SUMMARY EXPERT OPINION

INDEPENDENT VERIFICATION: OVERSHADOWING ANALYSIS

s.96 Application
94-98 George St Hornsby

1 June 2017

0.0 SUMMARY/VERIFICATION

I have undertaken an evaluation of the shadow diagrams and overshadowing analysis prepared for the approved DA and s.96 application on the above site.

Property: **94-98 George St Hornsby**
Approval: **DA | s.96 application**

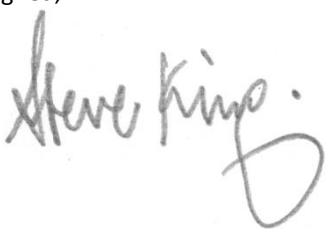
I confirm that
OVERSHADOWING ANALYSIS
as undertaken by Tony Owen Associates Architects and illustrated in diagrams provided to me
may be considered as accurate, and demonstrates compliance with the relevant control.

I provide this independent third party analysis to facilitate the interpretation of that information submitted by the applicant in relation to both the approved DA and present s.96 applications.

My credentials are summarised in *1.0 Credentials.*

I refer to the materials listed in *2.0 Documents* and to the discussion in *3.0 Analysis* below.

Signed,



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Steve King

STEVE KING
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1.0 CREDENTIALS

I taught architectural design, thermal comfort and building services at the Universities of Sydney, Canberra and New South Wales since 1971. From 1992, I was a Research Project Leader in SOLARCH, the National Solar Architecture Research Unit at the University of NSW, and until its disestablishment in November 2006, I was the Associate Director, Centre for Sustainable Built Environments (SOLARCH), UNSW.

My research and consultancy includes work in solar access, energy simulation and assessment for houses and multi-dwelling developments, building assessments under the NSW SEDA Energy Smart Buildings program, appropriate design and alternative technologies for museums and other cultural institutions, and asthma and domestic building design. I am the principal author of *SITE PLANNING IN AUSTRALIA: Strategies for energy efficient residential planning*, funded by the then Department of Primary Industry and Energy, and published by AGPS, and of the RAIA Environment Design Guides on the same topic.

SOLARCH/UNISEARCH were the contractors to SEDA NSW for the setting up and administration of the House Energy Rating Management Body (HMB), which accredits assessors under the Nationwide House Energy Rating Scheme (NatHERS), NSW. I was the technical supervisor of the HMB, with a broad overview of the dwelling thermal performance assessments carried out in NSW over five years. I have been a member of the NSW BRAC Energy Subcommittee, and also a member of the AGO Technical Advisory Committee on the implementation of AccuRate, the new mandated software tool under NatHERS. I undertook the Expert Review for the NSW Department of Planning, of the comparison of NatHERS and DIY methods of compliance for Thermal Comfort under BASIX, and was subsequently a member of a three person expert panel advising on the implementation of AccuRate in BASIX.

Through UNISEARCH, NEERG Seminars and Linarch Design, I conduct training in solar access and overshadowing assessment for Local Councils. I have delivered professional development courses on topics relating to energy efficient design both in Australia and internationally, including the key papers in the general area of assessment of ventilation and solar access performance and compliance for NEERG Seminars, cited by Commissioners of the LEC. Senior Commissioner Moore cited my assistance in reframing of the Planning Principle related to solar access (formerly known as the Parsonage Principle) in *The Benevolent Society v Waverley Council [2010] NSWLEC 1082.*

I practiced as a Registered Architect from 1971-2014, and now maintain a specialist consultancy practice advising on passive environmental performance and sustainability in buildings. I regularly assist the Land and Environment Court as an expert witness in related matters.

2.0 DOCUMENTS

3.1 I base my report on the following documents issued to me by Tony Owen Associates Architects.

- Plans
  - S96-A609 Solar Diagrams - Level 12 (1).pdf
  - S96-A604 Solar Diagrams - Level 02 (1).pdf
  - S96-A605 Solar Diagrams - Level 03 (1).pdf
  - S96-A606 Solar Diagrams - Level 04 06 08 10 (1).pdf
  - S96-A607 Solar Diagrams - Level 05 07 09 (1).pdf
  - S96-A608 Solar Diagrams - Level 11 (1).pdf

- Digital copy of 3D Model exported to SketchUp 2015.

3.2 I have previously visited the site.

3.0 ANALYSIS

3.1 Introduction

3.1.1 I take as the scope of my expert opinion to independently confirm:

- The correctness of the **solar geometry** employed by the architects; *and*
- Whether the proposed s.96 amendments would increase **overshadowing** of any individual apartments in the building to the south of the subject development.

I do this by undertaking my own independent analysis using a 3D digital model of the proposed development.

3.2 Methodology

3.2.1 The applicant's technique

The Architects use a computer mediated analysis technique based on a 3D digital model for their analysis, but illustrate the outcome on their plans with a 2D 'fan' diagram superimposed on the relevant 'cutoff edges'. Figure 1 illustrates the technique.

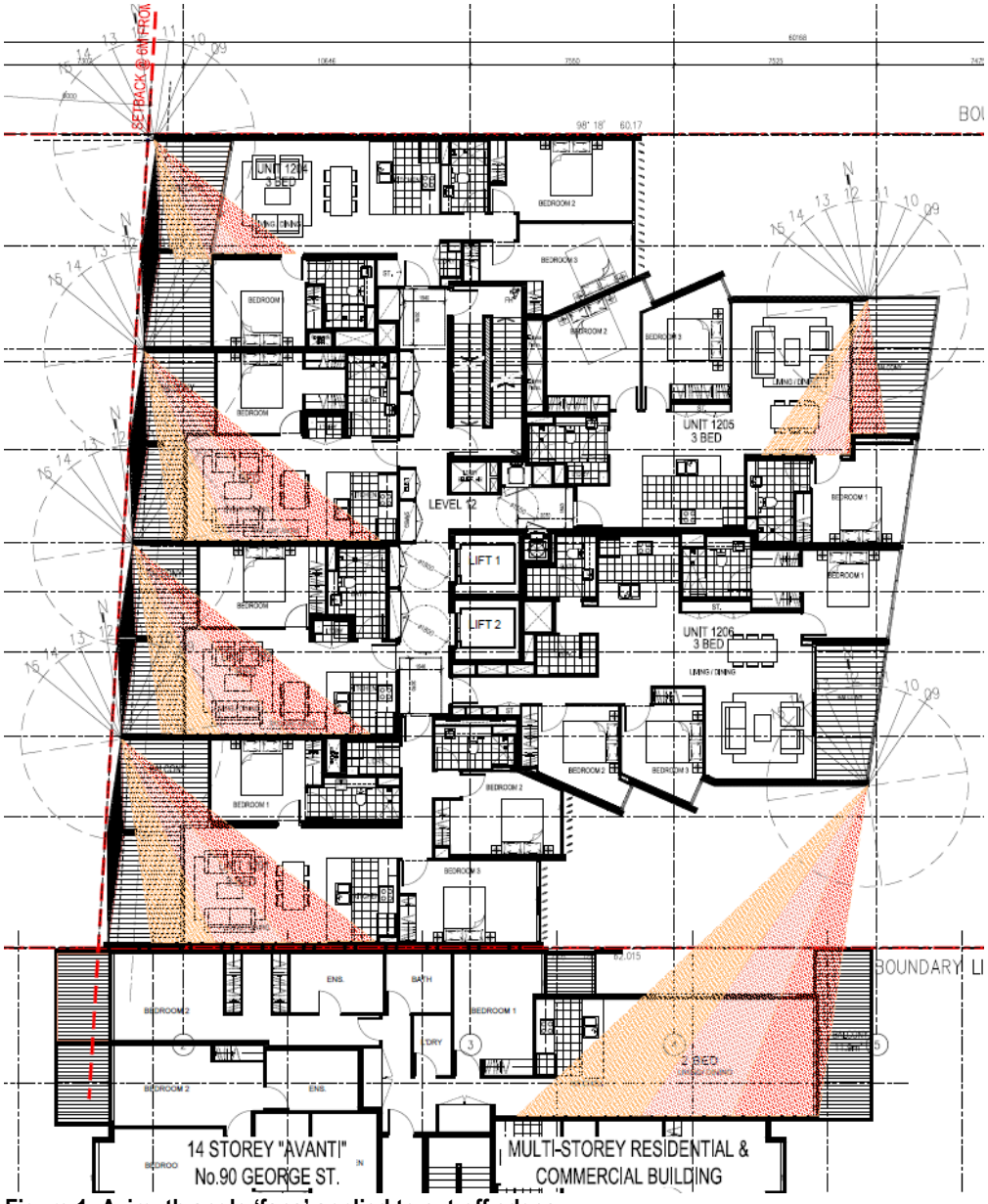


Figure 1: Azimuth angle 'fans' applied to cut-off edges

3.2.2 Verifying the solar geometry

I first confirm whether the designated azimuth angles are correct, by comparing the applicant's diagram with a top-down view of the shadow as it appears in my calibrated 3D digital model, set for 9 am on June 21. See Figure 2.

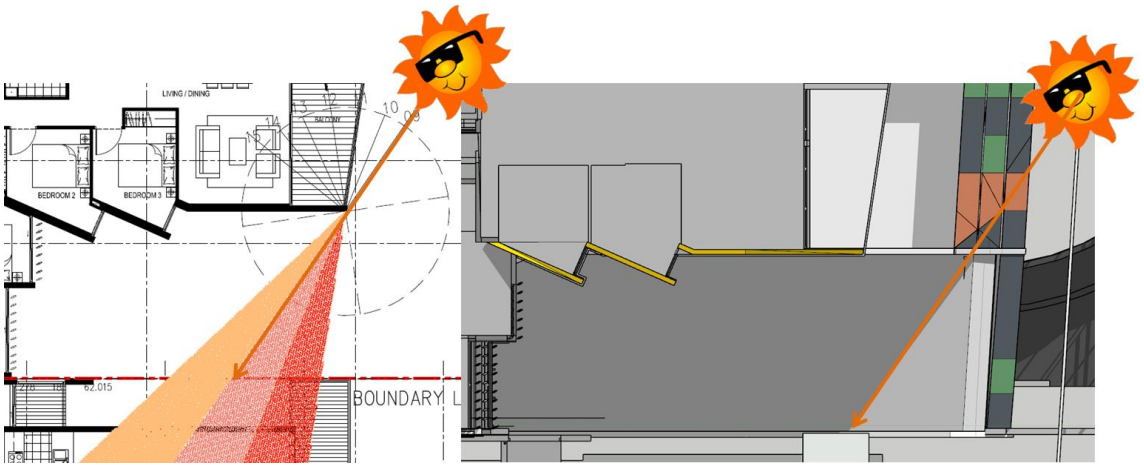


Figure 2: Verifying the azimuth angle

I note in approximately 1° discrepancy between the two angles. Explanation: At Hornsby, the MGA North (grid north) supplied on conventional surveys, is almost exactly 1° different to True North. This small discrepancy is effectively irrelevant in quantifying solar access and overshadowing, and may be safely disregarded.

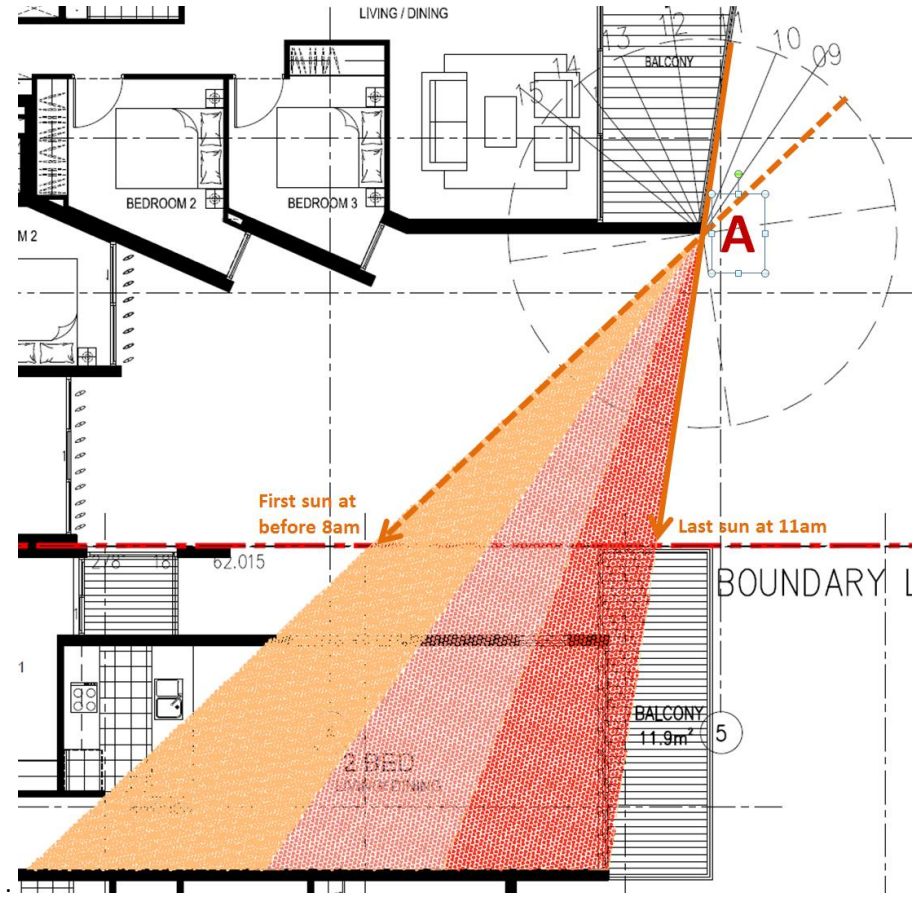


Figure 3: Detail. Interpreting the azimuth angle 'fans'

3.2.2 Interpreting the 2D 'fans'

In Figure 3, point **A** in plan remains unchanged between the approved DA and the s.96 application. The significance of this point is that it determines the extent of overshadowing for the north-east corner apartment in the 14 story 'Avanti' building at 90 George Street.

I note that interpretation of 2D azimuth angle 'fans', as with conventional plan and elevation shadow diagrams, may be inadequate to conclusively quantify overshadowing impact or solar access. Therefore I present the same condition in the form of 3D projections which clarify the information.

3.2.2.1 THE 3-D MODEL

I have been supplied by the architects with a copy of the 3D digital model in a suitable export format for me to employ Trimble SketchUp v2017 for my analysis.

I have independently geo-located the model and verified the direction of North, by reference to the cadastral grid north.

I have also independently verified the relevant model and location parameters, as well as time and date settings. From the model, I have summarily checked sufficient building dimensions by reference to figured RLs and plan set-out dimensions. Having established the accuracy of key points, I feel confident to rely on the general accuracy of the modelling.

The SketchUp software prepares the shadow projections by reference to accurate solar geometry. I employ aerial perspective projections known as *'View from the Sun'*.

A view from the sun shows all sunlit surfaces at a given time and date. It therefore allows a very precise count of sunlight duration on any point on a surface, with little or no requirement for secondary calculations or interpolation. The technique is illustrated in Figure 4. *Note that the views from the sun do not show any shadows. Shadows are those areas exactly coinciding with objects in the foreground.*

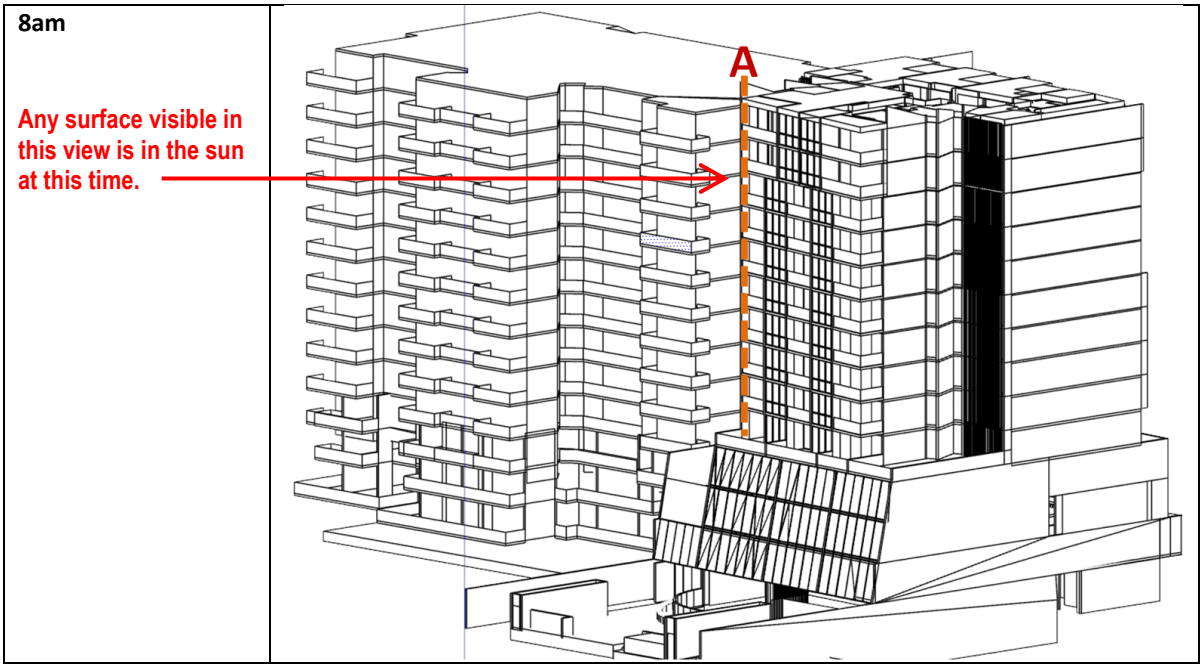
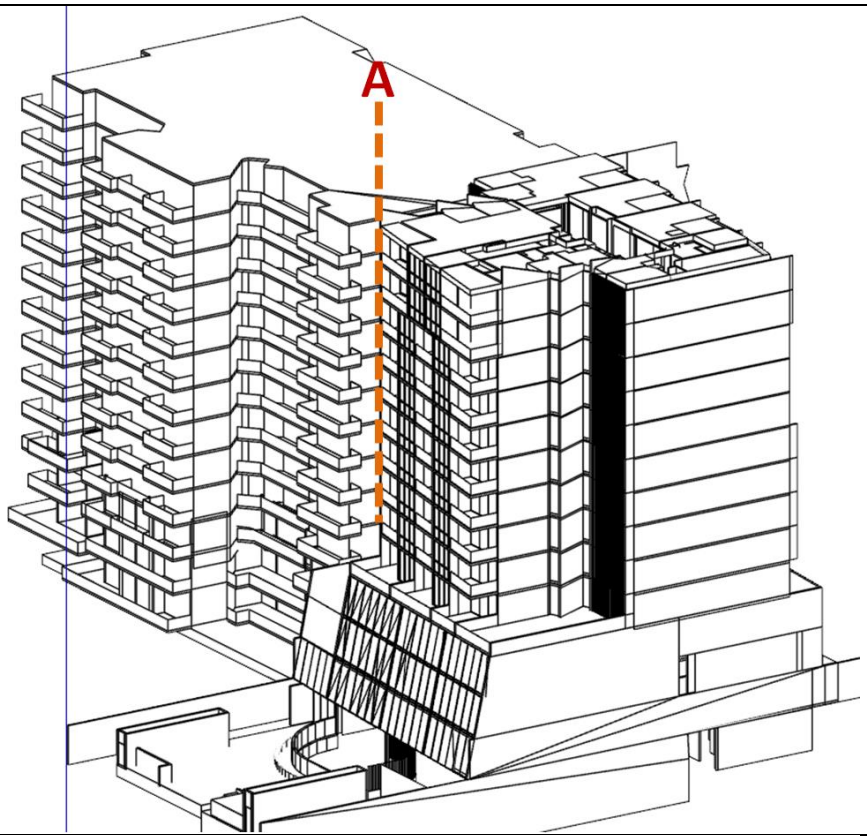
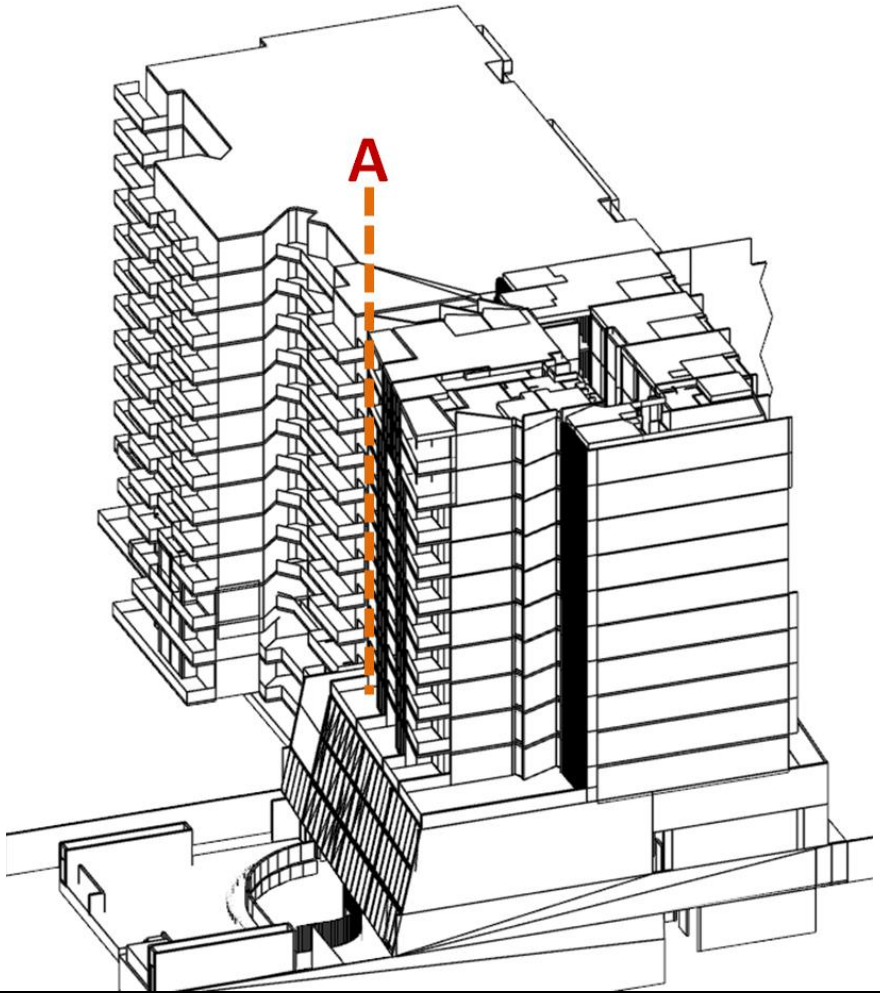
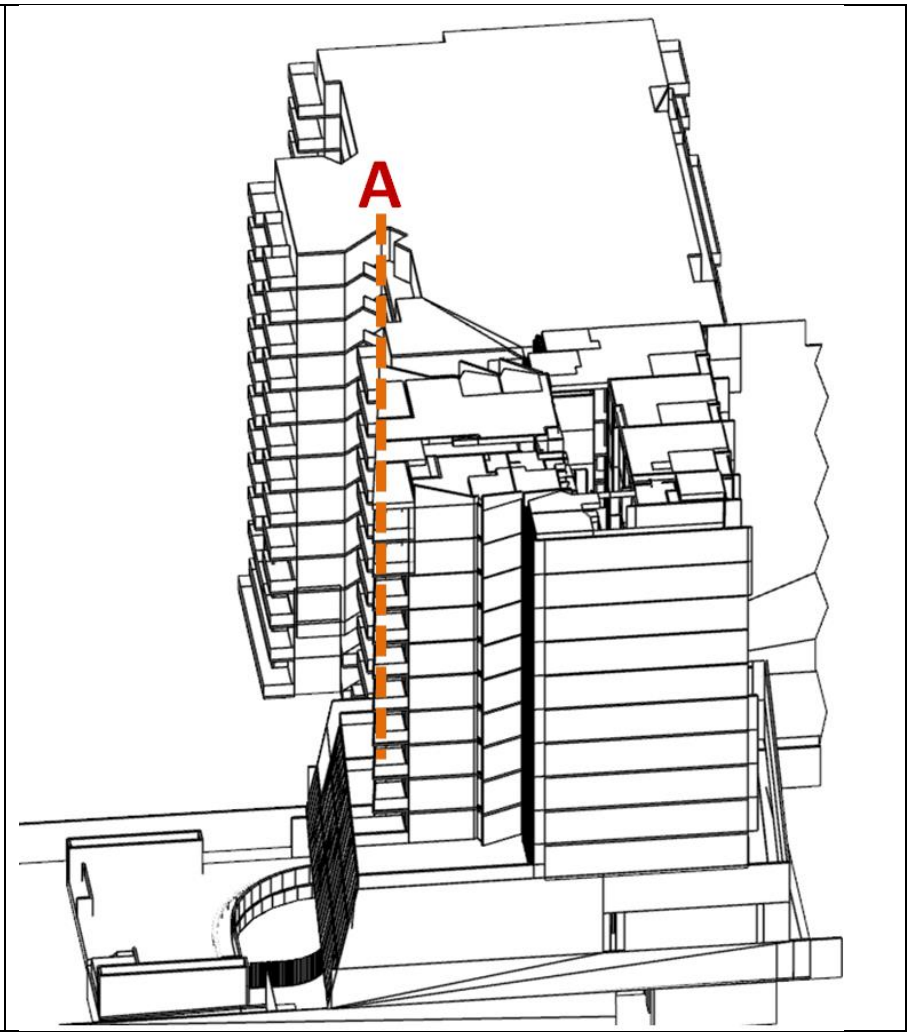


Figure 4: View from the Sun at 8am June 21

The following table shows hourly views from the sun for 9am, 10am and 11am.

Table 1: Views from the sun 9am to 11am

9am	
10am	

11am	

I note that the 3D view at 11am shows slightly less of the affected verandas and living room glazing than suggested by the Applicant's 2D 'fan'. In the context of the full sun access before 9am, I consider this small discrepancy negligible.

4.0 CONCLUSION

4.1 Accuracy of solar geometry

I am satisfied from my independent analysis using a 3D digital model that the **solar geometry employed by the architects is accurate** to a suitable degree for conventional solar access and overshadowing analysis.

4.2 Accuracy of solar geometry

I address myself in particular to the question whether the proposed s.96 amendments would increase **overshadowing** of individual apartments in the building to the south of the subject development.

The critical vertical edge of the subject building which occasions the potential overshadowing impact has been designated as 'point A' in plan throughout the foregoing discussion. I can safely infer that this building edge has been carefully positioned to assure two hours of morning sun on June 21, to glazing and private open space of the apartments in the north-east corner of the 'Avanti' building.

I note that the relevant building edge is not affected by the s.96 amendments, and therefore I would expect that the degree of overshadowing predicted would remain the same. My independent 3D model analysis confirms this to be the case.