



## Tall Buildings in Southeast Asia

# A Humanist Approach to Tropical High-Rise

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Images as credited

WOHA aims to transform and adapt vernacular and passive responses to the climate into the high-rise form and contemporary technologies, while creating comfort without the need for mechanical systems.

High-rise, high-density living has been embraced as a positive accommodation solution for many millions of people living in Asia's growing urban metropolis. WOHA Architects has designed a series of buildings for Southeast Asia that expand the way high-rise, high-density living is conceived. Approaching the design from lifestyle, climate and passive energy strategies, the towers are radical yet simple and show that the tall building form can be expanded in many directions. Located in Singapore, which has been the laboratory for much of its design research, WOHA articulates its approach to design, using both built and unbuilt projects as illustrations, in this paper.

### Singapore's Unique Condition

Singapore is an island of 600 square kilometres and a population of five million, one of the most densely populated countries on earth. It is located on the Equator, with warm, humid weather, and a daily temperature variation of only seven degrees Celsius. Seasons are distinguished only by precipitation and the direction of the breezes. The sun path moves in an almost vertical trajectory. Winds are extremely light, even at high elevation, and Singapore is not in a seismic zone. 80 percent of the population lives in public housing, which is based on the Corbusian Ville Radieuse model—high-rise, elevated on pilotis, above a verdant public landscape.

In such an environment, many aspects that normally shape tall buildings are absent or turned on their heads. Wind is to be accelerated, to increase comfort; overshadowing is not a problem, as shade is welcomed; external high-rise spaces are pleasant and comfortable. There is no community resistance to high-rise: it is the norm. Higher units command a significant premium over lower units. Ground floor units are unpopular due to blocked breezes, humidity, lack of privacy and views, and perceived security risk. All these factors contribute to WOHA's exploration of alternative tall building arrangements.

### A Humanist Response

As a type, tall buildings in the temperate West have evolved with technological solutions embedded in their DNA. The harsh climate of Chicago and the economic pressures of New York created the modernist tower as an engineered solution. Compact cantilevered columns, with maximised volume-to-surface area ratios and wrapped in smooth shiny skins, kept inhabitants comfortable mechanically. Aesthetically, culturally, and philosophically, these are heroic struc-

tures that jostle for height, status, and domination of nature through technology. Inhabitants of these aggressive structures take pleasure in the high status of these glossy technological marvels.

The emphasis in WOHA's high-rise projects has been on the individual, on human scale, on choice, on comfort, on opening up to the climate, on community spaces, and on nature. The mild environment of Singapore allowed these concerns to take priority over the typical shapers of the high-rise form. Through careful balancing of developers' needs and end-user amenity, WOHA has managed to incorporate these values into projects with standard developer budgets.

### Response to Climate

80 percent of Singaporeans live in public housing, most without air conditioning and many more only use air conditioning at night. Apartments have operable windows, naturally ventilated and lit bathrooms and kitchens, and drying yards—there is no mechanical ventilation. Singaporean public housing towers are an exercise in perforating the form, to allow natural light and air into every space.

However, due to a desire to replicate glossy western models, many private sector apartment developers have traded these sensible low-technology solutions after the 1980s for curtain-walled apartments that required air conditioning and mechanical ventilation to achieve comfort. These upmarket apartments became the aspirational model for public and lower-end housing, resulting in a loss of sensible climatic design across the region.

WOHA rejects this model. WOHA aims to transform and adapt vernacular and passive responses to the climate into the high-rise form and contemporary technologies, while creating comfort without the need for mechanical systems.

1 Moulmein Rise is a 28-storey, 50-unit tower in a residential neighbourhood that is 10 minutes from the Central Business District (CBD). The form is slender, with a footprint of only 230 square metres and a height of 102 metres. Fortunately, the panoramic views of the skyline were to the south, allowing good orientation whilst maximising the views. With a plot ratio of 2.1 and a height limit of 30 storeys, it was possible to place just two units on each floor, both facing the same view, connected only by the fire fighting lobby and escape stairs.



The most interesting innovation in 1 Moulmein Rise is the “Monsoon Window” façade. In Singapore, certain elements are sold as real estate but not taxed by the planning authority as developed floor area. For this reason, maximising bay windows, air conditioning ledges, and planter boxes maximises profits for the developers. In some apartments, these areas approach 15 percent or more of the floor area. WOHA wanted to use these high-profit areas to the benefit of the end user and began to research the ways that these projecting elements could be used to create greater amenity. The chosen solution involved the use of this façade “thickness” for climate control.

In Singapore, when it rains, the temperature drops to a pleasant 24 to 27 degrees Celsius. However, rain is often accompanied by gusty winds. In Borneo, where the climate is similar, Dyak longhouses have special horizontal openings below projecting ledges, which allow the cool wind to come in while keeping the rain out. With 1 Moulmein Rise, WOHA developed a contemporary version of the Dyak longhouses, with a projecting bay window that satisfied the developer’s requirement for additional non-taxed space but that incorporated a sliding ledge, which could be opened during cool weather to allow breezes in but keep rain out.

Other climatic elements incorporated are a perforated skin 900 millimetres out from the south façade, which fully shades the façade and conceals the air-conditioning units and clothes drying area, and the horizontal sun-shading ledges.

Newton Suites, a 36-storey, 118-unit tower designed in 2003, utilises sun-shading consistently over the entire façade. As with 1 Moulmein Rise, projecting bay windows were required by the developer but not favoured in view of reducing solar gain. Additionally, high-rise developments in the tropics gain almost all of their solar load from their vertical surfaces, not the roof, so shading the walls would be much more effective than insulating the roof. Two layers of sun-shading were used per floor, shading both windows and spandrels. An expanded steel mesh is used, as it has a three-dimensional section that acts like louver, appearing more transparent when viewed from above but solid from the angle of the sun.

The façade is painted concrete. As the tropical, dusty climate causes streaking within months, the façade was pre-streaked in a painted pattern. The painted articulation of the surface, combined with the “blurry” outline of the sunshades and cantilevers of the balconies, gives a unique tropical expression to the tower.

The Met (2004, Bangkok) is designed as a cluster of linked “Z”-shaped towers, allowing all units double-facing and cross-ventilation. Sunshades, structural fins, vertical greening, and naturally ventilated, green-walled carparking are some of the passive strategies used.

### Celebrating the Individual

Large developments are alienating in many ways. People buy apartments as off-the-shelf commercial products; home is reduced to a number. In many buildings, people signify their presence with brightly coloured objects or fabrics in the windows, to assert their presence in the face of conformity. WOHA has explored the way the individual is expressed in collective housing in several ways in different projects.



1. 1 Moulmein Rise: View from Southwest (Photo: Patrick Bingham-Hall).

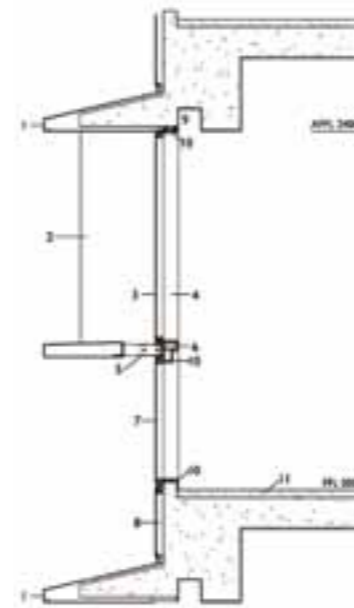
2. 1 Moulmein Rise: View of façade (Photo: Patrick Bingham-Hall).

3. 1 Moulmein Rise: Detail of Monsoon bay windows that were inspired by Dyak longhouses (Photo: Tim Griffith).

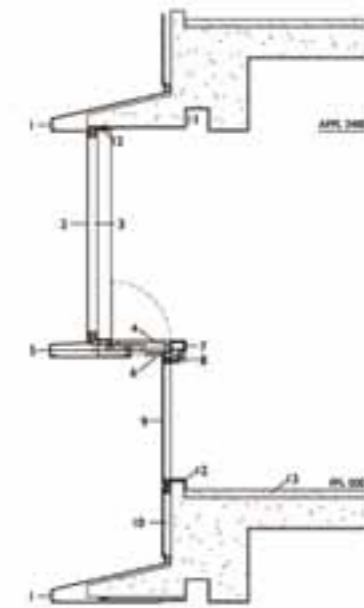


1 Moulmein Rise: Typical floor plan (Drawing: WOHA Architects)

- LEGEND
1. Fire Lift Lobby
  2. Private Lift Lobby
  3. Living/ Dining
  4. Kitchen
  5. Yard
  6. HS/Maid’s
  7. Master Bedroom
  8. Bedroom 2
  9. Bedroom 3



- LEGEND
1. Alucobond Sheet for Hood
  2. Alucobond Lining
  3. Open-Out Casement Sash for Ventilation and Cleaning
  4. Steel Mullion
  5. Aluminium Outrigger Plates at mullion centres
  6. RHS Bracket
  7. Fixed Tempered Glass
  8. Ventilated Cavity
  9. Curtain Recess
  10. Timber Lining
  11. Parquet flooring with Marine Ply Underlay



- LEGEND
1. Alucobond Sheet for Hood
  2. Open-Out Casement Sash for Ventilation and Cleaning
  3. Steel Mullion
  4. Perforated Aluminium fixed to hinged frame with insect screen between (closed position)
  5. MDF board sliding (closed position)
  6. Safety bars
  7. RHS Bracket
  8. Handle Winder
  9. Fixed Tempered Glass
  10. Ventilated Cavity
  11. Curtain Recess
  12. Ash veneer ply with edge veneer
  13. Parquet flooring with marine ply underlay

1 Moulmein Rise: Monsoon Window Section (Drawing: WOHA Architects)

The frequent rain, humid air, and low wind speeds make vertical planting much easier in Singapore than most other locations.



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Dawson Estate: Flexible Units (Drawing: WOHA Architects)

With 1 Moulmein Rise, the façade was developed as a system of climate-modifying façade modules—of overhangs, planters, bay windows, sliding windows and sunscreens. Analogous to DNA, where simple proteins generate incredible variety through their ordering, these modules could be rearranged in a myriad of ways to provide variety. Three different façade designs were developed, which were then stacked up in a random arrangement.

With the Duxton Plain Public Housing Competition, WOHA proposed to give individuals real choice in determining their building façade. A system of regular façade modules gave buyers the choice to select full-height windows, bay windows, storage modules, planters, and blank walls. In effect, the façade design would be a portrait of the inhabitants and exactly match their preferences for openness, privacy, and plants.

With upcoming Dawson Estate Public Housing, another form of individual choice is being implemented—floor plans where the buyers will have the choice of layouts, including a “flexible unit”, where they can lay-out internal walls in a beam-free, column-free space to suit their lifestyle needs. This is the first time the public housing authority in Singapore will be selling such units.

**High-Rise External and Community Spaces**

Since the scale of tall buildings differs vastly from the scale of humans, WOHA has been investigating the quality of external spaces in high-rise towers. In particular, this surfaced in the design of Duxton Plain, a 50-storey building inserted into a 3-storey historic district, which became a pivotal building in the firm’s oeuvre due to the solutions proposed. The project took the fine historic scale of the neighbourhood into the large development. However, when spaces that work at three storeys, such as the neighbourhood street width, were extruded to 50 stories, the scale became an inhuman vertical slot, rather than a charming well-proportioned street.

To avoid this problem, the vertical slots were divided with horizontal gardens every five floors, creating more stable proportions, which evoke a feeling of comfort, rather than dynamism. Additionally, the use of landscaping introduces visual cues of scale, rather than the abstraction of the curtain wall. The sky streets and sky parks were designed as social spaces, addressing the alienation of high-rise buildings. Residents take high-speed lifts at each end of the development, walk along the skystreets, then take low-speed lifts or stairs to their apartments. These pleasant, relaxed social spaces were seen as vital to the development of community, which does not often occur

in the tense compressed spaces of a typical lift or lobby. This insistence on community over privacy was WOHA’s proposed civil contract for subsidised public housing in affluent Singapore. The scheme, although placed in the top five, was not selected for construction. However, aspects of its design were included in subsequent schemes.

With The Met, sky gardens and inhabited external spaces were developed as both public and private spaces in the sky. Community areas were created every 20 storeys, giving all residents access to high-level views, terraces, and gardens in the sky. Additionally, in a post-911 scenario, the linking gardens give an incredible increase in safety: it would be possible to cross from one core to another, below or above an incident, to avoid vertical escapes compromised by attacks. Private gardens were created every five storeys, effectively creating penthouse-like units throughout the tower, an advantage in the glamour-conscious Bangkok market. These bridging spaces were designed with swimming pools and terraces. The double volume living room opens up to a quadruple-volume garden and pool with its own tree.

The Met, at 69 storeys tall, had to incorporate large structural elements as the load increases towards the ground. Rather than allowing the structure to impact the internal spaces, the designers utilised these structural elements as fins on the façade, which were then used for shading, and for external spaces. At the topmost third of the building, where winds are strongest, windows were kept small and the only sun-shading was used between the fins. At the middle third, where the columns project further, balconies were included between the columns together with sun-shading. At the lowest third, where the views are not as spectacular and the fins projected even further, larger projecting terraces were provided with planters and trees, full outdoor rooms that provide a transitional zone between the chaos of Bangkok and the apartment.

The social community spaces of the envisioned Duxton Plain are becoming a reality in the Dawson Estate project. Every apartment in this 960-unit public housing development belongs to an 80-unit “sky village”, which shares a common “Village Green”. This is a planted common sky deck every 11 floors, which will be overlooked by the lift lobby and circulation spaces leading to each apartment. In this way, every inhabitant crosses a common space when entering or leaving his or her apartment and can see the activities in the Village Green. Activities provided for are study areas, gathering areas, community gardens, and play areas.



### Incorporation of Nature

A final aspect of WOHA's approach to high-rise is the incorporation of nature in the form of high-rise planting. Plants naturally sprout from Singapore's buildings. The frequent rain, humid air, and low wind speeds make vertical planting much easier in Singapore than most other locations. WOHA treats landscaping as a primary strategy for defining a space, cladding a surface, and supporting functional requirements, rather than a secondary add-on.

The design of Newton Suites asked the question: is it possible to achieve a 100-percent green plot ratio on a dense urban site? With this aspiration, landscaping was incorporated at the concept level in every possible location of Newton Suites—at the ground level, at the car park podium, at the common lift lobbies, on the vertical walls, and within the private units. The most eye-catching elements are the green walls and cantilevered gardens.

Newton Suites features a 30-storey continuous wall of *Thunbergia* flowering creepers. Utilising simple technology, with deep planters, metal mesh, and an automatic irrigation system, the device succeeds due to its practicality. Adjacent to an external staircase, the planter can be accessed at every level for maintenance, behind the metal mesh. Further, the cantilevered sky gardens are common spaces that project off the lift lobbies every four storeys. All the naturally ventilated lift lobbies overlook these gardens, which incorporate fountains, trees, and planting, together with a small bench for sitting.

In the end, a 130-percent green plot ratio (counting both horizontal and vertical planted elements) was achieved. After the Urban Redevelopment Authority of Singapore saw that this was possible in a private development, it enacted a regulation requiring all new buildings in the central area of Singapore to achieve a green plot ratio of 100 percent over their horizontal surfaces.

The landscaping theme has been taken even further in WOHA's design of PARKROYAL on Pickering that achieved a green plot ratio of 200 percent. A total of 15,000 square metres of sky gardens, reflecting pools, waterfalls, planter terraces, and green walls were designed,

which is effectively double its site area or equivalent to the footprint of Hong Lim Park. A diverse variety of species ranging from shade trees, tall palms, flowering plants, leafy shrubs, and overhanging creepers come together to create a lush tropical setting that is attractive not only to the people but also to insects and birds, extending the green areas from Hong Lim Park and encouraging biodiversity in the city.

WOHA's skysrise greenery has since gotten more radical. Under construction, Oasia Downtown sets out to create an alternative imagery for commercial high-rise developments. It combines innovative ways to intensify land use with a tropical approach that showcases a perforated, permeable, furry, verdant tower of green in the heart of Singapore's CBD.

In response to the client's brief of having distinct Soho, Hotel, and Club rooms, WOHA adopted a "club sandwich" approach by creating a series of different strata, each with its own sky garden. Each sky garden is treated as an urban scale verandah, sheltered at a high level by the preceding sky garden, and open-sided for formal and visual transparency. The openness also allows wind to pass through the building for good cross-ventilation. In this way the public areas become functional, comfortable tropical spaces with greenery, natural light, and fresh air, instead of enclosed, internalised air-conditioned spaces.

The extensive landscaping is used as an architectural surface treatment and achieves an overall green plot ratio of 750 percent. The building form is softened by a living green façade of creepers and flowering plants, creating an alternative image distinct from the surrounding glassy towers of the CBD, one that is tropical and urbanistically sensitive and humanistic.

### "Permeable Lattice City" of the Future

All of the above ideas were brought together in a scheme that WOHA presented at the Vertical Cities Asia symposium. The brief specified a population density of 100,000 people within a one-square-kilometre site. By devising a one-square-kilometre city grid with a popula-



7. Newton Suites: Green textures and surfaces extend along the entire height of the building (Photo: Patrick Bingham-Hall).

8. Newton Suites: Unified façade of sun screens and protruding balconies (Photo: Patrick Bingham-Hall).

9. Duxton Plain: View across sky park (Photo: WOHA Architects).

10. Dawson Estate: Skygarden Plan (Drawing: WOHA Architects).

11. Dawson Estate: Sky Village (Rendering: WOHA Architects).

12. Newton Suites: Green textures and surfaces extend along the building (Photo: Patrick Bingham-Hall).




tion density of 111,111 people, WOHA created a basic module with the capacity to be extended seamlessly and endlessly in any direction for larger urban scales. WOHA's tropical high-rise, high-density themes were tested based on the model of The Met that champions sustainable passive design strategies.

A vertical "Permeable Lattice City" that uses modules of The Met as "City Columns" was envisioned. These City Columns were similarly staggered to create a high degree of perforation and porosity, resulting in cross-ventilated breezeways at city-scale and ensuring that fresh air and natural daylight reaches every part of the inner city. With minimal footprints, the City Columns freed up the real ground level for other uses, including nature reserves, heavy industries, and so on, and were structurally held together by a network of "City Conduits" that served as elevated ground levels. These City Conduits were then socially woven by layers of "City Community Spaces" and vertically interconnected by multi-cabin lifts and other forms of environmentally friendly people-mover circulation systems that map out a fully pedestrianised city, entirely negating the need for cars above the real ground level.

Ultimately, this exercise in urban densities suggests that by forming layers of stacked "live-work-play" communities, introducing multiple elevated ground levels at strategic horizons that relieves the real (existing) ground level, creating openness and porosity between towers that facilitates cross-ventilation of fresh air and natural daylighting, crafting out varying scales of tropical community spaces that encourages social interaction, applying vertical greenery and designing sensitively for human scale, a super dense vertical city can be both highly sustainable and liveable, without compromising the quality of living, if such alternative strategies to city planning and architecture are embraced.

### Impact

WOHA's passive strategies for tropical tall buildings are at an exploratory phase. These design principles are adopted in WOHA's projects around the world, including in Asia, Australia (Sydney), and Germany (Frankfurt). Each project is the testing bed for one or more ideas about how to live more sustainably in future but always framed in the context of architecture providing daily delight to the end-user.

Innovations in Singapore spread through Malaysia, Thailand, Indonesia, India, Vietnam, and China due to Singapore's advanced state of development, its role as a source of investment, its aid and consultancy, and its role as an important node in the diaspora of Asian ethnic groups. As such, the importance of Singapore's innovations is their impact on not just the small city of five million inhabitants, but also on the half of the world's population surrounding it. Additionally, much of the developing world is located around the equatorial belt, so it is vital that tropical design research addresses the important questions of how we can live well and sustainably with our climate and with the densities projected for the rapidly growing region. WOHA's projects show how approaching these problems from different viewpoints may open up fertile areas for further research and innovation. 

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13. Oasia Downtown: A perforated, permeable, verdant tower of green (Drawing: WOHA Architects).



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14, 15. Vertical Cities Asia: A Permeable Lattice City of the future (Renderings: WOHA Architects).