassall, 1991)

Thus, even for glazing with low reflectivity coefficients, the potential for glare increases significantly when incoming solar rays can impact on a building close to parallel to the plane of the glazing, i.e. a glancing reflection.

**Appendix 2: Glare Acceptability Criteria**

Consider an object that is just visible in the absence of glare. The object will no longer be visible when glare is introduced and it will be necessary to increase the contrast to make the object visible again. Threshold Increment (TI) is the percentage by which the contrast must be increased to make the object just visible and is the parameter calculated in this study to assess the acceptability or otherwise of potential reflectivity glare events.

TI is a parameter used in the design of Road Lighting, e.g. AS/NZS 1158.1.1:2005 where a maximum TI value of 20% is used for all roadway lighting categories. Although not directly applicable to solar glare reflections this value is useful in the current assessment.

Calculations in this report assume specular type reflective façade surfaces, where the reflected ray angle is equal to the incident solar ray angle; being valid for most smooth surface glazing materials such as the proposed façade punch windows.