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Tall Buildings in Southeast Asia - A Humanist Approach to Tropical High-rise



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Wong Mun Summ and Richard Hassell are co-founding directors of WOHA, a regional design practice based in Singapore. WOHA explores integrated design for the built environment. Rather than develop a house style, WOHA focuses on the architectural potentials within each project and acquires a formal language around these. The practice has extensive experience in a wide range of projects around the Asia Pacific region, including Singapore, Malaysia, Thailand, Indonesia, Australia, Japan and China. Rather than specializing in projects by type, projects are accepted for their design potential and points of interest, and include commercial, residential, hospitality, transport, infrastructure, exhibition, institutional, religious, mixed-use and interior projects.

"Much of the developing world is located around the equatorial belt, and 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."

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. This paper outlines a number of high rise case studies designed by a Singapore-based architectural practice (WOHA Architects) who have designed a series of buildings for South-East Asia that expand the way highrise, 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.

The Case Studies in this paper include: 1 Moulmein Rise, Newton Suites, Duxton Plain and the newly completed tower The Met. While Duxton Plain was not built its successor, the 980-unit Dawson Estate Public Housing, will start construction in 2010. WOHA's practice is located in Singapore, and the city has been the laboratory for much of their design research. In this paper, WOHA articulate their approach to design, using both built and unbuilt projects as illustrations.



Figure 1. Public Housing in Singapore © www.skyscrapercity.com

Singapore's Unique Condition

Singapore is a unique place in many ways. The Republic of Singapore is only 44 years old, a former British Colony, and it has undergone a radical transformation from an Empire trading post to the first developed tropical city. It is a small island of 600 square kilometers, and a population of 4.5 million, making it one of the most densely populated countries on earth. It is located 1 degree north of the Equator, and thus has constant warm, humid weather, with a daily temperature variation of only 7°C, and seasons distinguished only by the increase in precipitation and change in direction of the breezes. The sun path moves in an almost vertical trajectory, shifting slightly to the north in June, and to the south in December. Winds are extremely light, even at high elevation, and Singapore is not in a seismic zone. 80% of the

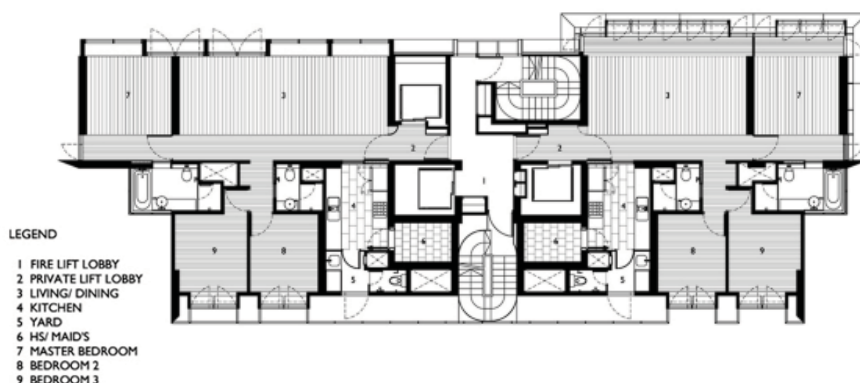


Figure 2. Moulmein Rise: Typical Storey Plan © WOHA

population live in public housing, which is based on the Corbusian Ville Radieuse model – highrise, elevated on pilotis above a verdant public landscape (see Figure 1).

In this environment, many of the aspects to which tall buildings are elsewhere shaped are absent or turned on their head. Wind is to be accelerated, to increase comfort. Overshadowing is not a problem, as shade is welcomed. External highrise spaces are pleasant and comfortable. There is no community resistance to highrise: it is the norm, and 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, despite Singapore having one of the lowest crime rates in the world. All these factors contribute to WOHA's exploration of alternative tall building arrangements.

A Humanist Response

Tall buildings in the temperate West evolved as a type that embedded its technological solutions in its 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 maximized volume-to-surface-area ratios, wrapped in smooth shiny skins, with inhabitants kept comfortable mechanically. Aesthetically, culturally and philosophically, these are heroic structures 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 highrise 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 highrise form. Through careful balancing of developers needs and end-user amenity, WOHA have managed to incorporate these values into projects with standard developer budgets.

Response to Climate

Many Singaporeans in public housing live without air conditioning, and many more only use air conditioning at night. Apartments have operable domestic windows, naturally ventilated and lit bathrooms and kitchens, and drying yards – there is no mechanical ventilation. Rather than maximizing volume to perimeter, Singaporean public housing towers are an exercise in perforating the form, to allow natural light and air into every space. Internal walls and external walls are no different – plastered blockwork and concrete – so there is little cost implication in the greater proportion of external walls.

However, due to a desire to replicate glossy western models, many private sector apartment developers traded these sensible



Figure 3. Moulmein Rise: View from South West. The building is exactly oriented to the cardinal points, exposing only a slim elevation to the east and west. © Patrick Bingham-Hall

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's approach has been to reject this model, and to instead transform and adapt vernacular and passive responses to climate into the highrise form and contemporary technologies, with the same aim of creating comfort without the need for mechanical systems.

1 Moulmein Rise is a 28 storey, 50 unit tower in a residential neighbourhood 10 minutes from the CBD of Singapore. The form is slender, with a footprint of only 230 m², and a height of 102m. Fortunately, the panoramic views of the skyline were to the south, allowing good orientation whilst maximizing the views. With a plot ratio of 2:1, and a height limit of 30 stories, it was possible to place just two units on each floor, both facing the view, connected only by the fire fighting lobby and escape stairs (see Figure2+3). ➔



Figure 4. Moulmein Rise: The façade incorporates monsoon windows in the bay window ledges. Façade variations produce an interesting effect. © Patrick Bingham-Hall



Figure 6. Moulmein Rise: Monsoon Window Detail © Tim Griffith



Figure 7. Horizontal openings below projecting ledges shelter from rain and allow ventilation of interiors. Inspiration for monsoon windows at Moulmein Rise.

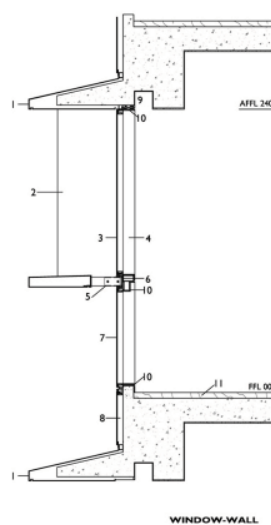
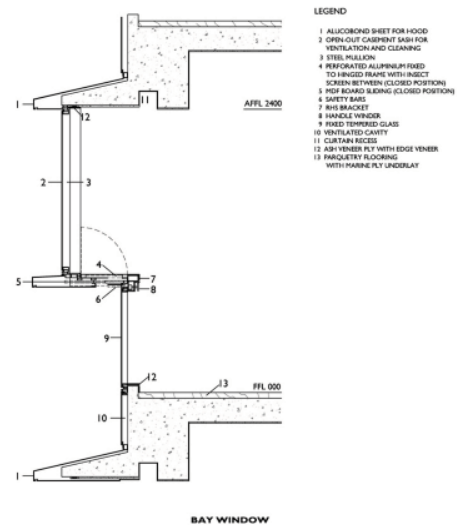


Figure 5. Moulmein Rise: Monsoon Window Section © WOHA



The most interesting innovation in 1 Moulmein Rise, is the “Monsoon Window” façade (see Figures 4-6).

In Singapore, certain elements are sold as real estate, but are not taxed by the planning authority as developed floor area. Maximising bay windows, air conditioning ledges and planter boxes maximizes profits for the developers. In some apartments, these areas approach 15% 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 ways in which 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 24-27 degrees. However, rain is often accompanied by gusty winds. In Borneo, where the climate is similar, the Dyak longhouses (see Figure 7) have special horizontal openings below projecting ledges, which allow the cool wind to come in, while keeping the rain out. WOHA developed a contemporary version, a projecting bay window which 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 the breezes in but keep the rain out.

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

Newton Suites, a 36 storey, 118 unit tower, designed in 2003, utilizes sunshading consistently over the entire façade. As in 1 Moulmein Rise, projecting bay windows were required by the developer, but are not good from a solar gain viewpoint. Additionally, highrise in the tropics gain almost all of their solar load from the vertical surfaces, not the roof, so shading the walls is much more effective than insulating the roof. Two layers of sunshading were used per floor, shading both

...machine room

“The wave of the future is a move towards creating buildings in which the machine room is eliminated.”

Shannon Kanli, Manager of Otis Elevator Co, speaking about new energy return systems for the elevator industry making new mechanical layouts possible. “The future is Now”, Elevator World, June 2009



Figure 8. Newton Suites: Unified façade of screens and protruding balconies. © Patrick Bingham-Hall



Figure 9. Newton Suites: Repetitive sunshading screens of angled mesh prevent insulation. © Patrick Bingham-Hall

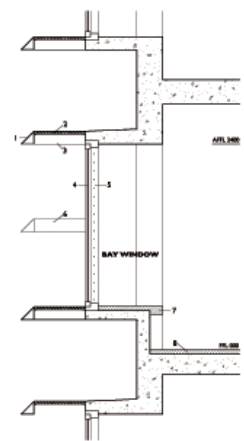


Figure 10. Newton Suites: Sunshade Mesh Screen Detail © WOHA

windows and spandrels. An expanded steel mesh is used, as it has a 3-dimensional section that acts like louver, appearing more transparent when looking down, but appearing solid from the angle of the sun (see Figures 8-10).

The façade is painted concrete. As the tropical, dusty climate causes streaking within months, the façade was pre-streaked in a painted pattern. The Mondrian-inspired painted articulation of the surface, combined with the “blurry” outline of the sunshades and the cantilevers of the balconies, gives a unique tropical expression to the tower (see Figure 11).

Newton Suites carpark was developed above ground, rather than below ground. This avoids mechanical ventilation and lighting, and results in huge savings in energy. To ameliorate its presence, it is covered with creepers, and the roof is designed as the primary leisure space, with swimming pool, gym and barbecue areas.

The Met (Bangkok 2004) is designed as a cluster of “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 in The Met (see Figures 12+13). ↻



Figure 11. Newton Suites: Green textures and surfaces extend along the entire height of the building. © Patrick Bingham-Hall

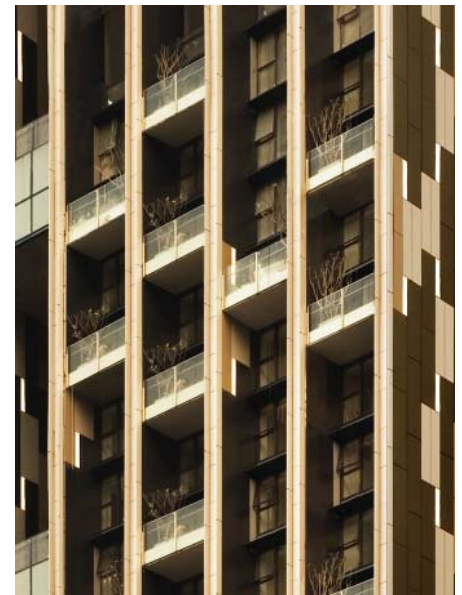


Figure 12. The Met: South Facade Detail © Patrick Bingham-Hall

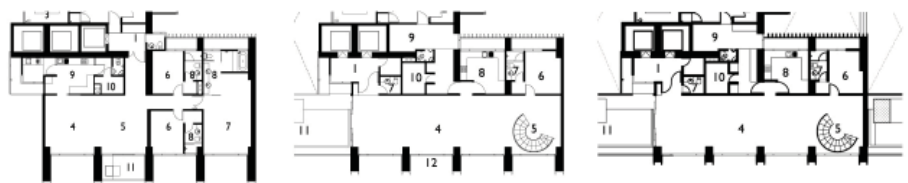


Figure 13. The Met: Stepping Back Structures © WOHA

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 have explored the way the individual is expressed in collective housing in several ways in different projects.

In 1 Moulmein Rise, the façade was developed as a system of climate-modifying façade modules (see Figure 14) – overhangs, planters, bay windows, sliding windows and sunscreens, which could be rearranged in myriad ways to provide variety, analogous to DNA (see Figure 15), where simple proteins generate incredible variety through their ordering. Three different façade designs were developed, which were then stacked up in a random arrangement. The façade gives the impression of high variation, assisted unwittingly by the contractor, who made several errors in the façade, creating something truly random out of something which had a hidden order.

In Duxton Plain Public Housing Competition, rather than the appearance of variation, the idea was to give individuals real choice in determining their interface with the exterior. A system of regular façade modules was proposed, where buyers could select full height windows, bay windows, storage modules, planters, blank walls – as they saw fit. The idea worked due to the large scale of the project and the small size of the module – each façade component was equivalent to a pixel in an image, and the façade design would in effect be a portrait of the inhabitants, and exactly match the population's preferences for openness, privacy and plants (see Figures 16+17).

In Dawson Estate Public Housing, this system was proposed, but removed due to logistic issues with the sales and tender process. However, another form of individual choice is being implemented – floor plans where the buyer has the choice of layouts, including a “flexible unit” where they can layout internal walls in a beam free, column free space to suit

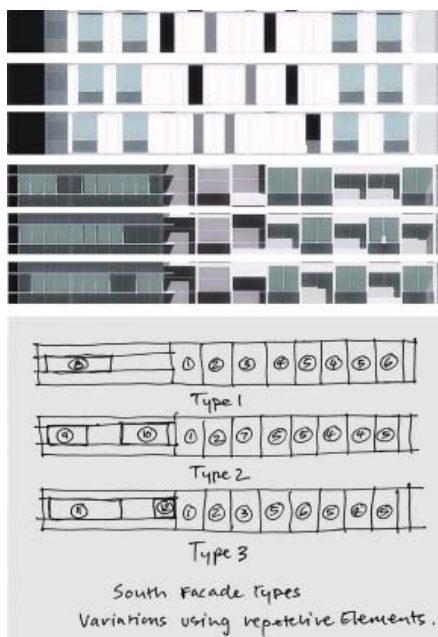


Figure 14. Moulmein Rise: Façade Arrangement © WOHA

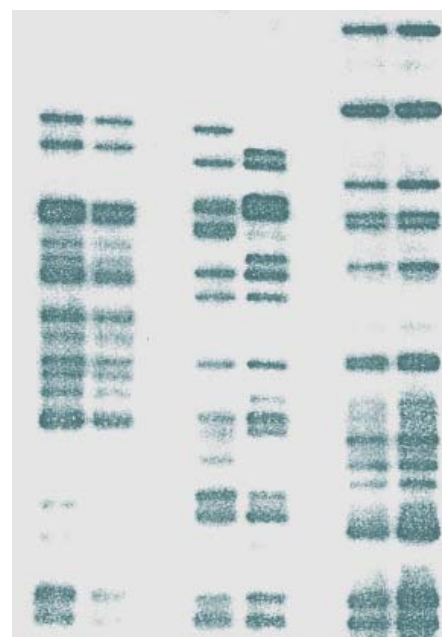


Figure 15. Moulmein Rise: DNA Inspiration © WOHA

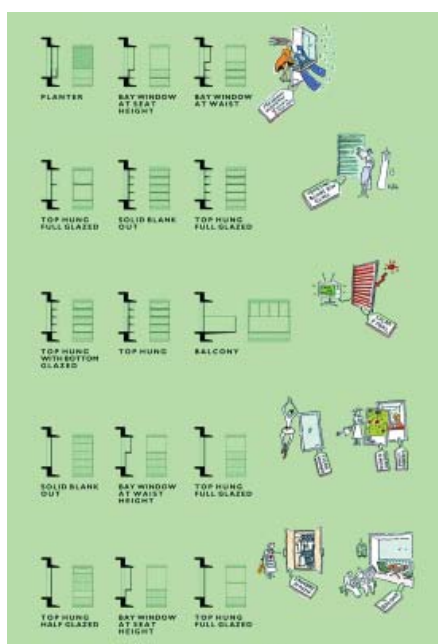


Figure 16. Duxton Plain: Façade System © WOHA



Figure 17. Duxton Plain: View across Skyparks © WOHA

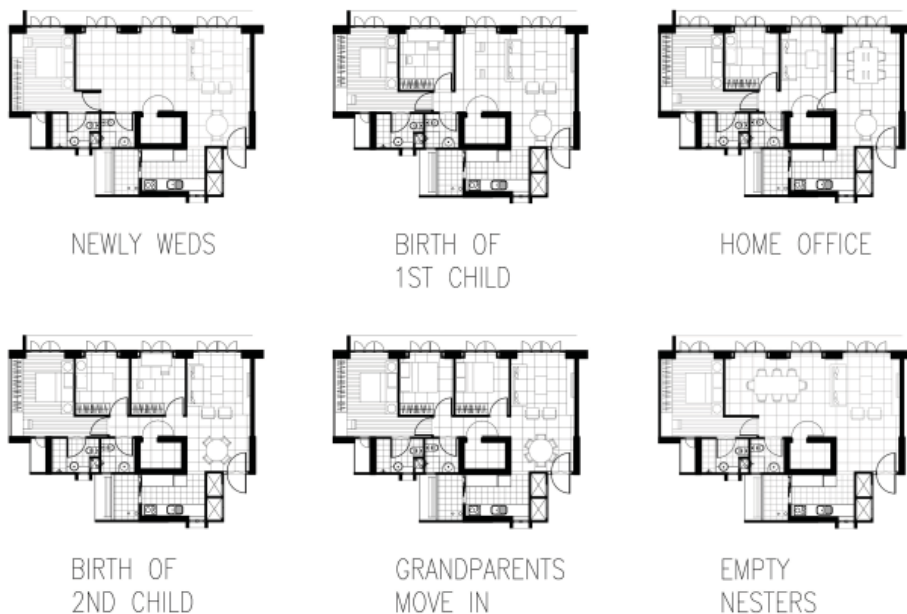


Figure 18. Dawson Estate: Flexible Units © WOHA

their lifestyle needs. This is the first time the public housing authority in Singapore will be selling such units (see Figure 18).

Highrise External and Community Spaces

Tall building's scale and human scale are vastly different. WOHA have been investigating the quality of external spaces in highrise towers. Duxton Plain, a 50 storey buildings inserted into a 3 storey historic district, particularly surfaced the issue, and was 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 3 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 (see Figure 19).

To avoid this problem, the vertical slots were divided with horizontal gardens every 5 floors, creating more stable proportions, which evoke a feeling of comfort, rather than dynamism.

Additionally, the use of landscaping introduces visual cues to scale, rather than the abstraction of the curtain wall. Combined with the

personalized pixilation of the façade composed of domestic elements – balconies, planters, bay windows – the vast vertical abstract canyon is transformed into a scene of domesticity and nature (see Figure 20).

The skystreets and sky parks were designed as social spaces, addressing the alienation of highrise buildings. Residents take high-speed lifts at each end of the development, walk along their skystreet, then take low-speed lifts, or stairs, to their apartment. 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 subsidized public housing in affluent Singapore.

The scheme, while placed in the top 5, was not selected for construction. However, aspects were included in subsequent schemes.

In The Met, the skygardens and inhabited external spaces were developed as both public and private spaces in the sky. Community areas were created every 20 stories, giving all residents access to high-level views, terraces and gardens in the sky. Additionally, in a post

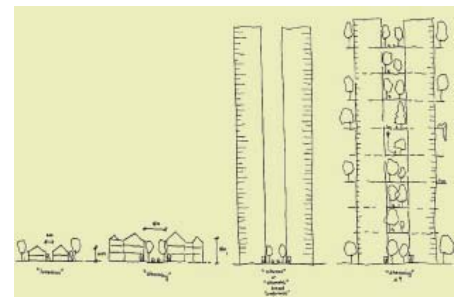


Figure 19. Duxton Plain: View across Skyparks © WOHA

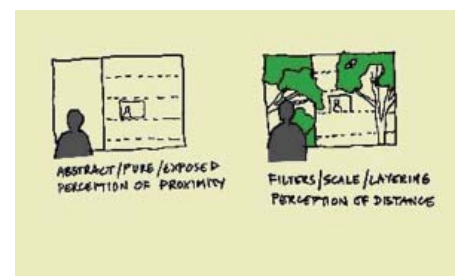


Figure 20. Duxton Plain: Landscape for Visual Scale © WOHA

9/11 scenario, the linking gardens give an incredible increase in safety – it is 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 5 stories, 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, being very tall at 69 storeys, had to incorporate large structural elements as the load increases towards ground. Rather than allowing the structure to impact the internal spaces, designers utilized these elements as fins on the façade, which are then used for shading, and for external spaces. At the highest third of the building, where winds are strongest, windows were kept small, and only sunshading is used between the fins. At the middle third of the building, where the columns project further, balconies were included between the columns, together with sunshading. At the lowest third of the building, where views are not as spectacular, and the



Figure 21. Dawson Estate: Skygarden Plan © WOHA



Figure 22. Dawson Estate: External View © WOHA



Figure 23. Dawson Estate: Sky Village © WOHA

fins projected even further, larger projecting terraces were provided with planters and trees, a full outdoor room that provides a transitional zone between the chaos of Bangkok and the apartment.

The social community spaces of Duxton Plain are becoming 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 is 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 their apartment, and can see the activities in the village green. Activities provided for are study areas, gathering areas, community gardens, play areas and potentially "sheds" for creative and entrepreneurial activities – a highrise version of the backyard shed (see Figures 21-23).

Incorporation of Nature

A final aspect of WOHA's highrise is the incorporation of nature in the form of highrise planting. Plants naturally sprout from Singapore's buildings, and building owners need to be vigilant against Ficus species,

which sprout in gutters and downpipes, and send long routes through moist cracks, and if not removed, would eventually pull the building apart. The frequent rain, humid air, and low winds make vertical planting much easier in Singapore than most other locations (see Figure 24).

WOHA provides landscaping as part of their multi-disciplinary services, as well as working with landscape consultants. This organizational and practical knowledge of landscaping means that landscaping is treated as a primary strategy for defining space, cladding a surface, or supporting functional requirements, rather than being a secondary add-on.

Newton Suites asked the question – can we achieve 100% Green Plot Ratio on a dense urban site? Landscaping was incorporated from concept level in every possible location – at the ground level, at the carpark 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 the cantilevered gardens (see Figures 25+26).

Newton Suites features a 30-storey continuous wall of Thunbergia flowering creepers. Utilising simple technology – deep planters, galvanized commercial weldmesh, and an automatic irrigation system, the device succeeds due to



Figure 24. Plant Growth on Building

the practicality of its implementation – adjacent to an external staircase, the planter can be accessed at every level for maintenance, behind the metal mesh. After 2 years, the maintenance has been minimal, and the creeper wall affords certain unusual delights, such as watching the huge lilac flowers gently helicopter down 30 storeys to land in the pool.



Figure 25. Newton Suites: Green textures and surfaces extend along the building. © Patrick Bingham-Hall



Figure 26. Newton Suites: Green wall looking up © Patrick Bingham-Hall

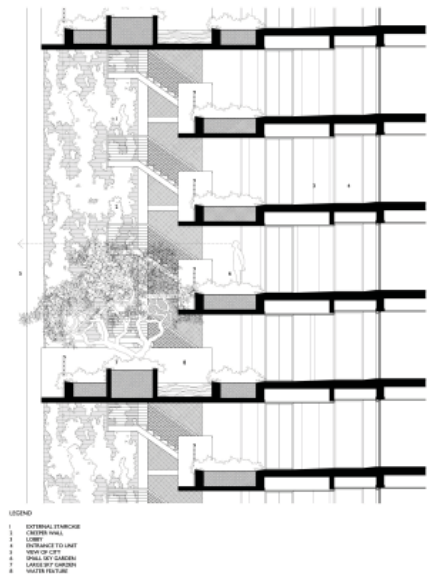


Figure 27. Newton Suites: Section of Skygarden © WOHA

The cantilevered sky gardens are common spaces that project off the lift lobbies every 4 storeys. All the lift lobbies are naturally ventilated spaces that overlook these gardens. The gardens incorporate fountains, trees and planting, together with a small bench for sitting. As a trade-off on cost, WOHA convinced the developer that fewer lifts would be tolerable, as waiting time perception is not absolute, but depends instead on the interest of the surroundings. As every lobby overlooks the garden and view, the increase of 20 seconds in waiting time passes without comment (see Figure 27).

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

The Pano, in Bangkok, was conceived of as an inhabited landscape. Due to Bangkok's problems with flooding, basements are avoided. For large buildings, enormous 10-12 storey car parks filling the site are necessary, which have a massive, negative urban presence. To turn this lump of concrete into a



Figure 28. The Pano: Long Section © WOHA

delightful environment, voids were carved out of the podium structure and presented as an abstract landscape of gulleys, waterfalls, cliffs and ravines. Podium housing was developed as "Cliff Housing" while the tower housing is expressed as a crystalline structure emerging out of a stony peak. Planters were incorporated throughout to drape the landscape in a lush tropical forest (see Figure 28).

For a new hotel in Singapore's Central Business District (see Figures 29+30), WOHA takes the landscape analogy even further. Sited along the entire length of Hong Lim Park, on a narrow linear site, the concept is that the park is draped up the entire façade of the building. The podium is developed as a floating rock formation, with the public areas below and the leisure deck above. The room corridors are



Figure 29. Upper Pickering Street Hotel: Hanging Gardens © WOHA



Figure 30. Upper Pickering Street Hotel: External View © WOHA

open air, draped in foliage, while the rooms overlook hanging gardens of jungle vegetation. Together these elements create a Green Plot Ratio of 206%.

Impact

WOHA's passive strategies for tropical tall buildings are at an exploratory phase. Each project is the testing bed for one or more ideas about how we can live more sustainably in future, but always framed in the context of architecture providing daily delight to the end-user.

Singapore's regulatory authorities have been a vital partner in this exploration, and WOHA have been an active partner in exploring the potential of incentives and feeding back on regulations. But are these innovations of global interest, or are they specific to Singapore and not portable to other places?

Singapore is a closely observed model for much of Asia, and innovations in Singapore tend to spread through Malaysia, Thailand, Indonesia, India, Vietnam and China due to its 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 not just the impact on the small city of 4 million inhabitants, but on the half of the world's population who surround it. Additionally, much of the developing world is located around the equatorial belt, and 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. These projects show how approaching these problems from different viewpoints open up fertile areas for further research and innovation. ■