

Title: **Designing High-Rise Housing: The Singapore Experience**

Authors: Elena Generalova, Associated Professor, Samara State University of Architecture and Civil Engineering
Viktor Generalov, Professor, Samara State University of Architecture and Civil Engineering

Subject: Social Issues

Keyword: Residential

Publication Date: 2014

Original Publication: CTBUH Journal, 2014 Issue IV

Paper Type:

1. Book chapter/Part chapter
2. **Journal paper**
3. Conference proceeding
4. Unpublished conference paper
5. Magazine article
6. Unpublished

Designing High-Rise Housing: The Singapore Experience



Elena Generalova



Viktor Generalov

Authors

Elena Generalova, Associated Professor
Viktor Generalov, Professor
Department of Architecture of Housing and Public Buildings
Samara State University of Architecture and Civil Engineering
Kievskaya Street, 15, App. 55
Samara 443013, Russia
t: +7 927 695 0233; +7 905 0189298
e: generalova-a@yandex.ru; vp_generalov@mail.ru

Elena Generalova

Elena Generalova, PhD, is a member of the Union of Architects of Russia and an associate professor in the department of Architecture of Housing and Public Buildings at Samara State University of Architecture and Civil Engineering. Her scientific interests focus on researching modern high-rise residential complexes. Generalova supervises post-graduate research students in Architecture. She is the author of more than 50 scientific works, including monographs and educational editions. She is also a practicing architect with more than 60 completed projects.

Viktor Generalov

Viktor Generalov, PhD, is a professor at, and head of the Department of, Architecture of Housing and Public Buildings at Samara State University of Architecture and Civil Engineering, a member of the Union of Architects of Russia, and advisor to the Russian Academy of Architectural Sciences (RAASN). His scientific interests focus on the modern problems of specific types of high-rises. Within this framework, he supervises post-graduate research students in architecture. He is the author of more than 100 scientific publications, including monographs and educational editions. He is also a practicing architect and has more than 80 completed projects in Russia and Kazakhstan.

There is a land shortage in Singapore, compelling the search for different models of high-rise housing. Singapore's experience breaks with the dual stereotypes that high-rise construction is expensive, and that an apartment in a skyscraper is a privilege of the rich. Reflecting the strategy of providing the average consumer with affordable and comfortable housing, there is a rapid growth of design and construction of high-rise residential complexes in Singapore. This process is based on the principles of sustainable urban development, minimizing environmental impact, and maximizing energy efficiency. A clear standard of comfort for public housing has been developed, including a set of required improvements of the site, in the structure of residential towers and in apartment layout.

According to many researchers, the most dynamic and vibrant housing markets are those where public and private sectors coexist harmoniously. Singapore has managed to develop conditions that support a high standard of living by way of a set of required elements and system quality criteria for different consumer strata embedded in high-rise residential complexes, innovative technologies and "green standards," based on the principles of energy efficiency and environmental friendliness which have become available for mass consumers.

It should be noted that Singapore has reached such a high standard of living in a very short period of time, based on its unique climatic, political, regulatory, and economic conditions. The history of public housing in Singapore began in 1960, when the Housing and Development Board (HDB) was formed, the main purpose of which was to provide affordable housing in a high-quality environment for the masses. In order to

become the owner of an HDB apartment, the applicant must meet certain requirements concerning nationality, age, and marital status. Also, there are limits on the average gross monthly household income that can be earned by residents of a given type of apartment.

Development of Multiple Financing And Occupancy Models

Public housing in Singapore was originally intended to be for-rent only, but the policy was quickly adjusted to extend applicants the opportunity to buy apartments. The government attached great importance to allowing the popular majority to become owners. Those lacking sufficient income to purchase homes, but who were eligible for HDB housing, could receive preferential mortgages, housing subsidies, and savings from the Central Provident Fund (CPF). The CPF is a state fund in Singapore to which every working citizen and their employer pays monthly. The public pension, medical services, and home loans are fully financed by these contributions. In general, the system works quite efficiently, as more than 80% of Singaporeans live in public housing, and 95% of public-housing residents are owners. As a result of the housing program, the country has provided every citizen with comfortable housing in a very short time. The wealthy have also overwhelmingly chosen high-rise

“More than 80% of Singaporeans live in public housing, and 95 % of public-housing residents are owners. The wealthy have also overwhelmingly chosen high-rise condominium ownership through their own means.”

condominium ownership through their own means.

The range of available housing types is improving for HDB owners and renters. For example, Executive Condominiums have been introduced in order to accommodate the needs of young professionals who can afford more than a HDB flat, but for whom private commercial housing remains out of reach. Such flats are comparable to market-rate condominiums in terms of design and amenities.

The Design, Build, and Sell Scheme (DBSS) was launched in 2005, involving private developers in a substantial way. Under DBSS, developers are responsible for the entire design and construction process (including purchase of land, design development, construction, and sales). Apartments built under this scheme are intended for public housing. They are developed by private companies, which are free to design and implement their projects as they see fit, so long as they do not jeopardize the objectives, principles, and basic features of public housing. This means that, while providing sufficient flexibility in design, finishes, and sizes, tight control is nevertheless exerted over the developments' integration into the urban environment, so as to support favorable social and aesthetic interaction with the surrounding existing HDB buildings. To date, 13 DBSS projects have been constructed in different parts of Singapore on 10 sites. Notable projects include City View @ Boon Keng, Park Central @ Ang Mo Kio, Natura Loft @ Bishan, and The Peak @ Toa Payoh.

HDB Town Features

When the HDB took over in 1960, the agency adopted the "new town" planning concept on a large scale, building entire towns from scratch in locations all around Singapore. There are now officially 24 "HDB Towns", compact and contiguous areas with a deliberate mix of residential, commercial, and institutional uses (see Figure 1).

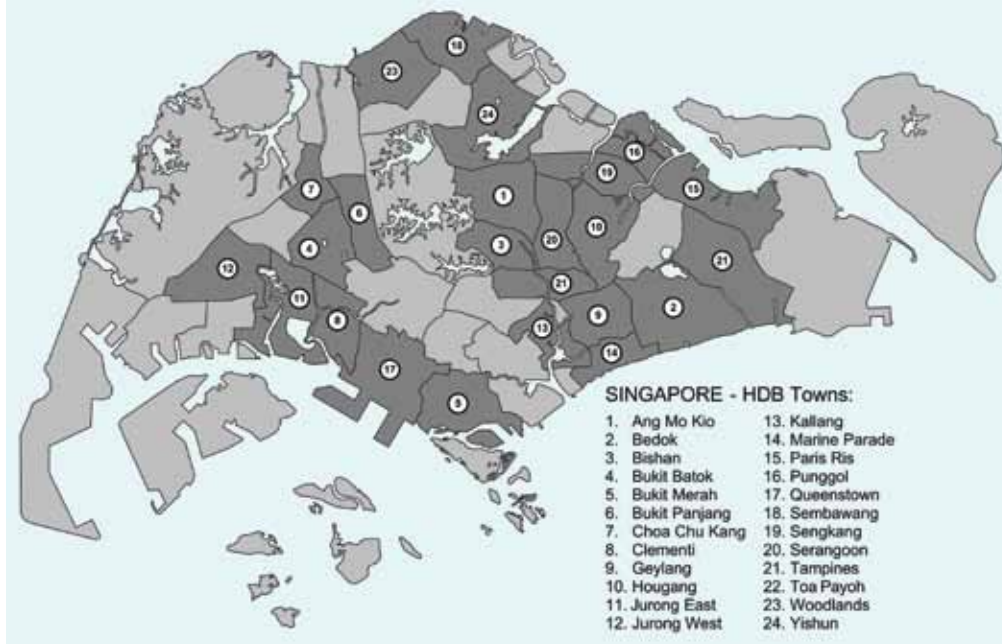


Figure 1. Map of HDB residential areas in Singapore.



Figure 2. People's Park Complex, Singapore



Figure 3. Golden Mile Complex, Singapore

Each HDB town is designed to be self-sustaining. There is no need to venture out of town to meet the most common needs of residents. Employment can be found in industrial estates located within several towns, and each has education and health care facilities, sports complexes, recreation zones, multistory car parks, and other common facilities. All HDB residential areas are connected to a well-developed public transport infrastructure, including underground, buses, and Light Rail Transit (LRT).

Every residential complex has well-equipped outdoor sports fields, embodying the state's commitment to the good health of its citizens. Children's playgrounds are an integral part of the living environment and employ a great variety of designs, advanced materials, variations in age-appropriate equipment, as well as areas equipped for parents. The covered walkway is the calling card of Singapore's living environment, a piece of infrastructure necessitated by the pressing need to protect citizens from the scorching sun, which can instantly turn into torrential rain. All residential areas have such walkways, which are ramped to account for the

requirements of a barrier-free environment.

In the initial years following the establishment and development of the concept of HDB housing, in addition to housing groups and estates development, the idea of building multifamily residential complexes in the high-density areas of Singapore was also encouraged. Some examples of the resulting experiments with integrating various functions in "megastructures," include: People's Park Complex, (1973, 31 floors, 103 meters) (see Figure 2) and the Golden Mile Complex, (1974, 16 floors, 89 meters) (see Figure 3). These were designed by Gan Eng Oon, William Lim, and Tay Kheng Soon, who subsequently founded DP Architects. These were among the first high-rise facilities in Singapore, built as part of a reconstruction program that cleared dilapidated buildings and installed new public housing. Both complexes are multi-use buildings with apartments, catering establishments, trade enterprises, social amenities, offices, parking lots, and other facilities.

In recent years, several high-rise complexes have enhanced the status of public housing,



Figure 4. Pinnacle @ Duxton, Singapore. © ARC Studios

such as Pinnacle @ Duxton (2009, 163 meters), designed by ARC Studio Architecture + Urbanism. It consists of seven 50-story towers, which house 1,848 apartments, served by 35 elevators and a basement car park. The building offers a unique concept of mass housing for densely populated cities most notably by linking towers with public space at height. It is a bold experiment in the field of high-rise housing, resolving numerous functional, economic, and social issues, and in practice confirming that high-rise buildings can generate a comfortable living environment for people of average or below-average means (see Figure 4).

Six Common Operational Diagrams of HDB Housing

Having analyzed operating and space planning characteristics of HDB housing, we can distinguish six typical operational planning diagrams.

Diagram 1

In this typology, residences are raised on columns above the ground level, and as a result, Void Decks are formed under buildings and used for residents' recreation (see Figure 5). The entrance to the Void Deck is via stairs or elevator. Part of this level is also devoted to kindergartens, small shops, medical centers, clubs, fire stations, and other facilities. Car parks are typically detached multistory buildings in their own right. In the space under the building, residents can easily move

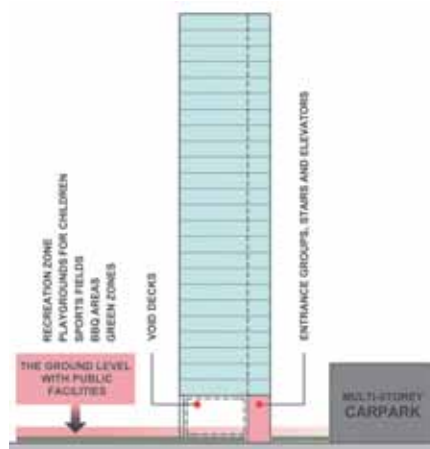


Figure 5. Operational planning Diagram 1.

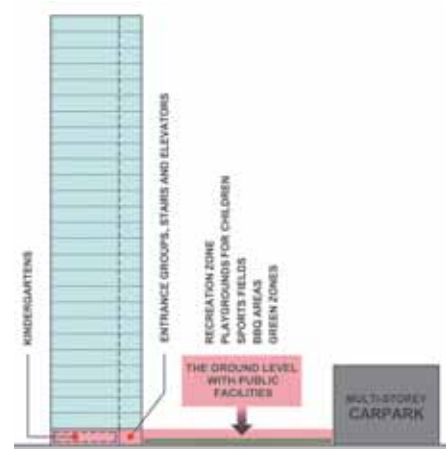


Figure 6. Operational planning Diagram 2.

from unit to unit, and along the route there are storage spaces for bicycles and activity rooms for social events, such as weddings, holidays, parties, and markets. In combination with the covered walkways, the Void Decks form a unique living environment, allowing pedestrians to travel long distances along the residential areas under shelter from the elements.

Diagram 2

In this scheme, the ground floor is used for the entrance, kindergartens, clubs, and some residential apartments. Zones for meetings, recreation and sports are offered in the interstitial yard space, in the form of gazebos and platforms with canopies. The garage is usually a detached multistory building with an entrance to the main building via covered walkways (see Figure 6).

A representative example is found in City View @ Boon Keng (2011, 40 floors), comprising 714 apartments. These are three-, four-, and five-bedroom apartments ranging in area from 69 to 117 square meters. Three tower complexes are located on a compact rectangular plot, which adjoins the multistory car park connected with residential towers via covered walkways. The whole area is surrounded by a covered arcade, accommodating vehicles that may need to access the entrance directly, such as personal and commercial vehicles making deliveries, fire, and garbage trucks (see Figure 7). Between buildings at the ground level, everything necessary is provided for comfortable living: a playground with a full set of equipment for children of different age groups, a sports area with a gym, a quiet relaxation space, a zone for mass events, and a barbecue area. The orientation of the towers



Figure 7. Covered arcades and walkway to car park at City View @ Boon Keng, Singapore. Source: Google Maps

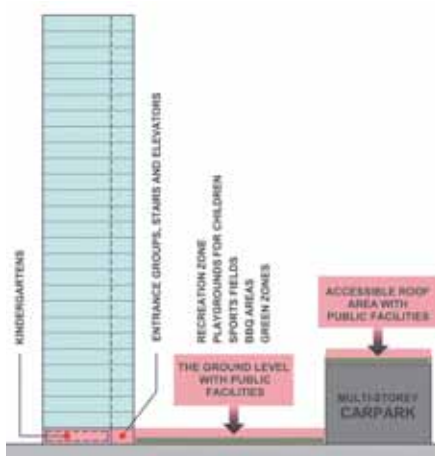


Figure 8. Operational planning Diagram 3.

was established using traditional natural-ventilation principles for Singapore.

Diagram 3

This arrangement features an accessible roof area atop the detached multi-story car park which, in addition to the ground level, is used for public facilities (see Figure 8).

The Diagram 3 exemplar is The Peak @ Toa Payoh, (2012, 40–42 floors), comprising 1,203 three-, four-, and five-room apartments of 70 to 117 square meters each. The complex is located on an elongated rectangular plot and consists of five towers and a multi-story car park. Three of the towers are 40 stories and two are 42 stories. All the free space on the ground level is divided into functional areas needed for a comfortable family life. All the facilities are linked via covered arcades, which also lead to the house entrances and



Figure 11. Park Central @ Ang Mo Kio, Singapore. © Koh Sun Yew. Source: flickr.com



Figure 9. The Peak @ Toa Payoh, Singapore. Source: Avantparc.org

multi-story car park. The garage's split-level roof is a landscaped space for recreation and the façade is shaded with vertical climbing plants. The interaction of vertical communication (stairs, elevators, ramps) and natural ventilation is carefully designed (see Figure 9).

Diagram 4

This format consists of a multi-story car park, linked to the residential towers via bridges. The roof of the car park is green space, with grass zones for recreation, vegetated zones, and sports fields (see Figure 10).

All of these features have been implemented in Park Central @ Ang Mo Kio (2011, 30 floors), comprising 578 apartments. These are four- and five-room apartments of 90 to 120 square meters. The space planning of this residential complex is innovative, even in Singapore. The complex consists of four

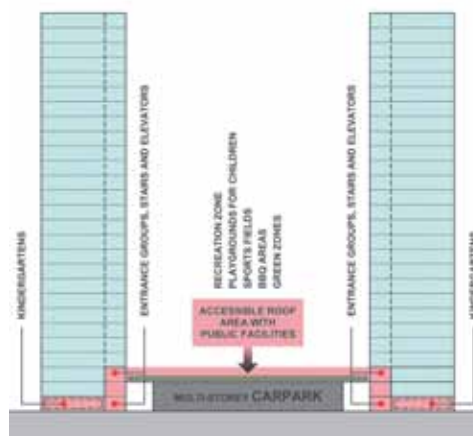


Figure 12. Operational planning Diagram 5.

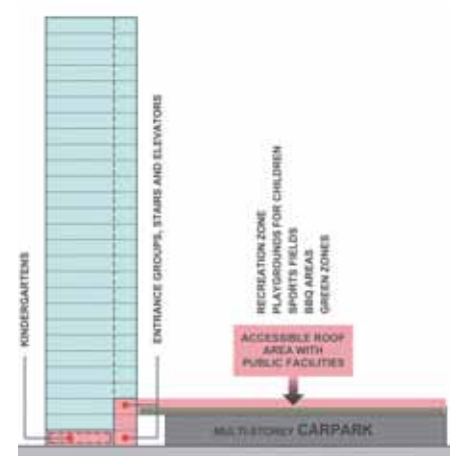


Figure 10. Operational planning Diagram 4.

30-story blocks, set in a row along the multi-story car park, the roof of which is 100 meters in length. On the roof there is a great deal of greenery, a playground for children, well-equipped sports fields, gazebos for recreation, a barbecue area, and other facilities (see Figure 11). Pedestrian bridges lead from the roof of the garage to residential buildings. Park Central was awarded the BCA Green Mark (Gold) Award in 2010. This award is given for environmental sustainability, based on environmental friendliness, economy, energy efficiency, and social qualities. It should be noted that the Green Mark certificates are re-evaluated for compliance every three years, to reflect changing criteria.

Diagram 5

This model consists of a multi-story car park with accessible roof areas for residents, located between the two rows of residential units and connected through stairs and elevators to each unit via link bridges. In each of the residential buildings, there are entrance lobbies, kindergartens, clubs, and facilities on the ground level (see Figure 12).

The exemplar is Punggol Breeze, (2012, 15–17 floors), which won the BCA Green Mark Gold Award 2011 and BCA Universal Design Award 2013. It consists of 12 residential blocks and comprises 964 four- and five-room apartments of 93 to 120 square meters. The complex is unique, in that there is a garden on the roof of a multi-story car park of 270 meters' length, with all necessary facilities for a comfortable and healthy life (see Figure 13).



Figure 13. Punggol Breeze, Singapore.

The outstanding peculiarity of this project is the way in which the LRT passes above the ground level alongside the residential complexes and provides a convenient connection to the main underground lines. The Punggol LRT line, one of four in Singapore, is 10.3 kilometers long with 15 stations.

Diagram 6

In this scenario, a multistorey car park forms the podium. For ventilation and lighting of parking levels there are through-holes in the lift-slabs ("light windows"). The roof of the podium is leveraged for the organization of public facilities. There is an entrance into residential units on every floor (see Figure 14).

The Diagram 6 exemplar is Natura Loft @ Bishan (2012, 40 floors), comprising 480 apartments. These are four- and five-room apartments with an area of 95 to 120 square meters. There are three 40-story towers located on the platform, with several parking levels. To reach apartments, there are entrances from the parking level, as well as from the roof. For residents' comfort, there is a playground for children, a well-equipped sports field, a barbecue area, gazebos, and other facilities. Natura Loft meets the high requirements of green standards in Singapore. In 2010, the project was awarded a certificate of BCA Green Mark Gold Plus, indicating that it is an environmentally friendly, energy-efficient, and safe complex.

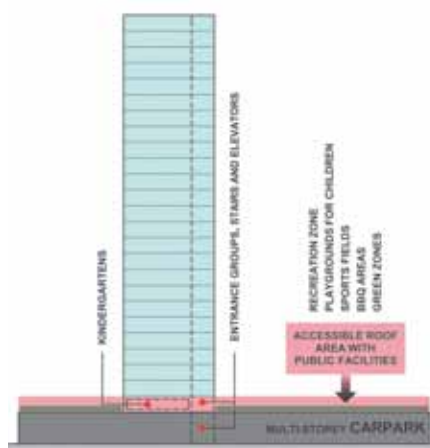


Figure 14. Operational planning Diagram 6.

Apartment Layouts

In the early years of its development, public housing in Singapore was regarded as standardized housing for low-income groups. The HDB flats today are targeted at people with average income, and management is less focused on standardization than on improving the quality and variety of planning solutions. Thus far, seven basic types of apartments have been developed: studio apartments, two-, three-, four-, and five-room flats, 3Gen flats, and executive apartments.

Studio apartments are designed to meet the needs of older people, and accommodate one or two people in an area of 35 to 45 square meters. This accommodation is completely ready for occupancy: there is an equipped kitchen and a built-in wardrobe. Non-slip floor coating is used, there are no differences in floor levels, and the bathroom has special equipment for the disabled. There is also an alarm system in each apartment and in the elevator lobby on each floor.

Two-room flats have an area of nearly 45 square meters. There is a living area that may be subdivided into an extra room, if needed, a kitchen, one bedroom with an attached bathroom, and a storeroom/shelter.

Three-room flats have an area of 60 to 65 square meters. There is a living area, a kitchen, one master bedroom with attached bathroom, one additional bedroom, a common bathroom, an outdoor service yard, and a storeroom/shelter.

Four-room flats have an area of nearly 90 square meters. There is a living/dining area, a kitchen, one master bedroom with an attached bathroom, two additional bedrooms, a common bathroom, a service yard, and a storeroom/shelter. Such apartments are appropriate for a young couple or family with small children.

Five-room flats, with an area of 110 square meters, are for a family of four or five people. They offer comfortable living space, even for a big family. There is a living area, a dining area, a kitchen, one master bedroom with an attached bathroom, two other bedrooms, a common bathroom, a service yard, and storeroom/shelter.

3Gen flats, with an area of 115 square meters, are for families living with several generations together under one roof, and also for big families in need of an extra bedroom with an attached bathroom. There is a living area; a dining area; a kitchen, one master bedroom with an attached bathroom, an additional bedroom with an attached bathroom, two additional bedrooms, a common bathroom, a service yard, and a storeroom/shelter.

Executive Flats have an area of 130 square meters. There is a living area, a dining area, a kitchen, one master bedroom with an attached bathroom, an additional bedroom with an attached bathroom, two other bedrooms, a common bathroom, a service yard, a storeroom/shelter, a study room, and a balcony.

HDB flats are all built on a clear, well-established pattern and with a high standard of comfort (see Figure 15).

All of the unit types share these common traits:

1. A dining and living room are considered as a single space, each flowing into the other;
2. A kitchen is usually located at the entrance, and it has a connection with an outdoor service yard, which serves as a laundry;
3. The master bedroom has a private bathroom equipped with a toilet, sink, and shower;



Figure 15. Basic types of HDB flats: two-room flats, three-room flats, four-room flats, five-room flats, and 3Gen flats.

4. When there is more than one bedroom, then a second bathroom is included;
5. There is a storeroom in all types of flats, serving as a utility room and as a shelter in case of typhoons or other emergencies.

From July 2006, universal design has been required to be implemented in newly built residential complexes. The main aim is to create a comfortable environment for residents, regardless of their age, level of mobility, and health, and to meet the needs of residents of all ages. It is considered to be more cost-effective and rational to first create conditions for people with limited mobility at all levels, from apartment interiors to site improvements, rather than retrofit individual elements when the need arises. Site improvement includes barrier-free routes between residential blocks, with transport stops and social amenities.

Every residential unit supports access by sight-disabled people and those who have musculoskeletal disorders, by way of ramps, public areas for recreation and communication, contrasting color buttons in elevators with Braille type, and easy-to-understand

pictograms. Every apartment is designed to be adaptable for the disabled: corridors and doors are appropriately wide for wheelchairs; special handrails can easily be installed in bathrooms, etc.

There is an optional component scheme, according to which a public housing apartment can be adjusted to meet the needs of a particular family for an additional fee. For example, there is a choice of installing extra plumbing equipment or entrance doors. The “open kitchen” concept, in which there is no partition between a dining room and kitchen, has been implemented as standard. This gives free space for meeting different needs of individual lifestyles. A breakfast bar can be substituted in place of walls or partitions.

Conclusion

A case study of Singapore shows that high-rise public housing is the most rational form of housing development in contemporary large cities. High-rise housing can be public and affordable as well as expensive and elite. Singapore, of course, is not the only

“It is considered to be more cost-effective and rational to first create conditions for people with limited mobility at all levels, from apartment interiors to site improvements, rather than retrofit individual elements when the need arises.”

place with outstanding endeavors to develop an equitable form of high-rise construction. For instance, an impressive public housing sector has been created in Hong Kong, where grave housing problems have similarly found their solution through erecting high-rise housing complexes with a complete set of social and public services. Nevertheless, the Singapore experience with sustainable high-rise design can be very instructive for cities with land shortages, constrained urban conditions, and vulnerable populations. ■

Unless otherwise noted, all photography credits in this paper are to the authors.