About designing flexibility in high-rise housing

Peter Doig, Architect
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The starting point has to do with financial structures - high density or high-rise apartment buildings are, in Australia, almost exclusively created by the private sector for profit - the public sector having disgracefully abandoned its responsibilities in regard to the provision of public housing.

As a vehicle for the generation of profit, the aim of the developer is to secure sales to a target market for his specific offering, in other words, there is no benefit to the developer in considering any issues beyond that of the first sale.

The Australian habit is to move regularly, and if a family’s situation changes, i.e. additional children, increased wealth, they will tend to move rather than modify, therefore there is little appeal to a first or second or even third time buyer to consider whether the apartment they are buying now can be modified to suit changing circumstances in the future. To that extent, apartments are a consumer product, and once their suitability no longer matches current needs, the owner will simply dispose of them and buy a new one.

What does flexibility mean to you in the context of a high-rise condominium tower? Generally speaking the only flexibility offered by developers is in the form of “options”, i.e. a restricted range of modest add-ons such as an additional ensuite bathroom, upgrading of the quality of fixtures and fittings and the like. Flexibility is heavily constrained by a developer’s desire to maximise yield. Generally this means extreme refinement of available space and the best possible use of available perimeter walls in other words, windows. As a result, one of the requirements of flexibility, relatively generous space, is not available. Each apartment is designed to accommodate effectively only one layout, and every square metre of space is pressed into service, refined if you like to make the smallest space efficient.

The cost of land and construction will place a required sale value per square metre on the apartments to ensure an acceptable profit. The market is very sensitive to this sale value. A typical two bedroom apartment will, in specific locations have a “ceiling” on what the market is prepared to pay. In the CBD of Melbourne, this sale value is about $500,000. Given the cost of land (about $3-5000/sqm) and the cost of construction (about $3000/sqm) plus the cost of taxes, financial contributions to public utilities, consultants, sales agent’s fees and lawyers, the typical apartment must be about 70sqm with a resulting sales “rate” of $7500/sqm. Clearly if a developer can fit a two bedroom apartment efficiently and attractively into say 65sqm or even 60sqm, his profits will rise, but the resulting area of the apartment and efficiency of layout militates against a “flexible” concept.

In the recent past, developers offered “shells” which had all structures and services in place, but the buyer carried out the fit-out. This option has virtually disappeared in the past three years, as the market has discovered it can’t create these fit-outs as cost effectively as the developer with his much greater buying power.
Do you design built spaces for future scenarios beyond the primary requirements of your client? Why, why not? If so, how? If not, is it something that you want to do?

The simple answer is no. Fees for architects are highly competitive, and the time required to test layouts against multiple layout scenarios would price an architect out of a competitive fee process. As above, we are told that no developer will ask for this as a part of the functional brief, because the market won’t recognise the merits of the design or pay for it.

It is common sense to create such models, and with an appropriately visionary client we would very much like to examine the potential. The market of course gets what it deserves, and it is an interesting fact that while most developers simply design and build for sale, the lion’s share of the buyers are investors. This latter group may well find it of value to see flexibility available, as their horizon is much longer than the developer, and if they could be convinced of the financial benefits of being able to offer the rental market alternative layouts, things might change. I’m going to follow up on this.

In my research I have observed two key factors that limit flexibility. Access to services such as plumbing, venting, electricity, and internal load bearing structural elements, especially walls.

Agreed. Multi level buildings have an additional complication that fire and acoustic regulations (as well as structural requirements for stability) will demand concrete floors. As a result, services such as soil and waste pipes and their “traps” will lie within the envelope of the apartment below, making the relocation or introduction of new wet areas such as bathrooms and kitchens very difficult, unless the owner has both spaces. These services connect to vertical stacks, and for cost and efficiency reasons layouts are usually refined to a point where the stacks are in a single location serving multiple floors. Even if access to the stacks is available, the distance a fitting can be placed from the stack limits flexibility.

The provision or relocation of water, venting, gas and electricity is generally an easy task in a refurbishment as these services remain within the boundary of the apartment structure, and are not subject to gravity in the same way as waste and sewer!

The alteration of structure too is usually straightforward, albeit sometimes costly. High rise apartments are either column and beam or load bearing precast structures. In the former, all walls will be of “lightweight” construction between columns, ie two lines of non load bearing timber or steel studs with several layers of “fire check” plasterboard each side for walls between apartments and single studs for internal partitions. These can easily be rearranged. In the latter system, party walls are often precast load bearing concrete, and in some cases, for example above car parks, they may be functioning as wall beams. These latter structures cannot be modified, and even where a concrete wall is only load bearing and not spanning, it can be problematic and very costly to alter.

Do you agree, disagree with these elements; are there more that I have missed? One other issue is the “common areas” which will exist in any apartment building. A Body Corporate or Owners’ Corporation usually controls these, and this body may severely restrict the amount of work that can be carried out within the apartment space, even if it does not directly impinge on other owners or the Body Corporate’s
services, walls or spaces. These bodies tend to be, by their nature very conservative as they are protecting the amenity of many owners, who may not wish to have their peace and quiet disrupted by renovation work.

How do you deal with these elements when designing for a residential project? What impacts your decisions when designing these elements? I’m afraid the design approach simply does not consider the next cycle of life for the building. These apartments are considered to be a fixed asset by developers and buyers, so structural systems and services layouts tend to be designed to be as efficient as possible in regard to cost and construction. This means limiting the number of variables, rather than providing for variety.

One particular client of ours has been refining his product for two decades, and the architecture, yield, layout, structure and services are now so codified and refined that virtually no “fat” exists in the concept.

The classic tenement buildings of Britain (and also I suspect the “brownstones” of the US) tend to have relatively generous floor areas with bigger rooms than modern day apartments allowing subdivision of spaces, or indeed better “open plan” layouts by removing walls. Floors are usually tongue-and-groove (T+G) timber flooring over very deep timber floor joists with lath and plaster ceilings below. This hollow, deep construction allows services to be run within the floor space, accessible from above without breaching the thick plaster ceiling to the apartment below (good fire ratings). The main vertical structures are usually heavy masonry, brick or stone, and have great capacity, allowing localised penetration or removal to link rooms or create larger spaces. In addition, the grander of these types of building have soaring height within each floor level, often of sufficient scale to allow the introduction of mezzanines within the apartment footprint.

Office buildings. In Australia, there was a boom period for office buildings in the 1980’s, when hundreds of thousands of square metres of new office buildings were constructed. This left a huge legacy of previous generation office buildings with no tenants, and consequently limited value. There was, and still is a healthy market for converting 1960’s and 1970’s office buildings to apartments which currently have a much higher value than office space. These buildings have higher floor to floor heights, column and beam structures which give open floor plates ready for a flexible layout, and a much higher structural capacity than current apartment buildings.

I’m not aware of any multi level high-rise apartment buildings that have been specifically designed to offer flexibility for alteration, but I’m sure they exist, almost certainly in the public sector.

A few other observations:

In Australia, housing is designed for sale. I understand that in the US, if not in Canada, housing is developed for lease. This is a wholly different paradigm, and if an organization or individual developer/owner can be convinced that the income he can generate from this asset will be improved by an ability to alter the layout, size or interconnectedness of the units, there is a much better chance of gaining interest in the concept of a custom built flexible residential building. With the current unmet
demand for housing in Melbourne, a number of the larger financial institutions are considering developing in this mould, we’ll see whether it leads anywhere. Creating flexibility in buildings is actually relatively easy from a technical standpoint, it simply needs some thought and research. If you look at the history of intellectual investment in studying Office typologies you’ll see a huge range of options which have been developed over many years to provide more flexible office environments, ie access floors, air conditioning systems, operable facades and the like. The underpinning logic of course is firstly that the commercial office “unit” being considered is very much larger than a residential “unit” and therefore the typological and commercial scale of the project and entity can sustain the necessary research investment. Secondly, Office spaces are by their nature ever changing, “churn”, that is changes to layouts or tenancies, continue for the entire life of the building and flexibility is a fundamental premise in the functional brief. By contrast the inherently cellular nature of apartment buildings tends to militate against flexibility, and there is certainly an expectation that beyond cyclical redecoration of the individual units, the fabric will be fixed for the life of the building.

The development of high density/high rise apartment buildings is the preserve of the wealthy (and of government agencies). Undoubtedly they are a form of mass housing, and so the lowest common denominator will apply; the best match for the largest number. Individuality and flexibility is antithetical to this concept. As an aspect of this fact, if change is to be brought about at any substantive level, there must be a demonstrated financial benefit identified, and that fact applies to both public and private sector investment.

On a more practical level, planning regulations, height in particular often controls the design of high-rise towers. As a result, the cost of providing a more flexible layout may not only be the cost involved in building a taller building to provide for double height spaces, or more flexible services plenums, but in yield, ie on one of our projects the height limit was 60m, and the options were 20 storeys at 3.0m floor to floor, or 21 storeys at 2.85m floor to floor. The latter was of course adopted, and the developer secured an additional 20 apartments for the same land price he’d paid.

Some visionary ideas for you are

- To provide “dry stacks” on a regular grid within buildings, say about an 8.5m grid. This will allow new wet areas to be connected cheaply to the stacks.
- Adopt either a “fat” floor system such as hollow core precast planks which will allow services to run within the body of the floor without disrupting the apartment below, or
- Adopt the access floor concepts created for offices so there is a structural concrete floor for fire and acoustics and an access floor above, perhaps of about 300mm in height to create the necessary plenum for services runs connecting to stacks.

I very nearly convinced a developer about three years ago to adopt a flexible format I’d designed. This was in the Melbourne CBD where there are no restrictions on use, and no restrictions on height. The structure was a vertical honeycomb 8.0mx8.0m and about 8.0m deep. All precast, the unit was to be provided for sale with vertical wet and dry stacks, power, gas and water, a balcony and external glazed façade with a
regular grid of opening windows. It allowed a buyer to fit out this shell in a number of ways, ie just fit out the space as a single bedroom apartment on one level; install a part mezzanine within the double height space for elevated additional bedrooms and bathrooms; install a full second floor instead for more bedrooms or even create a second apartment; do the same but have one level for an apartment, and the upper (or lower) level for an office/studio. The 8.0m module is a very efficient span for precast plank floors, and a relatively small crane can handle the vertical panels. The module is also a natural and therefore very efficient fit for the car park grid below.

This subject is timely and very relevant to urban development. The creation of cellular, inflexible residential boxes is wasteful and if refurbishment/restructuring is carried out is usually expensive and wasteful in resources. I suspect the issues confronted in this study may need to be broken up into Technical, Regulatory (mainly Town Planning) Financial, Political, and Social, even if one simply seeks to acknowledge the need for study of these issues.