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Author:
King, Steve

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THE FUNDAMENTALS OF URBAN DESIGN: WHAT ARCHITECTS AND PLANNERS NEED TO KNOW

Our place in the sun: urban design implications of solar access controls

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STEVE KING

Architect, Sustainability Expert & Lecturer
FACULTY OF THE BUILT ENVIRONMENT, UNSW

Introduction

The purpose of this paper is to review the impact of one particular amenity control on urban design outcomes in the local New South Wales compliance regime, in particular relating to multiunit residential construction.

Assuring solar access amenity as required by the Residential Flat Design Code is understandably a relatively high priority. But most planners and architects would agree that it is but one of a number of competing considerations in determining desirable urban form. The problem that I perceive has emerged is that solar access is a uniquely reductive, geometric determinant of building form, responding to numerical controls. Such controls have the deceptive appearance of being objective, while most other building variables that contribute to urban conditions appear in comparison to be almost subjective. As a consequence, accounting for minimum standards of solar access has arguably come to dominate overall site planning and massing strategies, and the detailed design of multiresidential buildings which fall under SEPP65.

Solar access as a historical determinant of building form

Design to take advantage of the amenity of passive solar heating in winter, combined with appropriate shading in summer, is possibly the oldest documented architectural guideline. Socrates is quoted to have advised:

"In houses that look towards the South, the sun penetrates the portico in winter, while in summer the sun is right over our heads and above the roof so that there is shade."

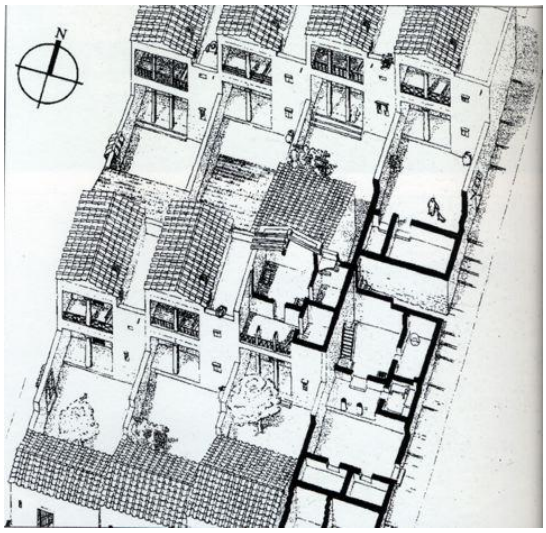


Figure 1: Reconstruction of row houses in Prienne

Pre-Columbian civilisations in America have left us examples of remarkable landscape integration, and settlement forms responding to solar geometry. Chinese Feng Shui is clearly an elaboration of sensible siting and design rules for climate responsive architecture.

Modern European preoccupation with access to sun in an urban setting really begins with the identified health problems of worker housing during the English Industrial Revolution. The more general problems of substandard housing were compounded by the effects of mediaeval taxation laws discouraging the use of window glass, and led to the commonly quoted aphorism: "Where the sun does not go, the doctor does".

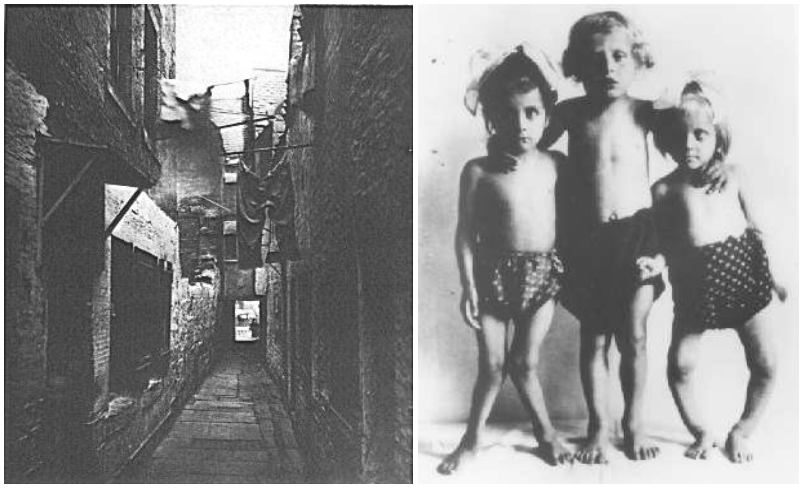


Figure 2: Urban housing, Industrial Revolution
Children with the prevalent bone wasting disease rickets

The prevalence of rickets was identified by the mid 19th century as associated with both poor diet and the prevailing physical conditions. The explanation of its cause as a deficiency of vitamin D – which is manufactured in the body with the agency of exposure to sunlight – brought about a sudden and emphatic commitment in Europe to the provision of worker housing with guaranteed access to sun.

Early proponents understandably advocated relatively simplistic geometric rules for the spacing and height of buildings. In particular, Augustine Rey advocated long, thin lowrise apartment blocks with an east-west orientation, based on a combination of longest sunshine duration with relatively good land economy.

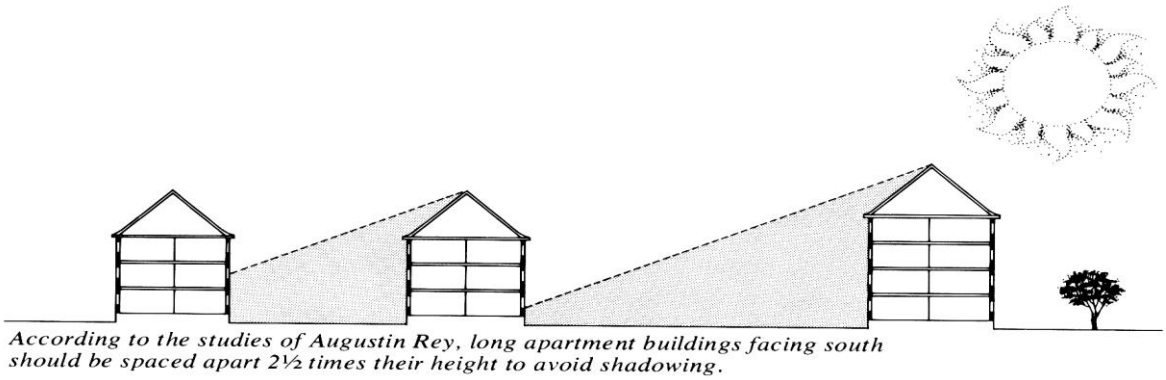
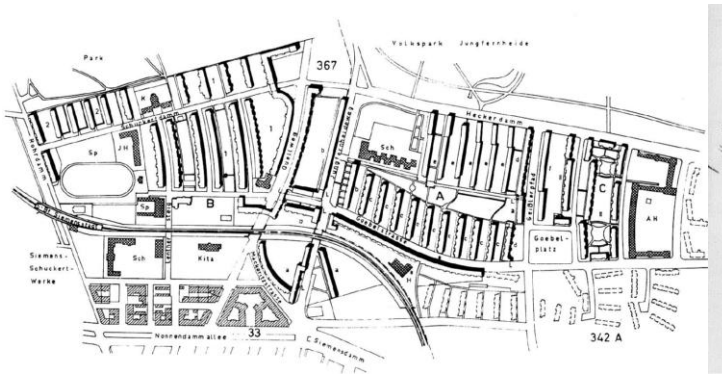


Figure 3: Augustine Rey, Paris 1912

Built examples that followed Rey's layout principles include the Siemenstadt solar oriented worker community near Berlin of 1929.



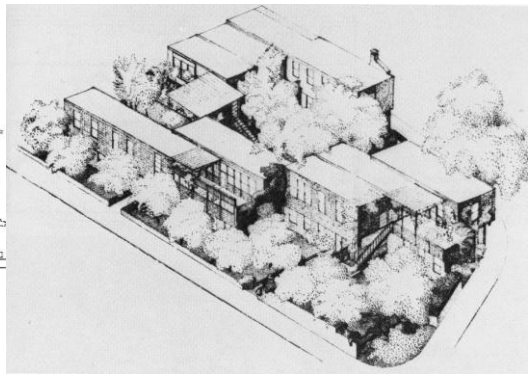


Figure 4: Siemenstadt: The Zeilenbau plan
Most apartment buildings faced east and west

Figure 5: Hugo Haring design of 1934

However, architects soon realised the drawbacks of the Zeilenbau plan. While the east-west orientation assured the greatest number of hours of sunshine, the quality of the sunshine during the northern European winter is quite poor. In response, they began to orient buildings south, with what might be described as a chequerboard layout, such as in the Hugo Haring design of 1934.

This tradition of direct geometric envelope controls based on strict solid geometry has persisted in Europe and the European inspired jurisdictions. Arguably its most powerful manifestations were during the 1970s in response to the first oil crisis. The housing competition for Midzpe Ramon, Israel, 1980, with its convenient spacing calculator accounting for siting on slopes, represents something of a watershed. After about that time, we see fewer examples of the preoccupation with urban form as a response to simple solar geometries, as more complex three-dimensional layouts became amenable to analysis by the newly developed personal computer.

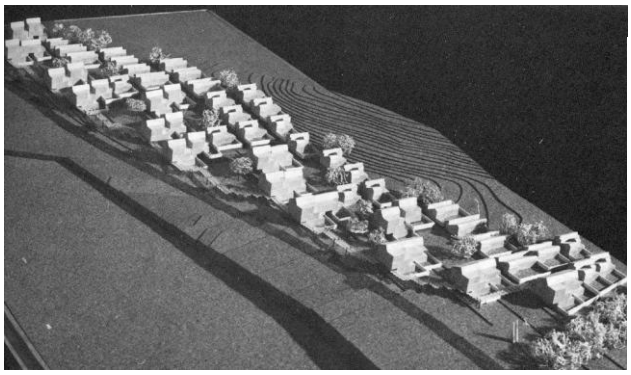


Figure 6: housing competition for Midzpe Ramon, Israel, 1980

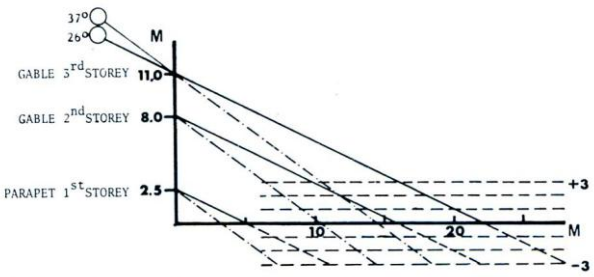


Fig. 11. Solar dimension modulator.

Even the briefest survey can't avoid mention of the famously complex building envelopes of New York City brought about by the NYC Zoning Resolution of 1916. However, to be strictly accurate, those controls were not about access to sun, but merely a 'sky exposure plane' to assure a certain penetration of daylight the street level.

In contrast, locally we still control the heights and setbacks of buildings in certain parts of the city by height planes intended to ensure primarily lunchtime sun access to public spaces such as major parks.

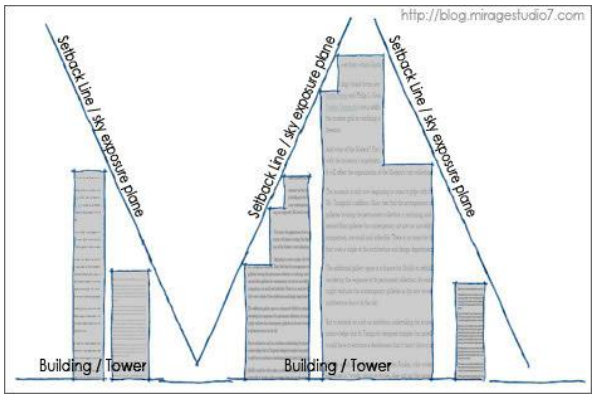


Figure 7: 'sky exposure plane' NYC Zoning Resolution of 1916

Contemporary Australian solar access controls

Otherwise, Australia enjoys the rare distinction of a country renowned for its sunshine, having taken over world leadership in the regulation of solar access to buildings. It appears to have been the legacy of Walter Bunning, through his book of 1945 *Homes in the Sun*, and his earlier Ministry of Post-War Reconstruction Report of 1944. It is in the latter that we find Bunning's recommendation:

> ". . . any proposed building should not reduce to less than one hour the sunlight falling on windows of the living and main bedrooms of any adjoining buildings between 9am and 3pm."

We recognise every element of the control present in most Councils' DCPs in 20011, and in the Residential Flat Design Code.

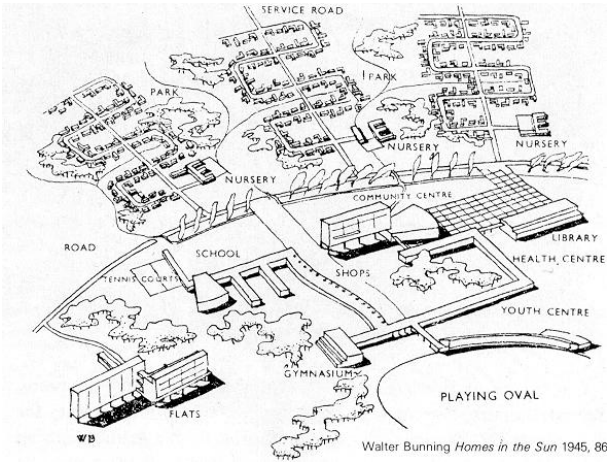


Figure 8: Walter Bunning: *Homes in the Sun* 1945
Arcadian housing for the returning servicemen

The problem is that during the 67 years since, we have long lost sight of the context in which Bunning made his recommendation. If we refer to the diagram of arcadia which accompanied Bunning's principle, we realise that he was describing an idealised green fields subdivision in which every house could be expected to have a north facing living room. Given that no graphic or computer techniques existed at that time for calculating periods of solar access, Bunning was making the logical assumption that if the trees that he was advocating were the right of every

suburban dweller to enjoy, sun would not be available to those north facing windows until it cleared the tree canopies in the morning, or after it dropped below them in the afternoon.

The Residential Flat design Code

For some years after the introduction of SEPP65 and the Residential Flat Design Code, the proposition that performance based standards allowed for consideration of effective sun at times including outside the 9am to 3pm envelope, gained some currency – including a general acceptance in the Land and Environment Court of New South Wales. But even with this degree of latitude the investigation of building massing to achieve compliance for two to three hours of midwinter solar access became the dominant design development exercise for any larger residential complex or precinct,.

It certainly dominated the ultimately failed attempt by the winners of the design competition for the redevelopment of the Chippendale CUB brewery site now known as Frasers Central Park. The detailed exploration of minutiae in interpreting the controls was clearly at odds with any reasonable application of a performance-based code. It was bound to lead to an approach based on minimum compliance with what were always arbitrarily defined numeric standards.

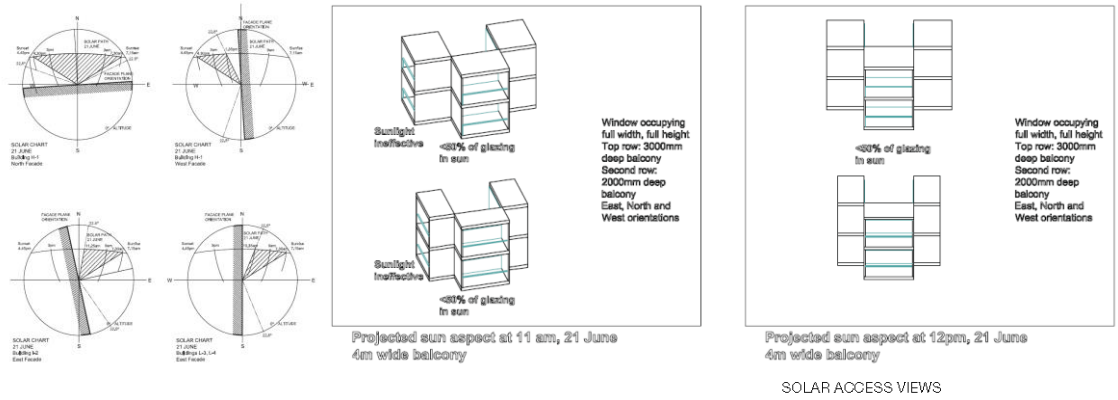


Figure 38 Development sun's eye view at 11.45 am on June 21

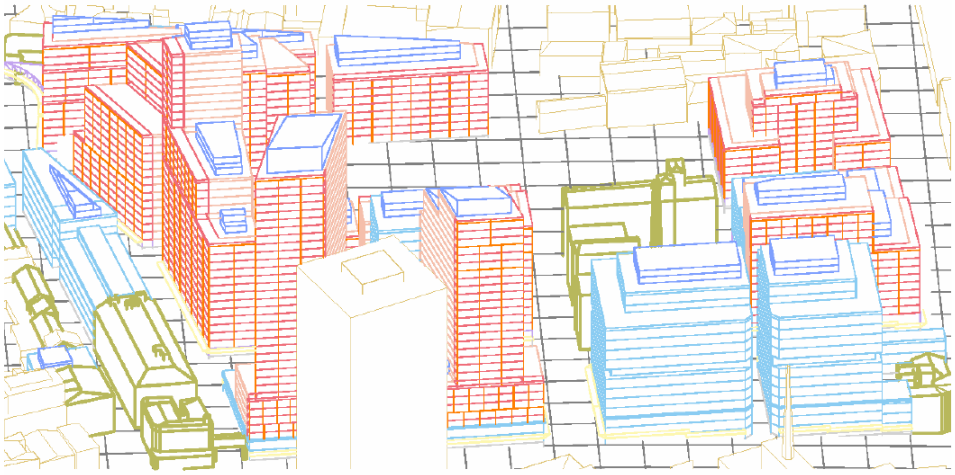


Figure 9: Detailed investigations of solar access potential
CUB Brewery site, Chippendale, Sydney *(Source Tzannes/Cox)*

The current developers appear to have succeeded in radically revising the scheme by reallocating building uses. It is only conjecture on my part, but I strongly suggest that the breakthrough that has allowed the current owners of the site to resolve Council's stringent interest in the development controls, was that the prominent international architects brought in were not acculturated in the reductive approach to solar access, to which the local architects are now so beholden. While there is evidence of the legacy of exhaustive detailed exploration of dynamic solar access in the way that the foreign consultants utilise the same analytical techniques (views from the sun), it is clear that the generation of urban form has been approached more creatively, and taking on board more variables.

Figure 10: Views from the Sun, Fosters scheme for CUB brewery site

Solar access in current local developments

So it is doubly disappointing to have to describe the conditions I perceive to prevail in the application of solar access principles in current local developments.

In my view, there is clear evidence that the larger scale layout of high-density precincts is generally determined by considerations which rarely include the creation of optimum lot sizes and building forms to facilitate the rigorous application of the subsequent solar access standards for multiunit residential construction.

Figure 11: Typical very large apartment block on brown fields redevelopment site, Sydney 2011

In the case of large brown field sites, there is an identifiable tendency to pay some limited attention to the notion of solar access in the public domain. This seems motivated largely by a desire to serve the needs of potential

outdoor eating. It is accommodated by a rudimentary understanding of the advantages of north-south streets, in as much as these allow the penetration of up to 2 hours of sun at pavement level in winter. This favouring of the north-south street grid is reinforced by strong imperatives for connectivity of view corridors associated with both sides of Sydney Harbour.

Unfortunately, if the block sizes defined are quite large, this approach also creates typically U-shaped 'perimeter wall' style, very large apartment blocks, with very long east and west elevations. Trying to assure complying solar access to the magic proportion of 70% of apartments then becomes a reductive game of distorting individual apartment plans, a characteristic 'wedding caking' of the building form, and inevitably the introduction of skylights where nothing else can get the last few apartments and over the line.

In rezoned areas, the effect is even more insidious. Smaller developers acquire former individual dwelling sites for amalgamation, based on yield calculations determined by a pragmatic anticipation of the relationship between achievable FSR and arbitrary height controls. This process rarely relates to any usable urban design prepared by Council. The design process from that point is then determined by the same juggling exercise to reconcile the competing considerations of required proportion of apartments with minimum standards of solar access, and protection of minimum solar access for existing dwellings on neighbouring sites. Where the developer and architect are relatively sophisticated in their use of three-dimensional CAD-based tools, this process could be said to be relatively reductive in establishing inferred height control planes, to which the details of the building form will subsequently conform.

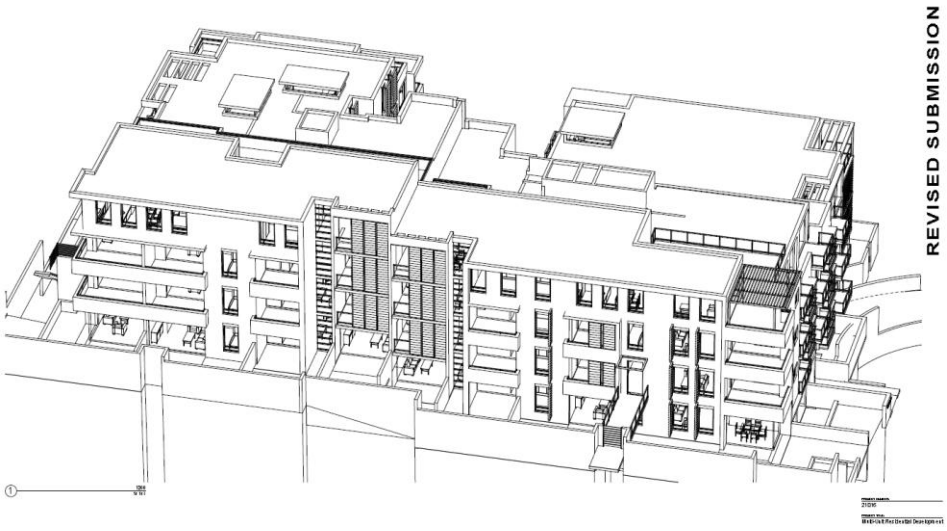


Figure 12: Typical redevelopment of amalgamated sites in rezoned areas

With the typical 3 to 4 block amalgamation, there is a fairly typical building form emerging. It could be described as a lumpy, deep 4 to 6 storey building block, masquerading as four stories above a sloping natural ground level. The double loaded plans are almost invariably too long to conform to preconceived controls of maximum building length, and therefore are somewhat arbitrarily articulated on their street facades.

If, as commonly occurs in Sydney, the underlying original subdivision was laid out with a north-south, east-west street grid, these building forms commonly develop a characteristic south facing 'notch'. The width of the half-hearted courtyard (with adverse orientation) is determined by another arbitrary control – 12m separation between facing living spaces. But it also happens to allow an additional small cone of sun to sweep the façade of any building located to the south at a minimum setback, over a period of 2 to 3 hours in the middle of the winter day.

In combination with the inevitable 'wedding caking', this becomes an almost standard response to the deterministic requirement for protecting solar access to the southerly neighbour.

Figure 13: Impact of future development
Hypothetical development modelled by developer to demonstrate solar access compliance

To conform with the strict application of assuring three hours of sunlight between the hours of 9 AM and 3 PM on June 21, has become the most time-consuming process of design development for multi-residential apartment blocks. Because no regard is paid to effective sun before or after that period, being able to demonstrate sun penetrating glazing at 12 o'clock (as either the end or the start of the mandated period) has taken on an undue significance. At least two identifiable building details are emerging, that can only be described to this control:

- The necessity to push the glazing of the living space to the plane of the façade, with sideways access to a veranda which meets the parallel control for a son to a private open space of prescribed minimum dimensions. This is rarely conducive to the best internal layout of the apartment.

- What might be described as the '20 minute bay window'. This is a glazing configuration designed to pick up an additional 20 minutes to half an hour of northern sun for glazing that is otherwise facing east or west, and which may not otherwise have been utilised were it not for the necessity to start complying period of sun access at 12 noon.

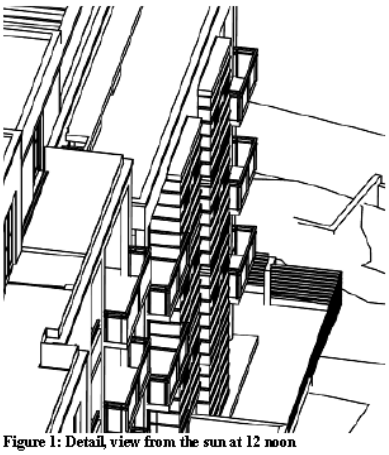


Figure 1: Detail, view from the sun at 12 noon

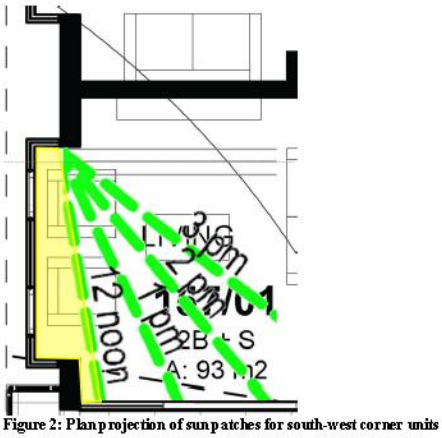


Figure 2: Plan projection of sun patches for south-west corner units

Figure 14: The '20 minute bay window'
Capturing the last sliver of sun at 12 noon

Increasingly, abstract block massing is subject to three-dimensional analysis sometimes over a period of months, with attention to other qualities of the resultant billing form or outdoor spatial experience inevitably compromised. At the other end of the process, reporting of compliance can become obsessively detailed, with the sole aim of forestalling 'death by a thousand cuts' where council staff seeks to support more general objections to denser development.

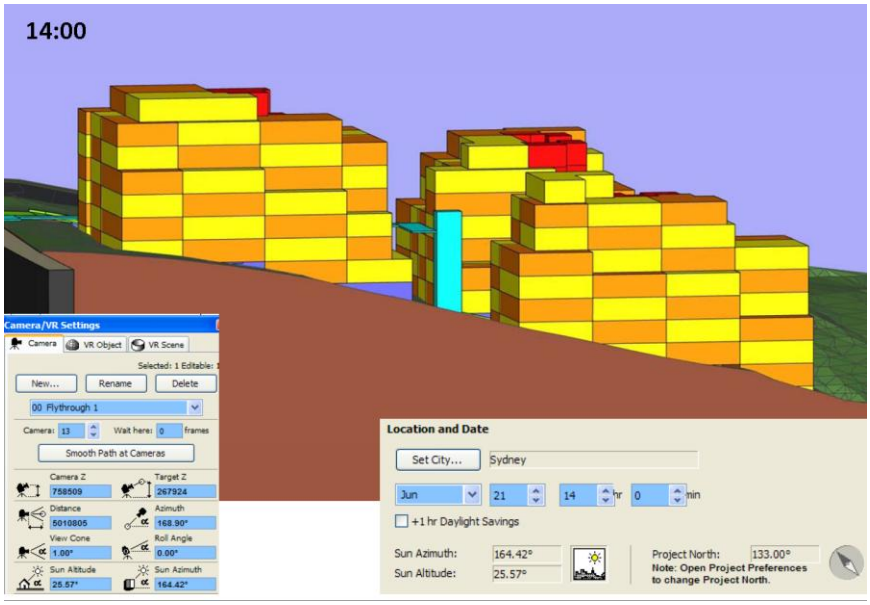


Figure 15: Massing exercise for investigating solar access compliance

Conclusion

Perhaps we have not gone so far as Boulder, Colorado, where the *Citizens to Elect an Effective City Council* manifesto *Principle #4: Limit Social Engineering* turns out to be the question "Do we really want to live in a city of lopsided houses?".

Figure 16: Boulder, Colorado
Solar access determined by geometric controls.

But there is no doubt in my mind that due to the way the solar access controls are applied by Councils, the work of those architects designing multi-residential buildings is dominated by an obsessive procedure in establishing numerical compliance. Especially as we overlay the controls with further requirements to anticipate future development of adjacent sites, we are increasingly seeing the potential to determine the typology of street facades by a reductive process of finely tuned building masses designed primarily to achieve precise solar access compliance.