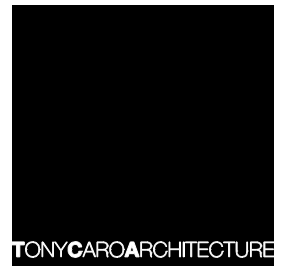


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**DISCUSSION PAPER
SEPP 65 UPDATE AND APARTMENT DESIGN GUIDE -
APPLICATION TO RESIDENTIAL TOWER DEVELOPMENT**

1.0 INTRODUCTION

As requested, TCA recently provided Dexus (ref. letter CRockliff - 27 10 14) with brief comments on the Dept of Planning's proposed update to SEPP65 and the Draft Apartment Design Guide. The latter will replace the existing Residential Flat Design Code. The over-arching purpose of SEPP65 and the ADG is to raise the quality of apartment design in NSW, and this update by the Dept is timely.

Members of the Property Council of Australia (including Dexus) recently held discussions with the Dept in relation to the new documents. This consultation highlighted concerns by Dexus and others in relation to the specific application of the draft documents to the design of high density, tall residential development within central business districts such as the Sydney Metropolitan area.

The Dept are willing to engage in further discussion about the new SEPP and ADG, and have requested that any proposals for amendment are to be based on examples and project analysis. We believe that many of the issues related to taller residential development can be explored through reasoned analysis rather than empirical evidence.

Dexus have subsequently asked TCA to prepare a concise Report setting out the perceived range of issues as a framework for further detailed consideration, work-shopping and further consultation with the Dept and the development community.

TCA recommend that

The Guide should include a separate section addressing environmental amenity in free-standing residential tower buildings, where achieving good privacy, sunlight, natural light and natural ventilation is markedly different to achieving these things close to the ground in dense urban courtyard and street typologies. Perhaps this could be specifically addressed in Part 4 where performance based alternatives assessment is provided for.

2.0 GENERAL COMMENTS

- Many of the commonly recognised problems in the original RFDC have been addressed.
- The ADG should be practical, clear, concise and user-friendly, however it is less accessible when compared to the RFDC.
- The ADG should avoid being a text-book for planning professionals. It clouds its key purpose.

3.0 SPECIFIC APPLICATION TO TOWER FORMS

- A “one size fits all” approach in a diverse place like Sydney is asking too much: It is not reasonable to design a courtyard apartment and a tower apartment by the same rules.
- Expectations and standards vary according to location, market and LGA. eg inner Sydney vs The Hills.
- The “Alternative Solutions” approach is vital if the SEPP and ADG are to address this diversity issue. It is likely to become the default option for developers and architects in places like central Sydney where “Acceptable Solutions” are not practical or feasible. The “Alternative Solutions” approach is likely to create complexity and a significantly higher level of time and cost devoted to assessment. In some cases, it will be willfully exploited by developers.
- The residential Tower as a specific building typology was not adequately defined in the RFDC, and this effectively remains the case with the ADG. The only RFDC reference is in relation to building separation, where buildings over 8 storeys are to be separated by 24/18/12 depending on cross usage relationships.
- For the purposes of this Overview, we have not included sites where high-density infill residential development is the likely form of development. These sites have further constraints as usually the side walls are party walls and there are complex relationships with the rear boundary. This analysis must be done in a future stage.
- The issue of “aesthetics” is not given a specific section within the ADG, rather it is integrated throughout the document. This is an important issue for big-picture city-form however – tall residential buildings are seen from great distances and their design quality in terms of scale, proportion, silhouette and the like is important. The SEPP65 Update refers generally to

context, scale and architectural expression as key design principles, but in a broad, generic sense.

- Issues of bulk and scale are significant: the reason why a typical residential tower usually appears to be finer and more slender than an office tower is that a greater façade to core depth is accepted in the latter (typically 10m for residential, 20m for an office tower), thereby producing office floor-plates of up to 2000sqm in comparison to a more typical residential tower plate of 700-1000 sqm.
- Serviced apartment development is increasing in Sydney and should be separately addressed.

4.0 SUMMARY COMMENT

In undertaking a review of the proposed SEPP65 Update and Draft ADG, we believe there is a strong case for residential tower development in dense urban centres like central Sydney to be addressed by an additional section of the ADG. The significant divergence in context and constraints for residential tower development in dense existing centres compared to less dense urban types in emerging areas warrants this consideration.

It is likely that most inner city residential development will not be able to comply with the new ADG Acceptable Solutions approach, and therefore Alternative Solutions will be the necessary consent approach. This underlines our advice: if the new code does not adequately address the realities of the tower as a residential type in dense centres, then amendment is recommended to avoid this becoming the default method of assessment.

5.0 APARTMENT DESIGN GUIDE REVIEW – APPLICATION TO RESIDENTIAL TOWER DEVELOPMENT

ADG PART 1 – IDENTIFYING THE CONTEXT

“Tower Apartments” are identified in the ADG as one of seven apartment building types, and towers are defined as buildings of more than nine storeys. The RFDC did not provide a definition.

The ADG should therefore include a more specific and relevant definition. There are many apartment buildings of nine storeys and even up to 15 storeys that are not towers by any accepted measure. An alternative could be considered by relating typology to generally accepted height thresholds:

2-4 storeys	lower density/scale inner and suburban development
5-9 storeys	medium density/scale urban typologies (below 25m sprinkler requirement)
10-15 storeys	this is a “transitional zone” where buildings can be hybrid typologies. Small tower forms may exist within this threshold depending on their urban context and design characteristics.
16-25 storeys	smaller residential towers (includes city infill sites)
26-50 storeys	larger free-standing residential towers
51 storeys and above	super-tall free-standing residential towers – (limited possibility in Sydney)

A “tower” is generally perceived to be a “tall” building, typically with a sense of overall vertical proportion or profile. There is a degree of subjectivity in this however – many buildings perceived to be towers are slender in cross section but “squat” in the opposite, long section. “Tall” is also subjective and related to context – a 15 storey building may be considered “tall” in Liverpool but not in central Sydney. For the purposes of dense CBD sites, we would suggest that towers are defined as 16 storeys and over.

For “Strategic Centres” the local character and context is described by the ADG as:

Considerations for residential flat buildings in strategic centres include complex relationships with adjacent buildings, impact of taller building types, privacy between commercial and residential uses, parking demand, high site coverage, limited deep soil, reliance on quality public streets and places and overshadowing.

Generally we concur with this description, the issue is whether the SEPP and ADG adequately address the significant issues raised in relation to the residential tower type.

Precincts And Individual Sites (Part 1C) suggests that sites should be purchased/amalgamated with the onus of development capacity a key consideration for developers:

The size, shape and orientation of individual sites directly inform the possible building types and development capacity.

The examples given in the ADG focus upon less dense urban typologies in transforming areas, however potential to achieve this is more constrained in developed, high density areas such as central Sydney.

Our overall view is that the Draft ADG in its current form does not adequately address high-density residential tower development – many of the key principles are difficult or impossible to achieve because of the reality and constraints described above.

ADG PART 2 – DEVELOPING THE CONTROLS

This section of the Draft ADG is akin to a text or reference book for planners preparing new development controls, rather than a practical guide for developers and designers. Whilst this intention is laudable and will have application, it's suitability within the ADG is questionable, given that the principal objective is for it to be a user-friendly, clear "guide" document aimed at setting out design criteria for developers and building designers. Notwithstanding, there is a range of important issues of relevance to this Review in this section.

- **Building Envelope** (Part 2B) is set at 30% greater than achievable floor area, and this is considered reasonable. High-rise floor plates tend to be compact and 30% for articulation, balconies and shafts would cover most design proposals. If not an Alternative Solutions approach could be used.

- **Building Height** (Part 2C) is clearly relevant to residential towers. The identified considerations are reasonable. The ADG does not attempt to determine what may be an acceptable height – this is left to other authorities and reasonably so. There should be an attempt to regularise definition of height however – presently across a variety of controls it can be defined as the highest habitable floor level, highest habitable ceiling level, roof level, or highest point of the building.

- The general description of **Floor Space Ratio** (Part 2D) is reasonable, however the statement that "*design of the development and allowable floor space should only 'fill' approximately 70% of the building envelope*" is misleading. Why 70%? It should not be confused with the inverse of "building envelope", which appears to be what

is intended. What if a design were to propose a large internal atrium? It could be dealt with by Alternative Solutions, however it would be preferable to amend as follows: *“prescribed building envelopes allow for significant built form articulation and non-GFA areas, and achievable floor area (GFA) defined by a sites maximum FSR must be contained within the defined envelope”*. Development profitability will ensure that design proposals are cost efficient, compact and highly unlikely to simply fill up an envelope, “just because you can”.

- The stated objective of: *“Ensure that development aligns with the optimum capacity of the site and the desired density of the local area”* will be difficult to achieve for existing, constrained sites in high density areas without demonstration of an Alternative Solution. This will place onus and cost on the developer: it would be preferable to have a separate Part to address these development conditions.

- **Building Depth (Part 2E) is a major issue for residential tower development.** The current maximum in principle is 18 metres between opposite facades. For example it is not unreasonable in a tower or slab typology to have a plan arrangement of two 10 metre wide bands of apartments separated by a 2 metre wide corridor, yielding a “building depth” of 22 metres. This would offer, for example, 10m x 10m 2-bed apartments of 90 sqm including an in-board 10-12 sqm terrace).

- The ADG states that *“Where greater depths are proposed, demonstrate that indicative layouts can achieve acceptable amenity with room and apartment depths.”* This presumably requires an Alternative Solution. Whilst 18m may be appropriate for lower height typologies, it is too constraining for tall residential towers and hence consideration for a specific variation should be considered.

- **Building Separation (Part 2F) is also a major issue for residential tower development, and particularly within existing high-density city centres.** The ADG has not changed the existing RFDC guidelines for minimum building separation:

Minimum separation distances for buildings within a site and between adjoining sites are:

Up to four storeys (approximately 12m):

- 12m between habitable rooms/balconies
- 9m between habitable and non-habitable
- 6m between non-habitable

Five to eight storeys (approximately 25m):

- 18m between habitable rooms/balconies
- 12m between habitable and non-habitable
- 9m between non-habitable rooms

Nine storeys and above (over 25m):

- 24m between habitable rooms/balconies
- 18m between habitable and non-habitable
- 12m between non-habitable

- It is notable that this is unchanged - is it reasonable generally, has it been proven to work, and specifically for tower development in existing high-density centres?. Why is more separation required with more height? Is it for solar access? If so this doesn't really work as the solar angle in winter does not afford required levels of solar access to lower apartments. Is it for visual privacy? If so it doesn't work either - residents look downwards and upwards as well as horizontally.
- An argument that it is more about a type of visual urban quality achieved by built form separation, or to limit height of street walls (New York for example) may be more valid and relevant. However these controls should be established by other relevant authorities.
- In existing high-density centres, the issue of solar access is complicated, tenuous and on many sites, simply impossible to achieve. The City of Sydney have recognised this in the past by accepting less stringent solar access controls and not requiring out-door private balconies in south facing development. Other councils such as Parramatta have followed suit, and this will increasingly be the case as Sydney densifies. Central Sydney's street layout has often been criticised for its narrow widths, however the long north-south blocks at least offer the possibility of arranging residential towers with long east and west facades. This theoretically makes compliance with two hours of winter solar access possible, notwithstanding that half of the apartments will face west with the attendant heat gain problems. What is possible for sites with substantial south-facing frontages? Clearly compliance with the ADG is exceedingly difficult and involves many compromises and contortions. Will such sites be automatically destined to the Alternative Solutions process, or is a different set of rules preferable?
- The ADG acknowledges that minimum building separation distances may need to be increased for a variety of good reasons, however (with exception of zero side boundary setbacks) it does not acknowledge that these distances could be decreased for other good reasons.
- Where tower form is proposed in existing high-density areas such as Central Sydney, visual form relationships between buildings and achieving acceptable amenity for residents are more complex matters. It is far less likely that the application of the new ADG Acceptable Solutions will achieve optimum design outcomes as well as meet the more challenging commercial objectives in these areas. It is far more likely that development of this type will only achieve ADG compliance through the more costly and subjective Alternative Solutions option.
- This could mean:
 - exemption for towers from ADG compliance, on the basis of over-riding urban design considerations of city form, density and orientation constraints, or
 - amendment to Acceptable Solutions performance criteria for tower development in existing high-density centres.

Side And Rear Setbacks (Part 2H) for podium levels are less relevant to tower development in dense city centres, where it is to be expected that nil setbacks are required for public domain reasons. This should be made clear in the ADG.

- The ADG should also acknowledge and address the increasing procurement of development consent through the Design Excellence Competition process and the bonuses offered – often an increase of 10% in height and/or FSR.

PART 3 – SITING THE DEVELOPMENT

Visual Privacy (Part 3F) is the only section in this Part directly relevant to residential tower development controls and this review.

As noted above, the diagrams 3F.3 and 3F.4 propose that greater separation is required with an increase in height. This is questionable because eyesight does not get sharper as height increases, and people also look downwards and upwards across a separation to a building opposite. Hitchcock's famed motion picture "Rear Window" is testament to this!

- The possibility of reduced building separation between buildings through careful siting inter-relationships should be further explored, and specifically in relation to freestanding towers. . Again, the ADG diagrams demonstrate that the focus of the controls and performance criteria is weighted towards lower height urban typologies. Off-set towers can be located closer than 24 metres, whilst maximising views for residents and at the same time improving visual cross privacy to a greater degree than adjacent or opposite towers.

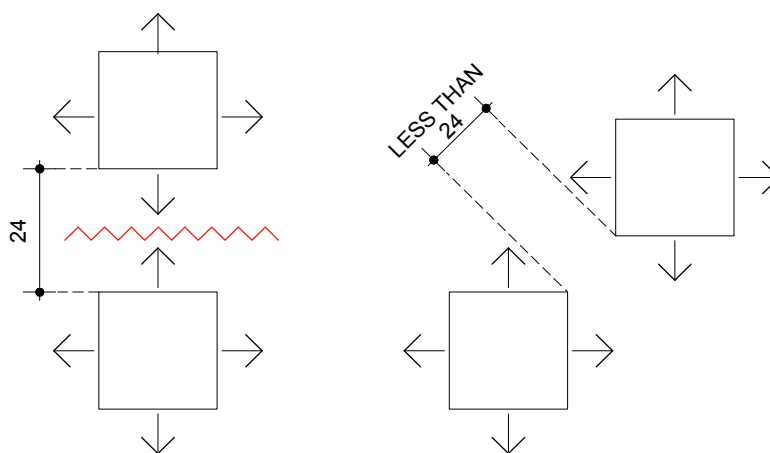


Diagram showing possible tower relationships

In tight and dense inner city centres achieving this may be more difficult to achieve, however the principle of resolving visual privacy through design is an important concept that could be demonstrated in the ADG.

There is far greater opportunity and development flexibility for the siting of taller tower forms in new developing areas compared to existing centres. An example is the Green Square precinct, where substantially greater distances between “tall” tower elements has been mandated by the City in order to create excellent amenity within the public domain and between buildings.

This simply isn’t possible in central Sydney because of existing block structure, ownership patterns and built form. In most cases there is only one option for siting a new tower building, as its alignment and orientation is largely determined by the existing street pattern. It is therefore reasonable to expect that a different set of controls taking into account the reality of the city centre’s existing urban form are considered as part of the new SEPP65/ADG framework.

PART 4 –DESIGNING THE BUILDING

Apartment Mix (Part 4A)

This is a complex area as the desirable social objectives achieved by provision of a diverse apartment mix are often in conflict with consumer demand and hence the development sectors financial objectives. The residential property investment market in Sydney is also driven by different forces to those that may be in the best interests of the actual occupier, be they owner or renter.

Notwithstanding, the ADG acknowledges that a place like Sydney is extremely diverse in its housing needs. It implies that whilst the social objectives of a diverse mix should be achieved, there is flexibility to modify a development apartment mix to reflect localised demand. For example, there is far less demand for large family apartments in the inner city than in other parts of the metropolitan area. The converse applies to smaller inner city apartments where younger urban residents require less private space and more convenient access to contemporary lifestyle services and facilities.

This section could reflect this with the inclusion of a range of acceptable apartment mixes within a development, that may change for recognised urban centres, and suburban contexts.

Mixed Use (Part 4J)

This section is relevant to inner city residential development, where the ground floor and some podium levels are usually allocated to other uses. Generally we agree with the performance criteria.

There is often conflict between authorities and developers however – the authority

requires a range of uses consistent with a diverse city, the developer requires highest and best use that often means maximisation of residential floor space. We believe there is merit in both considerations and that the preferred method of addressing this is to ensure that the ground floor (in particular) and some upper levels are designed for flexible uses and change. This could mean higher ceiling heights, more open structural grids, and less internal walls and partitioning, so that the spaces can be adapted between residential and other commercial uses. This may seem fanciful, however one only needs to consider the typical Parisian urban mixed-use building where internal spaces shift tidally between uses according to changing market forces – the spaces are sufficiently flexible to work as apartments or commercial workplace enterprises.

Solar and Daylight Access (Part 4L)

Together with Part 4Q – Natural Ventilation, this section is where the key requirements for environmental amenity and human comfort are addressed. It may seem reasonable to assume that these requirements are common to all types of residential development, including towers. However, it is likely that many people would trade, for example, some degree of solar access in their apartment for an inner city location with access to a wide range of services and transport.

The Draft ADG adopts the RFDC Rule of Thumb whereby a minimum of 70% of apartments must receive at least 3 hours of sunlight to primary living areas in mid-winter. It also acknowledges that there are certain circumstances where achieving this may not be possible, in which case an Alternative Solution approach would be required. We would expect that this would become the default for places like central Sydney.

The ADG states that *"Access to sunlight for habitable rooms and private open space is measured at mid winter (21 June) as this is when the sun is lowest in the sky and represents the 'worst case' scenario for solar access.* This should be clarified as the low winter sun actually provides the "best case" scenario for solar access, assuming that the building façade is not overshadowed by another building. The ADG diagram makes this clear: there is no solar access in summer in the middle of the day due to the high solar angle.

Performance criteria 4L-1.2 - *"single aspect single storey apartments have a northerly or easterly aspect"* is overly prescriptive and unworkable generally, but particularly in places like central Sydney.

Performance criteria 4L-1.3 – *"The number of single aspect west and south facing apartments is minimised"* is an over generalization, and will make achieving 70% solar access almost impossible if authorities refuse on this basis to accept west facing apartments. In central Sydney, the existing street grid dictates that many apartments will face this orientation. A better and more realistic approach would be to acknowledge that western orientation (to a view or street frontage for example) should be mitigated by inclusion of effective external operable shading devices.

Performance criteria 4L-1.5 – “*a maximum of 15% of apartments in a building have no direct sunlight between 9am and 3pm in mid-winter*”. This is likely to be impossible to achieve on many south-facing sites where the street frontage may be the primary source of access to daylight, ventilation and outlook.

Solar access to city apartments should be assessed in relation to likely hours of occupation. For example, what is the purpose of sunlight access between 11am and 1pm if the majority of residents are workers? This group may place a much higher value of sunlight in the early mornings and late afternoons when they are more likely to be at home.

In summary, the ADG guidelines whilst adequate for other lower density typologies are almost unworkable for inner city tower development. As already noted, a separate guideline for this typology is recommended.

Common Circulation and Spaces (Part 4M)

This is a complex issue for all apartment buildings, and particularly high-rise residential towers. Having access to natural daylight and ventilation within common circulation areas is a key environmental amenity objective for all apartment types for the reasons articulated in the ADG. This is perhaps most difficult for towers than other typologies. It usually requires a deep slot or slots cut into the floor plan, which creates inefficiencies in yield and structural performance. Conversely these slots create opportunities for more naturally ventilated apartments, albeit with compromises on acoustic privacy across narrow slots.

The benefits of providing good and ample access to natural light (and ventilation at lower levels) to avoid dark and airless circulation lobbies is considered to be a high-value objective for all apartment buildings including those in dense city centres.

Wider than minimum corridors are also supported, particularly in Lift Lobby areas where a minimum of 2 metres should be mandated. This has basis in other codes such as the BCA.

Performance criteria 4M-1.1 – “*the maximum number of apartments off a circulation core on a single level is eight*”. This continues a controversial and poorly considered RFDC Rule of Thumb. There is no verifiable social basis for this that we are aware of. In our experience, a common space with more front doors that is able to achieve quality access to natural light and ventilation creates significantly superior amenity and character, as well as being likely to encourage these spaces to be used for social interaction.

Performance criteria 4M-1.2 – “*number of vertical circulation points and number of entries are maximised*” – this certainly applies to perimeter urban typologies, but is irrelevant to towers.

As a general comment, the criteria are more focused on the design requirements for non-tower apartment building types. As already noted, a separate guideline for this

typology is recommended.

Apartment Layout (Part 4N)

The minimum apartment sizes (Table 6) are reasonable and supported. At these sizes however, design is crucial – avoidance of corridors and creation of good room proportions is essential.

Performance criteria 4N-2.1 – We do not accept the argument that ceiling height must increase with room depth (Figure 4N.3). Is there empirical evidence available that proves this? One could argue that larger windows without tinting, or light internal wall surface colours can achieve the same intent without loss of building efficiency and an increase in building costs that would inevitably lead to issues of affordability.

There may be a case for this in low buildings, however the impacts on overall height within building controls will have a significant impact on potential development yield for towers. An extra 500mm of Floor to Floor height loses an apartment every seventh floor. A 50-storey development would therefore lose seven floors.

One way of addressing this would be to design larger floorplates with more apartments per floor. This would inevitably lead to “fatter” buildings and other issues in relation to adjacent development.

Performance criteria 4N-2.2 – *“For open plan layouts, combining the living room, dining room and kitchen, the back of the kitchen is a maximum of 8 metres from a window”*. This is a hang-over from the RFDC and should be deleted – what is the empirical basis for this? A person standing at the kitchen bench with their back to the window will overshadow the work surface. Also in our view a linear space incorporating living/dining/kitchen requires a minimum of 3.5m/3m/2.5m respectively, or a minimum total length of 9metres.

Performance criteria 4N-2.5 – *“All living areas and bedrooms are located on the external face of the building”*. We generally support this objective, inclusive of “snorkel” type apartments with a minimum window width of 1.2 metres. A number of other authorities have recognised the necessity of snorkel apartments, particularly for deeper more square blocks with narrow frontages to favourable orientations. These authorities have prepared acceptable layouts and minimum dimensions for snorkel types including preference for the snorkels to be paired, reducing the depth / width ratio of the slot in-which the snorkel bedrooms have their windows.

A recognition of this type of apartment and the issues of site geometry and orientation would be a positive addition to the ADG.

There is also a question regarding the increasingly common “one-plus” apartment type, where a small internal space (usually called a media room) is often utilised as a de-facto second bedroom. We are cautiously supportive of the value of this apartment type as it creates wider choice – the second space is invaluable as an

office or media area, and has a relationship with housing affordability for first home buyers.

Performance criteria 4N-2.7 – “*All kitchens in corner apartments have an external openable window/door.*” This is arbitrary and restrictive. It should be deleted.

As previously noted in relation to building depth, it is of interest that the ALL of the indicative two and three bedroom apartment layouts have internal depths that, if “back-to-backed” off a central corridor, would exceed the maximum prescribed building depth of 18 metres by at least two metres. This is a clear indication of the inherent flaw in the building depth recommendations.

Performance criteria 4N-3.3 – “*Bedrooms have a minimum dimension of 3 metres excluding wardrobe.*” This is overly prescriptive. For example, 2.7 metres width allows 700mm to walk past the end of the bed, thus reducing façade area, building cost and improving affordability. A 10sqm bedroom of 2.7m width is 3.7m in length, thus allowing a desk or chair below the window and therefore a marked improvement in room functionality.

Our personal view is that there is a strong case for providing an additional multi purpose space in three bedroom units. Often there could be as many as four or five people in a 3 bedroom apartment, and a small adaptable space that can be used as a multi-purpose media space (TV area for kids, office in the evening for example) can make a lot of difference to a family in these circumstances. This could perhaps be linked to context and demand, refer to notes on part 4N above.

Ceiling Heights (Part 4O)

Where is the empirical evidence that 2.7 metres is necessary for primary living spaces?

Why do we readily accept significant reductions in apartment minimum areas, but not in ceiling height?

In our experience a 2.6 metre or even 2.5 metre ceiling height can be perfectly adequate in the typical 7m x 4m living/dining space of today's compact apartment.

Perhaps a minimum floor to floor height of three metres could be considered, leaving the floor to ceiling depth to the designers discretion. An allowance of 350-400mm to cover slab thickness and ceiling space is far more achievable when building tolerances are considered. This would result in 2600 to 2650mm ceiling heights together with more achievable construction outcomes.

Private Open Space and Balconies (Part 4P)

There is no inherent reason why a three bedroom unit should have a deeper balcony

than a two bedroom unit. More floor area may be justified however, through an increase in balcony length so that both an outdoor eating table and casual seating may be accommodated.

For tower apartment buildings in dense centres, the value of an external balcony should be carefully considered. This is acknowledged in the ADG, but would require an Alternative Solution approach for consent.

For upper levels of tall buildings, external wind issues can make many outdoor spaces unusable. South facing apartment balconies are rarely used and the space would be far better incorporated within the apartment, perhaps with a GFA concession.

Window cleaning is a major issue in tall residential towers. By providing a small setback to the glass line and extension of the balustrade across the full façade, space is created for residents to safely and regularly clean their own windows without reliance on a BMU for cleaning.

Natural Ventilation (Part 4Q)

Together with Part 4L – Solar Access, this section is where the key requirements for environmental amenity and human comfort are addressed. Previous comments in relation to the ADG being more focused and relevant to lower height urban typologies are equally applicable to this section.

The capacity to achieve good natural ventilation is usually based on ability to create airflow by location of windows on opposing sides or different levels within an apartment. Empirical verification of this is complex and depends on wind direction and air pressure or temperature differentials on different sides of a building, all of which can be laboratory tested. The ADG diagram 4Q.1 purports that “very good” natural ventilation in a single aspect internal space is only available for a horizontal dimension equal to the ceiling height. We are unaware of the basis for this, the source is not supplied in the ADG.

In our experience, there is are no simplistic “rules of thumb” that can guarantee good natural ventilation: there are too many factors at work. However we can say that there is usually a problem achieving it close to the ground in dense areas where wind is mitigated by built form. We can also say anecdotally that in tall buildings, natural ventilation is rarely a problem as wind patterns, exposure to higher winds and wind pressure differentials create ideal conditions for strong air movement within apartments.

Given the above and in specific relation to residential towers, we therefore question the assertions of Performance Criteria 4Q-3.2, 3.3, 3.4 and 3.7. Whilst we are not in a position to offer empirical evidence of the above, experience suggests that it would be worth undertaking laboratory testing and evaluation of air movement and ventilation in relation to natural ventilation provisions within residential tower buildings.

END PAPER