

Efficiency & Livability: Towards Sustainable Habitation in Hong Kong

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Summary

Hong Kong is a unique city. Lessons learnt during its 50 years of providing housing to its inhabitants could be shared. This paper highlights and critically evaluates some of her achievement and shortcoming. The key issue of mass housing has always been efficiency vs. livability. The essay begins with North Point Estate and concludes with the recent design competition of Hong Kong Housing Authority. Using case analysis and available expert comments of these better design examples, this paper summarise their key characteristics and comment in terms of their designs' livability and efficiency. Based on this qualitative survey, a way forward on plot ratio and design density is made. The study highlights that space efficiency (gross to net floor area ratio), a parameter that is commonly overlooked, has an important impact to liveable design. The study indicates that it is best kept at 70-80%. In addition, it is suggested that, for optimum land efficiency, site plot ratio be maintain at 4-6. This translates to an overall site coverage of around 10% for larger, multi-block site.

PRELUDE



The picture above depict a posture of St Barbara (Werl Altar, 1438). It gives a number of interesting readings. The picture indicates winter. She is well clothed and backing onto the fire. Facing away, she will not feel uncomfortable with the radiant heat of the fire. Her close proximity allows maximum thermal comfort. The room she was in was constructed of masonry. Judging from the reveals of the window, the walls were thick. She was reading, light actually come from the window on her far right. One could compute based on the outside scenery, the size of the window and her distance from the window that the amount of daylight available to her task, reading, is about 1%. Every detail of the picture tell a story of an individual seeking environmental comfort in a medieval space. The livability of the space depends on the individual's probability of finding this comfort. For example, if she decided to have a nap, she will close the wooden shutter and draw the curtain behind it to dim the light and to improve the thermal environment.

INTRODUCTION

Understanding Environmental Livability

Liveability describes a community's ability to provide and sustain a quality of life for all of its inhabitants. Liveability evolves out of a wealth of existing resources and conditions that promote healthy living, such as clean air, water and soil. Good schools, convenient shopping, safe community spaces and secure infrastructure all play an important role in making a community a success and relate to what makes a community livable.

Livability can be a philosophical concept, or it could be interpreted practically and objectively, like for example the amount of living space per person; or it could be understood via subjective and spiritual judgement like is it homely or does it gives an identity. Most rating agencies, for example Morgan Quitno Press of the US [a], have their own method

to assess the livability of a city or a living environment. In a nutshell, most systems evaluate, objectively and subjectively, the issue of climate and seasons, landscape and surroundings, crime and security, facilities and conveniences, transportation and infrastructure, education and recreation, care and health, open space and the environment, and livelihood and mortality. Using a weighing system based on the value judgement of the inhabitants, a ranking table could result. All in all, it has to do with the environment, safety, health, and economical security.

Environmentally, the desirability of the climate and the provision of healthy and comfortable indoor and outdoor spaces are the key indicators of livability. The environmental livability of the design of buildings can easily be understood by asking a few questions:

- Does it provide adequate contact with the outside (view)
- Does it benefit and enjoy the natural agents (daylight, sunlight, and natural ventilation)?
- Does it exclude undesirable elements (noise and pollutants)?
- Does it give privacy (visually and acoustically) and provides secure personal space?
- Does it provide comfortable (thermal and visual) spaces to work, to rest and to conduct our daily activities?
- Does it provide a healthy environment (freshness of air, hygiene)?

Although one could sweep clean with detergent and rid of wastes everyday, fundamentally, environmental livability of the living space is strongly dependent on the space's 'closeness to the outside'. This is particularly important for residential buildings, as most of them are, most of the time, passively regulated. In densely packed cities, buildings are typically developed to maximise the economic values of their land. Bulky and high rise buildings are geometrically efficient as they provide the highest volume per footprint and building surface areas. There are two problems. Firstly, beyond the boundary of the property, buildings have to be packed very close together and typically only separated by the street. The availability of the natural agent is greatly reduced by external obstructions and the close proximity of surrounding buildings. This is basically a planning and urban design problem.

Secondly, geometrically, for example deep plan buildings, except the perimeter zones which is normally 6 to 7 meters from the façade, most of the floor space could be regarded as 'windowless' and require the service of mechanical systems. The problem of perimeter to floor space ratio could be resolved by incorporating 'indents' into the building plans. However this increases the building costs and, in Hong Kong, created the 'deep re-entrant' problems. This is basically a building design problem.

Efficiency vs. Livability

Seeking ways to optimise building density, land utilisation, as well as at the same time environmental livability is a difficult design task. Can high-density habitation and sustainability meet?

From around the 1970s, the "green" agenda calling for energy conservation and pollution minimisation, etc. had been emerging. In 1987, the World Commission on Environment and Development through the Brundtland's Report *Our Common Future* formally introduced the term "sustainability". The extended agenda on sustainability is to cover a wider range of issues, embracing environmental, social and economic aspects.

This paper focuses on two key concerns that are potentially of utmost implications in the high-density living context of Hong Kong: "efficiency" and "livability".

"Efficiency" is related to the prudent use of resources – both natural and man-made. Examples may commonly include the use of land for housing development, use of materials for construction, use of energy for habitation (air conditioning, lighting, etc.), and use of spaces within the development (tenant space vs. communal space [i.e., spatial efficiency], built-up space vs. open space, etc.). These varying dimensions of "efficiency" are in turn related to cost efficiency – both in the initial development stage and in the building life-cycle perspective.

"Livability" is related to the effects of building performance on the quality of living, including both environmental and social dimensions. The environmental aspects typically include the issues of light and air, noise, etc., which cause significant implications on the health and well being of individuals. The social dimensions are associated with the quality and quantity of individual's habitation space as well as the quality and quantity of communal spaces.

In Memory of the North Point Estate (1958 – 2002)



Owing to both historical and geographical reasons, Hong Kong has cultivated a strong priority on certain issues of efficiency, especially the use of land resource for high-density building development. The first housing project undertaken by the Hong Kong Housing Authority (HKHA), the North Point Estate, was completed for occupation in 1958 – with an official opening ceremony held by the Governor, Sir Alexander Grantham, on 25 November 1957.

At that time, this pioneering project was already targeted at a very high residential density of about 5,000 people per hectare (2,000 people per acre) or about 750 flats per hectare, i.e., 1,955 self-contained flats for housing a total population of over 12,000 in the land of about 2.6 hectares (about 6.5 acres). The flats were of different sizes to accommodate from three to eight persons. [1] The building density in term of plot ratio is over 5.

To achieve such a density, the architect Mr Eric Cumine organised all the residential blocks in 11 storeys with a height of 30 m (100 feet). According to the *HKHA Annual Report 1957/58*, the individual blocks were so designed that the gross depth of the reinforced concrete frame was more than half the height of the buildings, thus minimizing the effect of wind pressure on this somewhat exposed site.

For any high-rise construction, structural efficiency is a key design issue for its substantial implications on the efficiency of construction material use as well as the cost efficiency.

While addressing the efficiency of both land use and high-rise construction in this high-density housing development, the integrative architectural design has been commonly praised for the quality of its living environment. The *HKHA Annual Report 1957/58* described the following site planning:

“The estate, located on a fine site of about 6.5 acres over-looking the harbour, is located between Java Road and the praya, and consists of three main sections, or courts. The West Court consists of a U-shaped perimeter block and one tower block; the Centre Court consists of one long block facing the concourse; and the East Court consists of a U-shaped perimeter block and three tower blocks. There is ample provision for playgrounds and gardens, which cover nearly half the total site area, while the ground floors of most of the blocks of flats have been left as covered-in playgrounds for use in wet weather. Along the harbour frontages of the East and West courts are wide promenades.” [1]

The North Point Estate also contained certain public facilities, including kindergartens, a primary school, clinics, a post office, an assembly hall, and a variety of neighbourhood shops. [1-2] In the typical residential floors, common access was by means of a central corridor, but the line of flats on either side had been broken at regular intervals for two environmental design strategies:

- To allow all rooms to be provided with windows; and
- To give excellent cross-ventilation in the individual flats.

Each flat was provided with basic facilities including kitchen and shower room, plus a projecting balcony on the main façade and a smaller utility balcony for storage and clothes-drying. [1]

According to the *HKHA Annual Report 1959/60*, the Resident’s Association was also established shortly after the occupation:

“The inaugural meeting of the Residents’ Association was held in the Assembly Hall in April 1959, An Anti-litter Campaign was organized by the Association in August 1959 in conjunction with the Colony-wide ‘Keep your city clean’ campaign. the twin virtues of cleanliness and hygiene being extolled by means of plays, songs, and films.” [2]

While this paper is being drafted, the North Point Estate is just in the process of demolition after having gracefully served the community for over forty years. What inspiration about sustainability can we learn from this first housing project of the HKHA?

The historical review on the North Point Estate reminds us of some very basic elements about livability that we are actively promoting nowadays, namely:

- Cross-ventilation, and cleanliness and hygiene; and
- Balcony and utility balcony.

The design of North Point Estate indicates that the aspects of cross ventilation, etc. are closely dependent on the layout of common corridor areas and their relationship with the flats. As such, an “appropriate” level of spatial efficiency is the prime determinant of the building environmental performance in Hong Kong’s high-density habitation.

REVIEW OF HOUSING PROJECTS (1960s – 2000)

Design Awards & Competition

Following the initial review of the North Point Estate, this paper looks for a list of representative housing projects that can collectively reflect the development of high-density housing design in the last 4 decades in Hong Kong. The local award schemes and the major housing design competition are taken as the basis for the shortlist of projects for analysis. Hence, the following sources of reference form the basis:

- The Annual Awards of the Hong Kong Institute of Architects (HKIA), established since 1965;
- The Environmental Award, organized by the Environmental Protection Department HKSAR (EPD) in the 1980s;
- Public Housing in the New Era: Shui Chuen O Architectural Design Competition, organized by the HKHA in 2000.

The HKIA Annual Awards represent the most authoritative and enduring award scheme on assessing architectural quality in Hong Kong. The inaugural award was honoured to the Choi Hung Estate, one of the earliest five public housing estates under the HKHA. Out of the roughly 100 awarded projects of various types so far, only less than 10 projects belong to the category of high-density residential estates.

The EPD Environmental Award offers an additional example of residential project for review. The Sceneway Garden was honoured in recognition of its achievement in creating an acoustically pleasant environment for the residential estate.

The “Public Housing in the New Era: Shui Chuen O Architectural Design Competition” as organized by HKHA was the biggest open competition on housing design in Hong Kong. The awards were judged on ratings of efficiency, buildability, environmental responsiveness, etc. The top three winning schemes are included for analysis.

Representative Projects

Given the above basis, the following list of 12 high-density residential projects in a chronological order is compiled for detailed analysis in this paper. The short-listed residential projects can be broadly categorized into three groups according to their representative design approaches at their respective era.

	<u>Completion</u>	<u>Award / Honour</u>	<u>Architect</u>
1960s			
- Choi Hung Estate	1962-1964	1965 HKIA Annual Award	P&T (formerly Palmer & Turner)
1970s – 1990s			
- Hung Hom Bay Centre	1979	1980 HKIA Annual Award	DLN (formerly Ng Chun Man)
- Sui Wo Court	1981	1981 HKIA Annual Award	P&T
- Mei Lam Estate Phase 1	1981	1982 HKIA Annual Award	HK Housing Department
- Siu Hong Court	1982	1985 HKIA Annual Award	HK Housing Department
- Clague Garden Estate	1989	1991 HKIA Annual Award	P&T
- Sceneway Garden	1992	1989 Environmental Award	DLN
1990s – 2000			
- Verbena Heights	1997-1998	1999 HKIA Annual Award	Anthony Ng
- Tung Chung Crescent	1999	2000 HKIA Annual Award	Anthony Ng
- Shui Chuen O: First Prize	2000 (Design)	2000 HKHA Competition	Tom Ip
- Shui Chuen O: 2nd Prize	Ditto	Ditto	Anthony Ng
- Shui Chuen O: 3rd Prize	Ditto	Ditto	John Ng (Housing Department)

The Cho Yiu Chuen Estate, completed in 1979 by P&T and with the HKIA annual award in 1981, has been once considered for inclusion in the above list. However, owing to very limited availability of data, this project is not taken for further analysis.

THE AGE OF SLAB BLOCKS (1960s)

Choi Hung Estate (1962/64)



Following the lineage of the North Point Estate, the Choi Hung Estate (1962/1964) represented another design exploration of HKHA in the early days. The *HKHA Annual Report 1959/60* described the following project status:

“... the Authority [HKHA] should build its fourth estate on a gentle-sloping 27-acre site [i.e., gross site area of about 10.9 hectares] at Clearwater Bay Road, Kowloon, to the North of Kai Tak Airport Messrs. Palmer & Turner, the architects originally appointed by the Authority in 1958 to prepare a master plan for development of the site, provided a number of alternative lay-out schemes, and were later invited to carry out the architectural work. After consideration of the alternatives, the Authority eventually approved Scheme No. 13, The scheme adopted comprises:

- (i) Eight ‘slab’ blocks, each of twenty storeys, with forty flats on each floor, including the ground floor. Each block houses an average of 4,000 people, and is serviced by three lifts placed centrally in the block. The flats are arranged on either side of a central corridor, 6-person flats on one side, 4-person flats on the other, except for one block which contain only 6-person flats.
- (ii) Low buildings of seven storeys (without lifts) containing 8-person flats on the six upper floors, with the ground floor left as open play space, except for a parade of 50 shops adjoining the bus station on the south-west side of the site.

... The estate will provide accommodation, at a nett density of about 1,930 persons per acre [4,770 persons per hectare], for approximately 43,720 persons (about the same population of Dartford, Kent), From the outset the Authority has considered that the estate should be developed as a ‘neighbourhood unit’ along the lines of that of the So Uk Estate, as domestic in character as can be consistent with ultra-high-density housing. There must be a sense of space without waste of land, Lengthy investigations were carried out by the architects to effect every possible economy in the structure, four alternatives being accurately designed, quantities taken off, and items priced on current costs. This analysis gave a very clear picture of the most economical type of system to be used, The final result is that the structure of the tall buildings contains a minimum steel requirement.” [3]

Choi Hung Estate was completed in 1962-64 and honoured with the first Silver Medal (the highest honour) of the HKIA in 1965. Its contribution included the design for high efficiency in terms of land use, superstructure and construction economy, while fulfilling the basic objective of HKHA on planning for high-density estates as neighbourhood units. At that era, HKHA had to struggle to strike a balance between quality and quantity in its construction plans. Material resources in general were still scarce, but citizens’ demands for low-rental residences were very high indeed.

Choi Hung Estate vs. North Point Estate

According to Dr M Y Leung in reviewing the 45 years of public housing development in Hong Kong, the following priority shift from the North Point Estate to the Choi Hung Estate was highlighted:

“... the costs of the North Point Estate’s buildings were far too high for large-scale construction. When Choi Hung Estate, with a housing capacity of over 40,000 people, was completed in 1964, the construction cost dropped to 1,100 dollars per person. That was less than half the 2,600 dollars per person cost of North Point Estate.” [4]

A slightly different cost data – at about \$1,700 per person for North Point Estate – was quoted by J R Firth in another paper. In 1962, the Choi Hung Estate was estimated at a cost of approximately \$1,225 per person. Nonetheless, it was clear that Choi Hung Estate eventually achieved the lowest capital cost per person among the early stock of housing estates by HKHA. [5-6]

While the Choi Hung Estate and the North Point Estate were both in form of slab blocks, there were remarkable differences in the environmental quality inside the flats as well as in the common areas at the residential floors. Unlike the North Point Estate, the Choi Hung Estate arranged the flats in continual rows along the both sides of a long central corridor. As a result, in the Choi Hung Estate, the common corridor was felt very enclosed and much darker; and the flats only had a single frontage facing the external air directly, i.e., the overall quality of daylight and natural ventilation were evidently inferior to that in the North Point Estate. In term of residential density, the Choi Hung Estate (over 800 flats per hectare) is only about 10% higher than that of the North Point Estate (about 750 flats per hectare).

The key factor causing the notable difference in the living quality between these two high-density estates was associated with the spatial efficiency of their respective typical floor layout. Nonetheless, the architectural design of the Choi Hung Estate was a reflection of the prevalent value judgment at its time of construction. The efficiency of initial construction and cost were taken as the priority.

Noting that all the resettlement estates built at that time provided bathrooms and kitchens at communal areas only, the provision of self-contained flats in the Choi Hung Estate was already considered of high acceptance level. Its juxtaposition of high and low residential blocks further enhanced the quality of daylight and natural ventilation, and reduced the perception of over-crowdedness.

THE AGE OF POINT BLOCKS (1970s - 1990s)

The Beginning of Point Blocks & Other Related Elements (1960s)

While the prototype of long slab blocks could in general save the quantity of communal facilities such as lifts and staircases, the resultant common corridors in length were increasingly considered as a waste of space, especially when such common spaces were mostly enclosed and dark, so that the residents were only willing to have short, transient stay there.

According to an oral interview with Mr Andrew Lee, a local architect having started his own practice since the 1960s, such negative comment on the long corridor in slab blocks was especially concerned in the design of private-sector residential development. In 1962, Mr Lee designed the first “tower block” for a private-sector, high-rise residential development in Kowloon. In the 1960s, the local architects also invented the integration of “scissor staircases” in the design of residential tower blocks, in order to maximize spatial efficiency of the typical floor plan involving two staircases for complying with the building regulation requirements for means of escape in taller buildings. In 1968, Mr Lee further pioneered in the introduction of “bay windows” in the local residential developments.

All these design evolutions were driven by a surging quest for maximizing the spatial efficiency, which was interpreted quantitatively as compressing the common spaces into minimum and in turn maximizing the saleable floor areas for the residents. The floor areas for both the common and the flats were accountable as the gross floor areas under the building control. Therefore, as a general rule especially in the private-sector developments, the less the common area in total, the more the usable floor areas inside the flats. Coupled with the prevalently small flat sizes for most of the common people in Hong Kong, high spatial efficiencies were hence praised.

On the other hand, “bay windows” could be exempted from the gross floor area calculation in residential developments, and hence offer more “apparent space” inside the flats. As such, bay windows have flourished as a highly popular element in various kinds of residential development in Hong Kong.

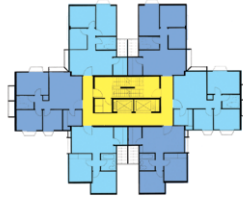
Hung Hom Bay Centre (1970s): Communal Landscaped Space in Urban Housing



The Hung Hom Bay Centre, completed in 1979 and granted with a “Certificate of Honourable Mention” in the HKIA Annual Award 1980, faithfully followed the lineage of the “tower block” design. The jury considered this project merited such an award, with the following commentary:

“The project has a sense of identity, a feeling of being a place of pleasant scale and unity. This has been achieved by the overall siting of the blocks and the linking of the internal spaces at ground floor level by a unified use of materials and an attempt to landscaping the internal courtyards, with greenery and the introduction of a water element. Therefore, this contribution to housing of this nature resulted in the above decision.” [7]

According to the jury opinions, the contribution of Hung Hom Bay Centre was especially associated with its ground and podium levels involving landscaping design, which was considered of pioneering nature in the 1970s. More greenery and open space for communal enjoyment was regarded as environmental assets in the dense urban living context.



In Hung Hom Bay Centre, all the residential blocks are of similar cruciform plans, and at a uniform tower height. The typical floor plans have flats tightly embracing the common core. Such central core comprises a narrow corridor, lifts, service rooms, and a pair of scissor staircases. The lift lobby / corridor is hence without any natural light and air. The flats generally follow the layout of cruciform plan, with the emergence of narrow “re-entrant” space between the flats. The “re-entrant” is a kind of uncovered air-well typically enclosed by three sides and with a narrow open side facing the external. This configuration offers external wall frontage for kitchen and bathroom windows in most cases.

This urban site is characterized with very high building and residential densities (domestic plot ratio in the range of 7-8 for over 1,000 flats per hectare), and a high spatial efficiency (over 80%). Bay window is its another feature, as described in *Asian Building & Construction* (1980),

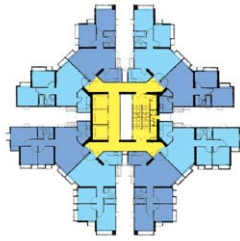
“Bay windows are provided on most of the flats. These are not only practical, but also create a unique sculptural external form for the buildings. It is believed that Hung Hom Bay Centre is the first completed project in Hong Kong to have bay windows in such a large scale.” [8]

Sceneway Garden (1980-90s): Traffic Noise Mitigation for Urban Housing



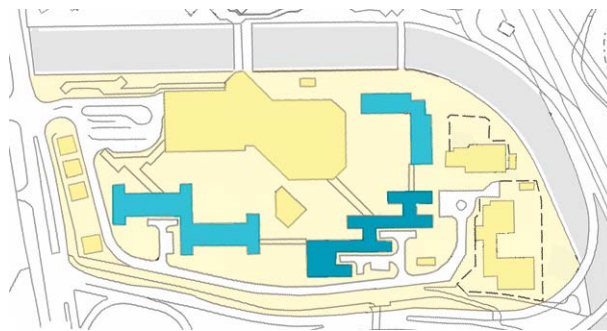
The Sceneway Garden, completed in 1992, was honoured with an Environmental Award organized by the Environmental Protection Department (EPD) in 1989, in recognition of its achievement in creating an acoustically pleasant environment for the residential estate. A bold planning concept was adopted involving a vast landscaped deck (45.5 m wide and 261 m long) that spanned over the busy carriageways adjoining the site. The deck structure effectively screened the heavy traffic noise from impeding into the domestic precinct.

The EPD was created in 1986 to co-ordinate and carry out pollution prevention and control activities. The EPD replaced the Environmental Protection Agency (which had been created in 1981 to replace the Environmental Protection Unit, created in 1977) as the main government body tackling pollution. In the 19780s, the focus of environmental issues was placed on the local pollution issues, such as the traffic noise impact.



Besides the improvement to traffic noise mitigation concern, Sceneway Garden basically continued the lineage of the compact, cruciform plan of the tower blocks in the private-sector residential design. The residential floor plans represent the popular layout with eight flats per floor with a central core for corridor, lifts, service rooms, and a pair of scissor staircases. Externally, there are bay windows and narrow re-entrants. The highlight is the extremely high spatial efficiency of its typical floor plan (close to 90%), while the re-entrants become very deep (at a width to depth ratio of about 1:4).

Mei Lam Estate & Siu Hong Court (1980s): Towards “Lower Densities” & “Towers in a Communal Parkland”



In the public-sector housing designed by HKHA’s architects, the Mei Lam Estate Phase One (in Shatin New Town) and the Siu Hong Court (in Tuen Mun New Town) were completed in 1981 and 1982 respectively. Both of their building density in term of domestic plot ratio is only around two to three, i.e., lower than that in the older HKHA estates like Choi Hung Estate, about half of that in Sceneway Garden, and about one-third of that in Hung Hom Bay Centre.

In the master layout planning, both estates segregate the roads for service vehicles from the pedestrians, in order to create a park setting rather than the more common estate dominated by roads, barriers and footbridges. The rental housing blocks (HKHA standard elements) in Mei Lam Estate are up to 28 storeys, while the towers for Home Ownership Scheme (HOS) in Siu Hong Court are up to 36 storeys, hence freeing even more open space for the landscaped garden. [9-10]

Despite the comparatively lower building densities, their respective typical floor plans are still compact and designed with the minimum common space. The spatial efficiency in both cases is estimated to be in the order of about 87-88%.

In the 1970-80s, such a density shift for the new housing development in the new towns was intended to foster an attractive living environment with more landscaped space around each residential block – an environmental quality that could hardly be achieved in any urban sites with very high densities. In these new town housing estates, the notion may be close to the Corbusian dream of ‘creating a city of towers set in a communal parkland’:

“These towers, rising up at great distances from one another, will give because of their height the same accommodation that has up till now been spread out over the superficial area; they will leave enormous open spaces in which would run, well away from them, the noisy arterial roads, full of traffic which becomes increasingly rapid. At the foot of the towers would stretch the parks; trees covering the whole town. The setting out of the towers would form imposing avenues; there indeed is an architecture worthy of our time.” [11]

Mei Lam Estate Phase One was awarded with a Certificate of Merit in the HKIA Annual Award 1982. The judges commended the HKHA’s architect for the care and attention given to the design of the external and public spaces and for the public buildings (commercial centre, etc.). Considerable imagination had been shown within the inevitable financial constraints. [12]

An additional merit about the master layout design of Siu Hong Court (HKIA Silver Medal 1985) was the attempt to harnessing the ambient wind for beneficial use. According to the project focus in *Vision* Issue No.23, the design solutions of Siu Hong Court with respect to open space, pedestrianization, traffic noise mitigation and natural ventilation were described as below:

“The micro climate of the site is noted for its cooling breezes which are funneled down the valley between Deep Bay and Castle Peak. The layout of the blocks attempts to utilise these breezes without creating undue turbulence at ground level.

The domestic blocks are located along the periphery of the site creating large central courts and providing privacy and views from flats to surrounding hills or into the central courts. Carparks are used as barriers against external noise from Light Rail Transit or distributor roads. All conventional roads are minimized by the creation of ‘pedestrian priority’ central courts with access for service and emergency vehicles.

An urban park has been designed incorporating the basic elements of traditional Chinese landscapes – water, rocks and wood. A variety of spaces each of human scale and with its own separate identity provide the opportunity to create beautifully landscaped courts with ponds, water features, pergolas and different species of plants.” [10]

Sui Wo Court & Clague Garden Estate (1980s): Spatial Efficiency & Livability



The Sui Wo Court in Shatin, designed by P&T and completed in 1981, is another HOS development under the HKHA. Honoured with the HKIA Silver Medal 1981, the architectural design was considered to be highly innovative, especially with respect to its “pinwheel” apartment plan. The architect’s design statement is as below:

“The apartment plan is the result of an attempt to combine the known advantages of a traditional corridor plan block [slab block] and a point block.

Corridor blocks have the advantage of through ventilation [cross ventilation] and a high social interaction, but the disadvantage of low security due to unrestricted access. They fail to provide owners with an identity and, as such, responsibility for the common circulation space.

Traditional point blocks, often with 8-units per floor provide good security and identity with a common lobby, but have limited through ventilation, a degree of isolation, and low usage of the lobbies and stairs, which encourages muggings and crime.

The ‘Sui Wo Court’ apartment plan combines the advantages of both plan types. 12-flats per floor are arranged in groups of three units, each with its own stair. Lift lobbies are formed every three floors. Through ventilation is provided to each flat and each lobby shared by 36 owners. Staircases are arranged to be visible from the lobby, to avoid concealed spaces. The increased lobby and circulation space allows table tennis and other indoor sports activities.” [13]

In terms of building density (domestic plot ratio), residential density (flats per hectare) and spatial efficiency (of the typical floor plan), the design of Sui Wo Court can achieve scores as high as those of Sceneway Garden. What Sui Wo Court can offer even more include both the environmental and social considerations, as pointed out in its design statement:

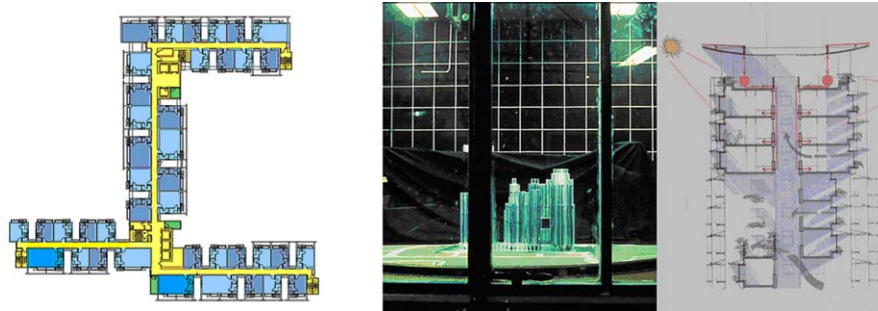
- Enhanced cross ventilation for both the flats and the common lobby spaces; and
- Enhanced usage of the common lobby spaces for social interaction and activities.

The Clague Garden Estate, completed in 1989, was again designed by P&T, yet for the Hong Kong Housing Society (HKHS). Honoured with a HKIA Certificate of Merit in 1991, the apartment plan of its tower blocks basically shares the same design concept of Sui Wo Court, resulting in a variation of the “pinwheel” plan form. The aforesaid environmental and social considerations are maintained in the design, and so are the densities and efficiency aspects.

Other design merits of Clague Garden Estate included the design of landscaping gardens and the integration of low blocks for single elderly homes. The latter was in particular considered a new design idea in Hong Kong by that time. The 3-storey blocks in the courtyard layout offered an appropriate scale and ambiance for habitation of the elderly, even right next to those 40-storey giant blocks. Traffic noise mitigation was also a design concern in this site, which adjoins highways at its sea-facing side. [14]

TOWARDS DESIGN ALTERNATIVES (1990s – 2000)

Verbena Heights (Late 1990s): A Holistic Approach



The Verbena Heights in Tseung Kwan O, completed in 1997, is another public housing development of HKHS, similar to the Clague Garden Estate. The key differences in the development brief are associated with a much higher building density (plot ratio in the order of 7-8) and a correspondingly high residential density assigned for Verbena Heights. Similarly high densities are also applied to other neighbouring residential developments in this new town, due to the governmental policy at a time aiming to further maximizing the efficiency of land use and speeding up the provision of more homes within shorter periods.

When the private-sector residential developments in the vicinity still adopted the point blocks as the norm, Verbena Heights was designed in an alternative approach in terms of both the master layout plan and the residential floor plans.

As a whole, the residential blocks were juxtaposed in a thin, linear layout embracing three communal courtyard spaces, while their building heights were strategically designed in a cascading profile between 8 to 50 storeys. These strategies optimize the harnessing of the prevalent summer breeze for natural ventilation, daylighting for both flats and common lobbies, view and privacy, landscaped garden space at the lower levels, etc., while minimizing traffic noise impact, and perception of over-crowdedness, etc.

Verbena Heights comprises six saleable blocks (HOS) and a rental block. While the saleable blocks have mostly eight flats per floor, its elongated linear configuration is conducive to cross ventilation for most of the flats and the lift lobbies. Sky gardens are also juxtaposed at strategic locations of the saleable blocks with a view to further enhancing the building permeability and in turn the natural ventilation performance of the estate.

The rental block is basically in form of slab block. Its common access is by means of a central corridor, but the line of flats on either side had been staggered and broken at regular intervals for optimizing daylighting and natural ventilation for both the flats and the common corridor. (Similar design strategy was found in the North Point Estate [1958] built in 40 years ago!)



Scientific assessments including wind tunnel modeling and computational analysis were carried out by the consultants to guide the design process. Along with the aforesaid environmental concerns, a comprehensive consultancy study on environmental design and management of housing development in Hong Kong was also conducted to investigate into the energy, emissions, resources, water, waste, and livability issues specifically for the local context and climate and in a more holistic way. Honoured with the HKIA Silver Medal 1998, the jury's report stated the following:

"The architect puts together a small town for 3,000 households, 8,000 people and yet, sets a benchmark of sustainability. Departed from traditional approach to high density housing, the architect responds to global concern of environment, redefines it and investigates, in a very wide spectrum, into the environmental aspect of architectural design. Without compromise, various environmental considerations, as well as urban and social considerations, amalgamated together to form a piece of architecture with distinct identity of its own." [15]

As a result of the elongated linear layout of the residential floor plans at both the saleable and rental blocks, Verbena Heights is associated with a lower spatial efficiency (about / less than 80%) – which becomes close to that of the slab blocks in Choi Hung Estate.

Tung Chung Crescent (Late 1990s) & Shui Chuen O (2000): Efficiency & Sustainability

The Tung Chung Crescent in Tung Chung New Town, completed in 1999, can be somehow considered as a succession of Verbena Heights by the same architect, yet in a less adventurous way – largely for its being a private-sector residential development which demands for a higher spatial efficiency. The plot ratio is about 5.9, and the spatial efficiency is around 85%. Honoured with the HKIA Silver Medal 1999, the jury's report stated the following:

"The development is designed and executed with a different kind of finesse seldom found in this type of residential development. The built form and open space arrangement clearly demonstrate a carefully work-out design concept to suit the site and other functional requirements. The minute innovations that the architects are able to implement for a housing project – a building type with great limitations – are more significant. It reflects a sense of modernity, functionalism and practicality, well suited to the 21st century, without looking 'space age'. It sets a standard of what attractive private housing could be." [16]



In 2000, in line with the implementation of the Quality Housing Initiatives to enhance building quality, the HKHA launched for the first time an Open Architectural Design Competition titled "Public Housing for the New Era - Shui Chuen O". Aiming to tap creativity from the entire industry, the competition invited all local architects to participate and contribute innovative ideas for future public housing design. The 2.5 hectare site at Shui Chuen O in Shatin was intended to provide 2,500 homes to 8,000 people, i.e., a residential density of 3,200 people per hectare or 1,000 flats per hectare. The overall design assessment was based on the ratings of efficiency, environmental sustainability, and other construction considerations. [17]



Among the first three winning schemes, it is noted that they all share an emphasis on the design of the public areas and natural ventilation aspects in the residential floor levels. Their respective spatial efficiency is about 80% (assuming that those large sky gardens are exempted from the gross floor area calculation).

CONCLUSIONS

Past Decades (1960s - 1990s)

Since the 1950s, Hong Kong has started with the approach towards providing habitation for the common people at high densities. While a few early-day exceptions such as the North Point Estate attempted to strike for a better balance between efficiency of the initial construction and livability during a building's life span, the trend had been predominately loaded with a high priority on spatial efficiency in both the private and public sector housing developments. The spatial efficiency of the apartment plans was targeted towards the level of 90%.

During the period of the 1970-80s, in association with the new town policy, an attempt to enhancing the living environment in the remote public housing estates was to lower their building densities. Their plot ratio was in the order of 2-3, which was significantly lower than that of urban sites. Coupled with sensitive site planning, the resultant estates could become notably more attractive to the residents especially in terms of openness between towers and communal space availability at ground and podium levels. Siu Hong Court exemplifies such a notion of "towers in a communal parkland". There are hence higher potential for harnessing natural light and air for beneficial use (although the actual environmental performance of the flats is still very much dependent on the design of apartment floor plans).

At the same time, there were certain pioneering projects in exploring an innovative design of the apartment plans with a view to improving both the ecological performance (e.g., natural ventilation performance for both flats and lobby areas) and social aspects (e.g., social interaction at the common lobbies), while addressing the prevalent market demand for a very high spatial efficiency. Sui Wo Court is the classic example, involving split-levels / stairs at the common areas linking the flats to the lift lobbies at every three floors. However, such a design strategy has become not viable upon the introduction of the statutory requirements of access for persons with a disability since the mid-1980s, i.e., implying that lift lobby has to be provided at every apartment floor directly.

In the 1980s, there was surging focus on the local pollution issues. For residential developments, traffic noise mitigation was once an overwhelmingly environmental consideration affecting the design and layout.

Recent Decade (late 1990s - 2000)

Along with the growing environmental concern locally and globally, Verbena Heights represents an early attempt to comprehensively address the wide spectrum of sustainable housing design issues. However, its extremely high building density in the plot ratio of about 7-8 rendered certain design constraints and deficiencies, as associated with the resultant tall structures up to 50 residential storeys above a multi-storey podium. It also demanded for higher design challenge to addressing those density-sensitive environmental parameters, especially daylighting and natural ventilation. The building density in the range of 4-6 appears to be a more reasonable compromise among various considerations. On the other hand, with respect to the design of apartment plans, there was also critical concern about the implication of spatial efficiency.

Spatial efficiency remains to be a prime barrier to alternative designs, especially in the private-sector residential development. The winning schemes of Shui Chuen O design competition indicate innovative examples of alternative plan forms that are conducive to environmental and social sustainability concerns, if the interpretation of spatial efficiency is more relaxed, i.e., a lower spatial efficiency at about 80% could offer more potential towards sustainable design in a building's life-cycle, including the beneficial use of communal spaces at the apartment floors to facilitate social interaction and ecological well-being.

The Way Forward (2000s & Beyond)

The method used in this paper is 'expert' based. The projects reviewed represent some of the better works of housing design in Hong Kong. They all received high accolade by experts in the profession. Their contribution to architectural design has been acknowledged with the prizes they have earned. Further research may be necessary to quantify the expert observation. So far, there are two messages.

There is an optimum ratio between Gross and net area that liveable design could be competently and conveniently generated. Base on our case study of some of the better examples in Hong Kong, this is around 70 to 80%. It seems that this factor alone is instrumental to better, healthier and more liveable designs. Therefore, it is important to see ways that rules or good practice guidelines be formulated to capture that.

The second message is that there seems to be an optimum density in terms of plot ratio that comfortable site layout of buildings for comfort, as well as for social and human scaled spaces could be designed. The range is wider than the gloss to net ratio mentioned above. Our study indicates it is around 4-6 (plot ratio). This translates to an overall site coverage of around 10% for larger site.

"Value added-ness" is the model that the business community in Hong Kong has been hotly debated. Many believed that this will provide a way forward. The issue of livability has to follow the trend. Hong Kong has reached a plateau of its social and economical development that the issue of efficiency and livability has to be critically evaluated. The model used in Hong Kong in the recent past has been biased towards efficiency, notably land and space efficiency. Whilst using a "green" and "resource used" perspective this can be a highly optimised model. However, the way forward must surely be to advance and enhance the livability of our housing design. For "sustainability" has to do with human living, their comfort, health and well-being. The built environment has a lot to offer.

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