



2013 On Site Review Report

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The Met Tower

Bangkok, Thailand



Architect
WOHA Architects

Client
Pebble Bay Thailand Company

Design
2004 - 2005

Completed
2009

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I. Introduction

The Met is a 66-storey residential high-rise in Bangkok. Located on South Sathorn Road in central Bangkok, the building is a welcome addition to the skyline of the city. It has already taken its place as a distinct trendsetter in the high-rise residential development of Thailand and in South East Asia as a whole.

The project tries to address the issue of high-rise, high-density living in the tropics, and does so successfully.

Most tropical high-rise housing in developing countries replicates cold-climate models with sealed facades and relies heavily on air conditioning. However, in the tropics, light winds, year-round balmy weather, constant temperatures and high humidity make outdoor living desirable. The high density of the site with a plot ratio of 10 to 1 provided the architects with an opportunity to devise a model of a green tower that was naturally ventilated and had a strong indoor-outdoor relationship. This model was a necessary alternative to the sealed, glazed curtain-wall buildings being erected across the tropical regions.

The apartments in the Met are in effect houses in the sky with breezeways, full exposure to light and views, outdoor living areas, planters and high-rise gardens, and open-air communal terraces with barbeques, libraries, spas and other facilities. Sky terraces, both private and public, link the blocks every six storeys, creating dramatic yet human-scaled external spaces. The building is planted on every horizontal surface including private balconies. Water pools are inserted along with gardens on the linked floors. Vertical faces are shaded by creeper screens. All apartments are cross-ventilated, and all face both north and south. The staggered block arrangement gives the apartments light and air on all four sides. An important aspect of this building is that the design makes it possible for its residents to live without air conditioning.

Thai elements – ceramic tiles, textiles and timber panelling – are abstracted to organise forms. The cladding on the east and west facades reinterprets Thai temple tiles, and the staggered balconies recall traditional timber panelling on Thai houses. The east and west walls incorporate random mirrored stainless-steel pleated panels, a contemporary interpretation of the sparkling mirrors of Thai temples.

High-rise requires large structures. Rather than intruding into the interior, the columns extend on the exterior of the building, creating protected indoor-outdoor spaces for balconies and terraces, and allowing apartment layouts to be standardised, even at lower levels. These exposed buttress columns are lit at night, transforming the building into an elegant, vertical screen.

The orderly, slender building is very befitting to its context. With its openings to the sky, planted facades, balconies and sky gardens, the Met successfully weaves nature into highly dense urban Bangkok.

II. Contextual Information

A. *Brief historical background*

Thailand's history goes back more than 40,000 years. Thailand was heavily influenced by the culture and religions of India. The first Thai state is considered to be the Buddhist Kingdom of Sukhothai that was founded in 13th century. A century later, the power of Sukhothai was overshadowed by the new Kingdom of Ayutthaya in the mid-14th century in the lower Chao Phraya River area. Thailand retained a tradition of trade with its neighbouring states, from China to India, Persia, the Arab lands and Europe. Ayutthaya became one of the most vibrant trading centres in Asia. The fame of this city grew and its golden spires became renowned throughout the world.

After the fall of Ayutthaya in 1767 to the Burmese, Thailand moved the capital to Thonburi for approximately 15 years. The current Rattanakosin era of Thai history began in 1782, following the establishment of Bangkok as a capital.

Despite European pressure, Thailand is the only Southeast Asian nation that has never been colonised. It is one of the reasons that Bangkok, the capital city and main port of Thailand, is a major economic and growing financial centre in South-East Asia. Bangkok has a population of over 8 million people within its administrative metropolis of 1,568.737 square kilometres.

The site for the residential high-rise – the Met – located in the central part of Bangkok, used to be the recreational grounds for the US embassy. It was tendered for sale in 2003 when the decision was made to shift all the functions of the US embassy office along Wireless Road in Bangkok. The developer who purchased the site decided to develop it as residential and commercial properties.

B. *Local architectural character, including prevalent forms and materials*

Bangkok is rapidly modernising and has one of the fastest rates in the world for erecting high-rise buildings, many of which replicate temperate models of sealed, glazed curtain-wall towers with little or no differentiation between commercial or residential typologies. These overshadow and dwarf the city's ornate temples and traditional wooden houses. The main structure of traditional temples is made from handmade bricks with a roof structure made from wood with multiple roof tiers. The timber houses are elevated off the ground to enhance ventilation and escape flooding. But these buildings are fast disappearing because of the increase in city population, hence the demand for taller buildings. The city is also inundated with three to five-storey post-industrial shop houses. The tall buildings in the surrounding area of the Met have mostly glazed exteriors with no shading devices that are much needed for cooling indoors and reducing the load on air conditioning. Almost none of these high-rise buildings are designed for natural ventilation.

C. *Climatic conditions*

Bangkok is situated on the low flat plain of Chao Phraya River which extends to the Gulf of Thailand. Geographically located 13°45'N (latitude) and 100° 28'E (longitude), the city's climate is hot and humid with temperatures ranging from 26°C to 31°C (78°F – 90°F). The year is distinguished by three main seasons, with the cool season occurring from November to February, the hot season from April to May, and the rainy season from June to October. In this environment, being high up where there is more privacy, better views, lower humidity, stronger breezes, better security, fewer insects, less noise and less dust make external high-rise spaces pleasant, comfortable and desirable. The typically overcast sky also means diffused lighting and many hours of sunlight that generally reaches into buildings at a height-to-depth ratio of 1:2, which needs to be countered with sufficient shading. All these factors contribute to the WOHA architects' exploration of alternative tall building prototypes.

D. *Site and surroundings*

The site is located along a main arterial road that passes through the Sathorn district of central Bangkok. Sathorn Road is lined with skyscrapers, corporate offices, condominiums and embassies. Holding the highest record for vehicular ownership in Asia, Bangkok is one of the most congested cities in the world, with traffic deadlocks and high levels of vehicular exhaust emissions resulting in severe air pollution. Conveniently situated between two train stations, the Met permits a higher use of the existing public transport infrastructure, offering a practical way of dealing with Bangkok's urban sprawl and traffic jams.

There are no parks or greenery around the site, except for some trees on privately owned sites along the road. Site planning of the Met took into consideration the maximisation of the Sathorn address, setting the tower back from the street to achieve maximum building height and quieter surroundings, conserving as many existing mature trees as possible, and maximising the views to the north and south.

E. *Topography*

The topography of the site is generally flat with soil conditions typical of those throughout Bangkok.

III. Programme

A. *History of the inception of the project*

WOHA's ideologies for high-rise, high-density tropical living were first encapsulated in the firm's entry for the Duxton Plain Public Housing International Architectural Design Competition (Singapore) in 2001. Their scheme was awarded a Merit prize, and was listed as one of two runners-up. The innovative ideas presented in the submission caught the attention of industry partners, including HPL, who eventually invited WOHA to participate in a limited competition for the Met.

The developer, HPL, wanted an energy-efficient and innovative design that would have a special place in the city's architecture. The whole site was to be developed for a residential tower and an office/commercial building. The eastern part was kept for the office building and the rectangular western part was designated for the residential building.

The architects' entry for the Duxton Plain competition was an investigative study into high-rise, high-density housing typology, which could be applied equally to public housing as well as high-end private apartments. Many of the ideas in Duxton Plain were transposed, developed and rigorously tested in this project. The original scheme involved a stepped design profile, which had to be altered due to the local rules regarding building setbacks. Although the massing was subsequently changed, the idea of the staggered plan of the towers, allowing wind and ventilation at all levels, remained uncompromised.

B. *How were the architects and specialists chosen?*

WOHA was one of seven international architectural firms from the US, UK, Australia, Thailand and Singapore that the developer HPL invited to participate in a limited competition for the Met. WOHA stood out amongst these primarily due to the vision offered for sustainable living presented in the form of an appropriately perforated, porous tropical solution.

All other consultants were selected by the architects.

C. *General programme objectives*

The Western model of tall buildings had its origins in cities usually with cold climates, where modern towers were constructed as mostly compact towers with maximised volume-to-surface area ratios and wrapped in glass skins. Such sealed tower typologies result in a strong separation of indoor and outdoor spaces, with interiors that are kept cool mechanically. By replicating these glossy temperate climate models in Thailand and other cities of Asia, many private-sector apartment developers have traded the sensible low-technology solutions for curtain walled apartments that required air conditioning and mechanical ventilation to achieve comfort. Such apartments have become the standard model for public and lower end housing, resulting in a loss of climate-conscious designs across the region.

WOHA rejected this model, and wanted instead to transform and adapt vernacular and passive responses to climate into the high-rise forms. Their objective for the Met was to design a building that respects the tropical setting. Hence the Met was designed and built with contemporary technologies with the aim of creating comfort without – or with minimum – need for mechanical systems. This also met the client's goals.

In designing the Met, WOHA set out to rethink the model of the tropical high-rise apartment, or more specifically, to arrive at a model that would achieve high amenity through designing indoor-outdoor private and social spaces at multiple levels throughout the tower. The idea of traditional timber huts was transferred into contemporary houses in the sky. WOHA took the "split-apart" tower typology used in Singapore's public housing, which was naturally ventilated, and added layers of

special architectural features to the model. The idea was to utilise the space between the buildings, and to maximise its potential for architectural and lifestyle innovations. The objective was for the entire megastructure – the massing and the residual space – to be calibrated as a wind machine, a provider of shade, and as a social organism.

D. *Functional requirements*

Upon discussion between the client and the architects, the programme was set for the building. It was to be a tall building of about 350 apartments, should have adequate parking spaces as required by the code, common meeting areas, a swimming pool, gym, community hall, children's play area, tennis courts and a garden.

IV. Description

The Met is comprised of 370 apartment units of two, three, and four bedrooms and penthouse-type layouts in three main towers or six interconnected smaller towers arranged in a staggered block configuration atop a nine-storey car parking podium. Common areas are spread throughout the towers, offering inhabitants a variety of experiences, from the recreational courts and intricately designed carpet of water, stone and vegetation at ground level, to the extensive indoor-outdoor facilities at the podium roof pool level, to a library, barbeques, and function areas on communal sky terraces that share the spectacular views from the highest floors. The staggered configuration of the plans coupled with the separation of three towers by air wells provides ample natural ventilation and daylight indoors. The look from the outside is very tropical, with its horizontal and vertical greens, balconies and shaded openings.

The apartments in the Met are designed to break free spatially, extending horizontally out to a private terrace and a void in the double-storey apartments. The set up is very similar to a typical house on the ground, where residents can walk out from their living room to the swimming pool and garden. The idea of community spaces was also borrowed from the typology of Bangkok's bungalows, most of which have a semi-public living room and a private living room. Community sky terraces were introduced on the 28th and 47th floor, serving as an extra living room that residents could use to entertain friends and guests. These, along with shared facilities such as meeting rooms, a big community swimming pool and a library on the ninth floor, add an extra layer of semi-public space to the project as a whole.

The apartments have windows on all four sides. The kitchen has a wet kitchen as necessitated by tropical cooking. The dry kitchen can be walled off if needed by the resident. The elevators open on each apartment, hence giving privacy to the residents.

The structure is of reinforced-concrete frame. The structural module is of 9 metres, which works well with internal space requirements as well as car parking. The 4.5-metre module again provides ample space for bedrooms. The floor finishes of the reinforced-concrete precast slabs in the apartments are local marble with broom finish and wood. The columns and the fins extend outwards to provide shade and sound insulation.

The architect tried to relate the building to the city and its local context. The Met's design is inspired by elements of Thailand's traditional buildings and temples, where the walls and roofs are very textured, with inlaid mirrors that glitter in the afternoon sun. Thai forms such as ceramic tiles, textiles and timber panelling are abstracted and used as a way to organise forms. The cladding in the west and east walls of the towers borrows inspiration from temple tiles, while the staggered arrangement of the balconies recalls the Thai teak staggered panelling on traditional house. The walls feature random inserts of faceted polished stainless steel that sparkle when sun falls on them, a contemporary interpretation of the sparkling mirrors of the Thai temples.

A. *Building data*

Building type:	condominium
Site area:	11,360.50 m ²
Gross floor area:	124,884.73 m ²
Building height:	• 230.56 m (from ground floor datum to refuge plate form level) • 66 habitable floors (of apartments) + 3 floors of M&E services such as elevator motor rooms, water tanks and so on
Ground footprint:	4,631,023 m ²
Net floor area:	112,833.523 m ²
Apartment unit details:	total 370 units, with: • 2 types of 2-bedroom unit (about 90 m²) • 2 types of 3-bedroom unit (about 190 m²) • 1 type of 4-bedroom unit (about 365 m²) • 1 type of penthouse unit (about 545 m²) 3- and 4-bedroom units have option of additional private pool/garden (about 40 m²) Ceiling height: 2.93 m
Other facilities:	ground floor: • reception area, meditation rooms, car park, children's playground, 2 tennis courts and mail rooms. 9th floor: • BBQ areas, aerobics room, games room, gym, pocket gardens, 50-metre swimming pool, children's pool, jacuzzi, pool deck, outdoor showers, male and female changing rooms, steam and sauna rooms, hot/cold pools (in changing room)

28th and 47th floors:

- terraces with sky gardens, BBQ areas, gym rooms, children's playroom, function rooms, library

B. *Evolution of design concepts*

Along with working on structural and formal aspects, the architects clearly identified the problem of natural ventilation and solar control as some of the primary aspects of environmental design. They sought solutions from the traditional Thai buildings as well as their previously designed buildings.

The Met is influenced by many of the naturally ventilated buildings designed by the architects. Duxton Plain Public Housing in Singapore inspired them with its thematic idea of dense housing and human comfort. Sky gardens, sky paths, vertical green, porosity and so on were tried out in the public housing project. Moulmein Rise, a single-apartment-depth skyscraper in Singapore also had given them experience in designing high-rise with superb natural ventilation. Another project, Newton Suites in the same city, had profuse greenery on the vertical as well as horizontal sky terraces throughout the height of the building, and also had good provision for natural ventilation. High-rise buildings have become inevitable in Bangkok and so the architects wanted to create comfortable "houses in the sky".

In the Met, the nine-metre column bay worked well with the arrangement of the apartments and car parking requirements. The whole skyscraper was divided into three individual towers linked by sky gardens and breezeways. After trying a few arrangements of the apartments, the staggered arrangement of the apartments was decided upon so that all sides of the apartments would get light and air.

1. *Response to physical constraints*

This project did not have significant physical constraints, however, the intensity of land use allocated to the site resulted in an extremely high-density tower with a plot ratio of 10:1. As the tower scale and the human scale are vastly different, the challenge of residential high-rise for the architects was to emphasise the individual in terms of human scale, choice and comfort, opening up to the climate, providing community spaces and relationship to nature. In designing the Met, WOHA introduced strategic horizons every 20 storeys, giving all residents access to high-level views and open-air communal terraces, as well as private terraces every six storeys, effectively creating miniature garden houses, each with its own little plot in the air throughout the height of the tower. These tower divisions help to create more stable proportions, which evoke a feeling of comfort, rather than dynamism, while landscaping devices serve to give visual cues to scale.

2. *Response to user requirements*

The client's request was to consider modern-day living in Bangkok and provide comfortable and contemporary spaces. The apartments were to be energy efficient and green, as much as possible. The apartment building should comply with all safety, security and fire codes. It should also have all amenities required for a modern day high-rise residence, along with a fair amount of community spaces.

In response, the architects approached the design of the Met by addressing how people could live well and sustainably in a Bangkok high-rise. In the tropics, light winds, constant temperatures and high humidity make outdoor living desirable. In addition, the environmental conditions up high in dense cities are preferable to those near the ground – there is more privacy, better views, lower humidity, stronger breezes, better security, less noise and less dust.

To make the most of these opportunities, the architects adopted ideas that were successfully implemented in low-rise tropical houses and resorts, and applied those in an innovative way to the high-rise design. The high-rise was treated as a residential compound of stacked up traditional houses. The architects made high-rise apartment living without air conditioning possible for most of the year by creating cross-ventilated tropical apartments in the sky. The Met has breezeways, full exposure to light and views, outdoor living areas, planters, high-rise gardens and open-air communal terraces. These sky terraces, both private and public, link the blocks every six storeys, creating dramatic yet human-scaled external spaces in the sky. Community sky terraces were again introduced on the 28th and 47th floors.

These horizontal connections were also deemed necessary for added level of safety in terms of fire escape. This is particularly pertinent in Bangkok as the bad traffic jams mean that fire engines cannot reach any emergency within a short period of time. The idea of interconnection between the single towers is therefore actually very important as it enables residents to run out of one tower and into the exit staircase of another.

3. *Purely formal aspects*

The form is slender and it has an open-to-surroundings look to it, which makes it very tropical, and thus Thai. It is a welcome addition to the Bangkok skyline. The Met includes six separate smaller or three larger towers of stacked apartments, staggered in plan, and linked by a series of sky bridges every six storeys. The configuration is simple and the towers are allowed to breathe by “pulling apart” the core, in order to establish a one-apartment-thick solution. The apartments in the Met are naturally ventilated, with access to light and air on all four sides because the tower effectively has no circulation core, in the traditional sense.

The staggered plan is expressed outside which makes a rhythm on the facade. The vertical lines of the extended columns help show the honesty in expressing the structure. The verticality of the lines exaggerates the height of the building and is somewhat Gothic in essence. The proportions are of human scale especially with the trees throughout the building. The west and east facades are made of painted aluminium panels with stainless-steel pleated inserts. These pleated panels brightly reflect the sun, and were inspired by the mirrors of the facades of Thai temples. The patterns of the aluminium panels were derived from patterns of Thai textiles and screens.

As a whole, the look is very tropical, with greenery throughout the height of the building and its openness.

The core of the Met is essentially an empty space, made up of a series of vast vertical voids that occupy the full height of the building. This perforated, porous alternative transforms the spaces in

between the staggered towers into breezeways, where wind swirls through the structure, ventilation is constant, and each of the blocks is shaded by the other. The design encourages and makes possible living without air conditioning. Simply by repositioning the elements, WOHA successfully manipulated the passive performance of the building and introduced innovation through a fully integrated structural, sculptural solution.

4. *Landscaping*

The Met contributes to the urban environment with its planted facades, balconies and sky gardens, bringing cool, dark, natural relief to the built-up urban Bangkok. The building is planted on every horizontal surface, including private balconies that have planters with full-sized Frangipani trees, creating almost 130% landscape ratio. The building is horizontally shaded by overhang ledges and perforated metal screens that protect all external walls from heat from sunshine on one hand, and vertically shaded by creeper screens at the east and west walls. The vertical green is planted in the car parking. The big trees in the forecourt are local Ficus and Bodhi trees. Hopea and Ashoka trees are used around the boundaries. On the pool decks and sky terraces a mix of Hopea and Pandanus are used. The creepers are mostly Thunbergia Grandiflora. All of the trees and plants are native and locally sourced. The sky-rise greenery cools the building through transpiration and shading, and improves air quality through photosynthesis, thereby reducing the urban heat island effect of built up metropolitan Bangkok. Water gardens are also used at ground level and recreational floors to provide evaporative cooling and store rainwater.

C. *Structure, materials and technology*

The design decisions for the Met, a 230-metre-tall residential skyscraper, were influenced by key considerations for construction efficiency, maintainability and sustainability. Structural engineering is fully integrated with architectural design. The Met is configured based on a very systematic and regular structure. Perimeter columns for the three towers are conventional reinforced concrete and set out on a 4.5-metre grid, making up 9-metre-wide modules that work well with all the various functions – apartments, recreational facilities and car parking. As columns increase in size as the loads accrue, the columns extend on the exterior of the building, creating protected indoor-outdoor spaces for balconies and terraces, and allowing apartment layouts to be standardised, even at lower levels. These exposed buttress columns are both structurally rigorous as well as an architectural expression. All the columns being on the exterior periphery and no columns placed inside make it a tube-like structure.

The Met's superstructure was erected using conventional post and beam reinforced-concrete construction. Slip form was adopted for the three towers, which enabled simultaneous construction from bottom up. This method achieved an approximate seven-day construction cycle per floor across the three towers. To further improve efficiency, precast elements were used for all floor slabs and planters, including those within the podium level car park. Conscious effort was also taken to reduce construction risk at high level by minimising the need for tall scaffolding. Accordingly, the sky connections between towers that contain pool or garden terraces were planned at no more than six-storey height intervals.

The slender profile of the towers resulted in a height-to-width ratio in the order of eight in the north-south direction. This required the full width of the building be utilised to resist lateral forces due to wind and seismic effects. Wind tunnel tests were carried out to ensure safety and comfort on the sky terraces.

The three towers are also structurally tied together at sky deck and sky garden levels every sixth floor in areas used for private gardens, private pools and common areas.

The envelope of the Met is characterised by modular aluminium-framed glazing systems and aluminium cladding. Aluminium cladding was specified for its robustness and buildability advantages in factory-controlled fabrication, quick installation and easy replacement for future maintenance. Expanded metal mesh was selected for the sun-shading canopies of the units and the green creeper walls of the car park due to its resultant zero material wastage and cost efficiency over perforated metal. For floors, local granite stones were sourced. Another local material was featured for the first time in Bangkok in the Met: brush-finished marble, which gives an antiquated look, was also used for flooring.

D. *Origins of technology, materials, labour force, professionals*

Wherever possible, local technology, materials and products were specified. This included locally sourced granite, marble, sanitary fittings, aluminium cladding systems and so on. The design consultant team largely comprised of representatives from the architects' Singapore office. Other consultants were mostly from international firms with local offices in Bangkok. Established in Thailand for over 20 years, Bouygues Thai Ltd (main contractor) helmed the construction of the Met with a cosmopolitan project management team and a predominantly Thai labour force.

V. Construction Schedule and Costs

A. *History of project design and implementation*

Project dates:	design inception:	March 2004
	start of construction:	August 2005
	date of temporary occupation permit:	19 December 2008
	completed:	December 2009

B. *Total costs and main sources of financing*

Project cost:	132,000,000 USD
Funding:	Developer funding and bank loans

C. *Comparative costs*

According to estimation by the developer, for Grade A condominiums, the comparative cost per square metre is between 85,000 to 100,000 THB (3,400 to 4,000 USD). Exact figures could not be obtained

D. *Qualitative analysis of cost*

The average cost per square metre is approximately 108,000 THB (4,320 USD).

E. *Maintenance costs*

Maintenance cost per month is approximately 4 million THB (160,000 USD). This is figure based on the property management's report.

F. *Ongoing costs and 'life performance' of building*

Technologically, a well-constructed reinforced-concrete structure that is protected from direct exposure to the external elements, as is the case of the Met, has a life span of about 100 years. Architecturally, external finishes (for example, curtain walls and cladding) can be expected to have a replacement cycle of 30–50 years.

VI. *Technical Assessment*

A. *Functional assessment*

The Met successfully fulfils the requirements set by the client. In addition, it enriches the functional spaces with a special provision – natural ventilation. The internal planning of the spaces in the apartment is straightforward and well organised with efficient circulation. The fact that each apartment is accessible directly by elevator gives added security and privacy to the residents. Access to community spaces on the 9th, 24th and 47th floors is easy. The swimming pool, gyms, tennis courts and children's play areas are well organised and inviting. The ground-floor design is well proportioned, contemporary and the circulation of vehicles and people is well defined. The sky gardens and terraces make the building look, as well as perform, as a tropical high-rise.

B. *Climatic performance*

The building takes into consideration the climate of the city very well. The apartments are well ventilated and can be used without air conditioning during most of the year. The presence of the tall vertical air wells and breezeways brings ample breeze inside. The presence of water at various levels also keeps the micro-climate cool. The apartments being open on four sides makes the interiors adequately day-lit. The natural ventilation keeps the indoors cool. All the windows are shaded, thus there is minimal heat gain by direct radiation. In the hotter seasons, the sun is higher up in the sky and the shading devices keep the sunrays from entering. In winter, some direct sunlight comes in,

which is welcome. The use of vegetation on horizontal and vertical surfaces helps keep the interior much cooler than a building without the vegetal surfaces. The aluminium cladding on the east and west facades also helps in providing insulation from the heat. In a nutshell, the climatic performance of the building is excellent, and in this respect the Met is termed a trendsetter.

C. *Response to water and rainfall*

The use of water bodies is very pleasant, cooling the air by evaporative cooling. The building has well shaded openings and thus rain does not come inside the rooms. The ground of the site is well designed with slopes for good storm-water drainage.

D. *Environmental response*

The site had a number of trees, and very few were cut for the construction of the building. The building replaces 130% of the amount of green its footprint had removed. The vertical and horizontal greening keeps the microclimate of the area cool. The ground area of the site has been planted with many more trees than it had originally. Hence it can be concluded that the environmental response is very positive in this case.

E. *Choice of materials, level of technology*

The reinforced-concrete structural system is very common in Bangkok area high-rises and the architects' decision was to use the same system. The construction stage was well scheduled and followed for maximum efficiency. The bridge between the towers was a challenging introduction to the high-rise technology of the city. Materials for structure and envelope were obtained locally.

F. *Response to emergency situations*

The building followed all the city codes regarding fire safety. There are two staircases to each core. As the towers are joined at 9th, 28th and 47th floors, there are alternative exit routes. There are separate fire stairs from the parking lot. Sprinklers and smoke detectors are installed in every apartment, and fire hoses in the elevator foyers.

The structure design has thoroughly taken into consideration the codes related to seismic design and it has met the zone 2A earthquake protection designs for Bangkok.

The building is raised from the grounds by one metre for flood protection. The apartments start from the 10th floor, so residents are safe in case of a flood.

G. *Ageing and maintenance problems*

The building has been in operation since December 2009 and there has not been any major repair. The maintenance is excellent and the building retains its original look. The aluminium facades are as good as new. The trees and creepers are growing as intended, and the building will have a much

greener look in a few years. The trees and plants get the regular care they need. The reinforced-concrete members have weathered well.

H. *Design features*

The massing is slender and very well proportioned. When completed, the 66-storey building was the tallest residential structure in Bangkok. Because of the height, the architects felt that it was necessary to express the structure. The three towers express themselves separately, and the connections or the sky-bridges connect the towers well. The tripartite division of the building is expressed subtly in the facade. The podium of nine storeys of car park covered with green creepers is the first stage, the second stage is of apartments with green terraces, and the top stage is apartments with balconies where residents have an option to put potted plants and some have done so. The staggered floor level in the front facade creates a rhythm that the architects relate with the patterns of Thai textile work. The east and west facades of each tower have cladding of aluminium panels of varying colours in a pattern seen in Thai textiles and wood panels in Thai houses. The stainless-steel pleated inserts in these facades reflect the sun brightly like a mirror and abstractly resemble the mirrors inserted in the ornamentation of Thai temple facades.

The spaces are well articulated in the apartments, as revealed by the residents. The communal spaces can be reached by the residents easily and are very well designed, interweaved with sky gardens and water bodies.

Site planning is excellent because of the fact that the design takes into consideration of orienting the apartments in the north–south direction for bringing in breeze. There are two gardens with profuse greenery, a large one in the front and a smaller one in the back of the building.

I. *Impact of project on the site*

The building is accessed by the major road and inside the site there is minimum black-top surface. Circulation of vehicles and pedestrians is well defined. Access to cars and parking is well designed. Infrastructure of the surroundings has improved because of the presence of the building. The city corporation redid the sidewalks along the site soon after the completion of the project. This prestigious development has added value to the residential market of the area.

J. *Durability and long-term viability of the project*

The building is a welcome intrusion in the central city, and seems like it is here to stay. It has already made an impact on the profession and teaching of architecture in the country. There has been meaningful inspiration obtained from the project and, again, many elements of the building have been copied by architects in the country. This building is a trendsetter and fits very well in its context.

K. *Interior design and furnishing*

The interior materials selected by the architects are all local. The floor finishes are marble with brush finish, and wood, all of which are local materials. The interiors of the apartments are contemporary and have a simple, rectilinear look. The swimming pool and other water body linings are of small coloured ceramic tiles, mostly blue, giving the water a more refreshing look. The ground-floor reception area and foyer lobby has composition of lines and planes – made of wood, exposed concrete and marble. From anywhere in the interior of this ground floor, the green gardens of the front or back are viewable.

VII. *Users*

A. *Descriptions of those who use or benefit from the project*

The residents are the primary users of the Met on a daily basis. Some of the residents own the apartments and some are renting. The residents are mostly Thai and there are some foreigners residing in the building. The residents' comments about the building were positive and full of praise. There is a sizeable staff running the everyday management of the building, and as discussions with the reviewer reveal, they like working in the building.

B. *Response to project by clients, users, community, etc.*

Contractor

Jean-Marie Verbrugghe: "This is a special gift to Bangkok by WOHA. The structure and architecture are interwoven very nicely. Three interconnected towers with their bridges, water and gardens – a unique example. I've built so many buildings in Bangkok but this was a contrast, and a positive one. It was to be finished in 30 months but took 36 months. The construction was done for maximum efficiency. To minimise cracks, the floors, each weighing six tonnes, were precast and raised by cranes. Bridges and the transfer girders on the ninth floor were cast in situ. We had a reservoir of skilled workers. There was good synergy between WOHA, us and other engineers; it was good teamwork. The architects regularly visited the project and had a small branch office in Bangkok. The citizens of Bangkok are used to high-rise living and the Met will contribute positively towards it."

Developer

Ray Yow: "We invited seven firms to compete and gave them the brief which stated that the building has to fit in the tropics, has to be a practical solution, and has to give something new to Bangkok. WOHA's design was most suitable and now it has become an iconic structure. This is our first building in Bangkok and we are very proud of it. It has added new aspects and many good qualities to the high-rise development in Bangkok. The facade looked darker in the beginning because of lots of shading devices, but now with trees and creepers growing it looks green and lively. All construction followed regulations defined by the code. The Environmental Impact Assessment (EIA) team worked on how to control debris, dust, noise and so on before and during construction. The

quality of construction was very good. The contractor was always well prepared. We had a very good professional relationship with the architects.”

Resident, Owner, 46th floor

Edward Walter Cislo: “I came here shortly after it opened and I wouldn’t live anywhere else. Architecturally, all facilities are perfect. Elevators bring me directly to my apartment. The swimming pool is very nice, I swim every morning. I can hear the birds, see green and have a view of the river in the distance. We have a nice breeze throughout the apartment and rarely use air conditioning, except in very hot summer days. Finish materials and appliances are very good. This building stands out as an excellent tropical building in the city.”

Resident, 29th floor

Ferdinand Oswald: “Today it is 40°C outdoors but I did not have the need to turn on the air conditioning. It was breezy inside and it felt comfortable enough. Greenery and water have both physical as well as psychological cooling effects.”

Resident, Owner, 60th and 61st floor duplex

Pisit Preugpaibul: “The location is very convenient in the city. It is very comfortable inside. Not much need for air conditioning. Daytime is fine with natural ventilation. Sometimes when it is very hot, I turn the air conditioning on during night. It’s very breezy most of the time. I use the gym regularly, which has an adequate amount of equipment. I walk around the building on the ground floor. The community spaces, gym and elevators are good spaces for meeting people. The night-time view is very nice. I now own nine apartments in this building. Among all my residential real-estate properties, this is the best.”

Resident: 62nd floor

Kun Jones: “The apartment is very comfortable without air conditioning. But recently I bought a cat and I have to keep the windows closed for him and hence turn on the air conditioning. I cook and like the kitchen design a lot, and the fact that it has a wet kitchen for Asian cooking. Views are spectacular. There is privacy in this apartment, with private elevators. The swimming pool and other community spaces are very functional.”

Resident: 62nd floor

Ms Sylvie: “I am the grandmother of Kun. I live with him and I love living in this apartment. I like the fact that it is so comfortable with natural ventilation. There is fresh air everywhere. I love to cook and the two kitchens help prepare different types of cooking. The privacy and security of the elevators is appreciable.”

Resident: 62nd floor

Mr Pathompong: “It is a housing facility, like a house with all other amenities – gym, swimming pool and everything is very accessible. I term the private lift as functional luxury. We use the swimming pool area and the common room on the 47th floor for our New Year’s party.”

1. *What do architectural professionals and the cultural “intelligentsia” think about the project?*

Architectural critic and professor

Tokyo Institute of Technology, Japan: Erwin Viray: “The Met is a ground-breaking architecture. It has superb proportions, has natural ventilation, it brings gardens close to people, even in the sky. The WOHA has shown a special way of working in the case of skyscrapers in Bangkok. Bangkok has all fully air-conditioned skyscrapers, with full glass facade and, sometimes, Corinthian columns which are very non-Thai. This one is different, in concept as well as its proportions. It has privacy in the apartments and also has public-ness – in the community spaces that opens potential for community development. I can compare Met with the scale and imagery of the buildings of Sumet Jumsai, the famous Thai architect. It has a beautiful presence in the skyline of Bangkok. From far away, it stands out as a beautiful addition to the skyline. It has an abstract relationship with Thai temples. Facades of patterned panels recall Thai art.”

Architectural critic and photographer

Patrick Bingham-Hall: “The new thing about Met is the structural principles, natural ventilation and the simple bold expression. This is not like the usual Bangkok towers with all-glass exteriors. In Bangkok, in my opinion, city planning and architecture are not so noteworthy. We see here copies of American models – air-conditioned reflective-glass high-rises. WOHA is returning to the basics like what Le Corbusier and Louis Kahn did in the tropics – architecture of structural expression, of natural ventilation. The important aspect here is that it is a structural prototype. The Met is elemental architecture, serene architecture. It used to be context-sensitive architecture that prevailed in the world, even 20–30 years ago. But in the last 30 years it has been new glass architecture, even in the hot climates of Bangkok and the Middle East. WOHA is now dealing with tropical Asia. This building fits the context very well. The connection to Thai temple ornamentations, textile and wood panelling is nice, and WOHA always brings in this type of relationship to the place in their buildings. WOHA’s work is fascinating at this moment – always uncompromising in the sense that not just how the building looks but what new contribution it can make. The Met has contributed greatly to 21st-century architecture and has brought in new input, new ideas. The architects’ theory is elemental, uncluttered and clear.”

Architect, teacher

Graz University of Technology, Austria: Ferdinand Oswald: “I am researching this building for my PhD work. The Met has introduced a new typology. The facade is clear in terms of material and structural system. The porosity of the structure helps in cooling the building. Concept, building structure, plan and facade are synchronised.”

Architect

Punpong Wiwatkul: “I was a project team member. Now I have my own firm in Bangkok. I worked on this project for five years, from competition to project completion. We did 400 variations of the plan for the developer. We had site meetings every week. There was good teamwork between all parties involved. There were no major problems during construction, only minor, such as the selection of wire mesh or galvanised steel for the creepers on the parking lot wall. The Met is definitely a nice addition and enrichment to my portfolio. I have talked to many developers in Bangkok and they all like the building. It has won many awards and professionals here are talking about it. Many have already copied some elements of this design, such as the creeper wall and sky garden.”

Architect and owner of apartment

Puiphai Khunawat: “I worked on the project for many years, now I have my own firm in Bangkok. This project shows how a new idea can be carried through all the way. The main aspects are that it is tropical, it has natural ventilation and has good views. The floor material is very good – brush-finished marble, obtained from a small quarry in Thailand. This is a natural material showing its natural grain, and gives a very nice textural effect. The schools in Thailand are showing this example as a good tropical solution. Students are coming for study tours of this building.”

2. *What is the popular reaction to the project?*

The Met has already stirred interest among the people of Bangkok. Local and international journals and papers have written about it. Students of architecture are visiting the building to study it. Various aspects of it have been class projects of architecture schools. A new PhD topic conducted by Graz University in Austria has the Met as the case study. Both local and foreign architects are visiting the building with great interest. And, as mentioned earlier, various elements of the building are being copied in the designs of many architects.

3. *What do neighbours and those in the immediate vicinity think about the project?*

During the site visits, one day of which fell on the weekend, there were quite a few visitors from the neighbourhood. The neighbours like the building with its new look and its greenery. They had expressed that the Met has added value to the neighbourhood in terms of architecture and also in terms of property values.

VIII. Persons Involved

Architect:

WOHA

Project team:

Wong Mun Summ

Richard Hassell

Sim Choon Heok

Punpong Wiwatkul

	Puiphai Khunawat
	Alina Yeo
	Techit Romraruk
	Jose Nixon Sicat
	Cheah Boon Kwan
	Carina Tang
	Gerry Richardson
	Janita Han
Architects in association:	Tandem Architects 2001 Co., Ltd
Structural engineer:	Worley Pte. Ltd
Mechanical and electrical engineers:	Lincolne Scott Ng Pte. Ltd
Quantity surveyor:	KPK Quantity Surveyors (Singapore) Pte Ltd
Landscape architect:	Cicada Pte. Ltd
Environmental impact assessment consultant:	ERM – Siam Co. Ltd
Contractor:	Bouygues Thai Ltd
Client:	Pebble Bay Thailand Co. Ltd

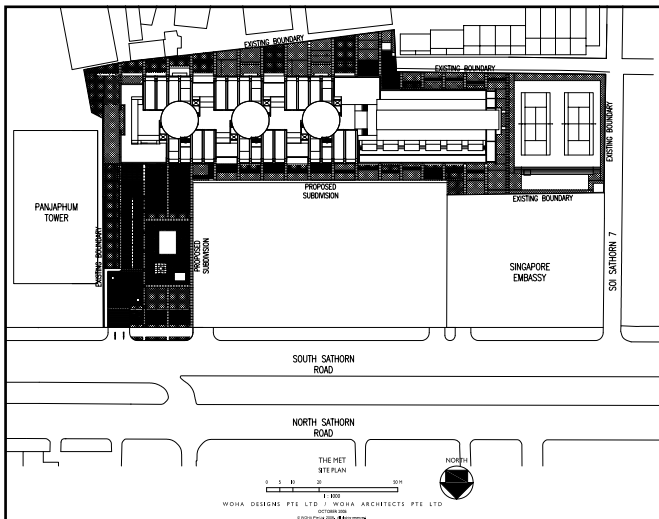
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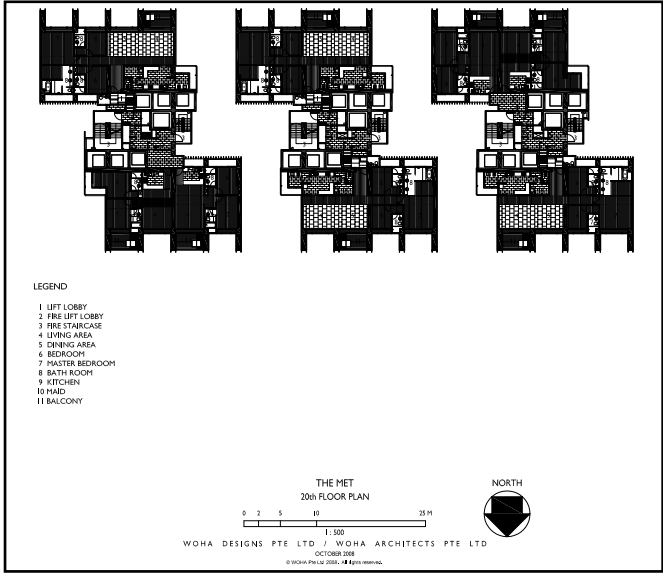
Zainab Faruqui Ali

April 2013



Site plan.

20th floor plan.





The site is located along a main arterial road that passes through the Sathorn district of central Bangkok. Sathorn Road is lined with skyscrapers, corporate offices, condominiums and embassies.



Site planning of the Met took into consideration the maximisation of the Sathorn address, setting the tower back from the street to achieve maximum building height and quieter surroundings, conserving as many existing mature trees as possible, and maximising the views to the north and south.



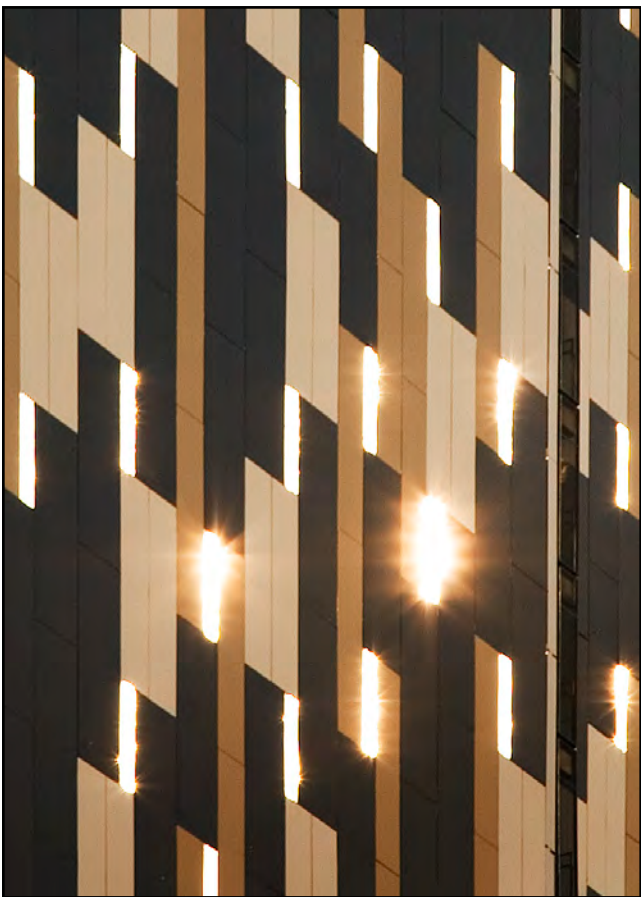
The building is planted on every horizontal surface including private balconies.



Community sky terraces were introduced on the 28th and 47th floor, serving as an extra living room. These, along with shared facilities such as meeting rooms, a big community swimming pool and a library on the 9th storey, add an extra layer of semi-public space to the project as a whole.



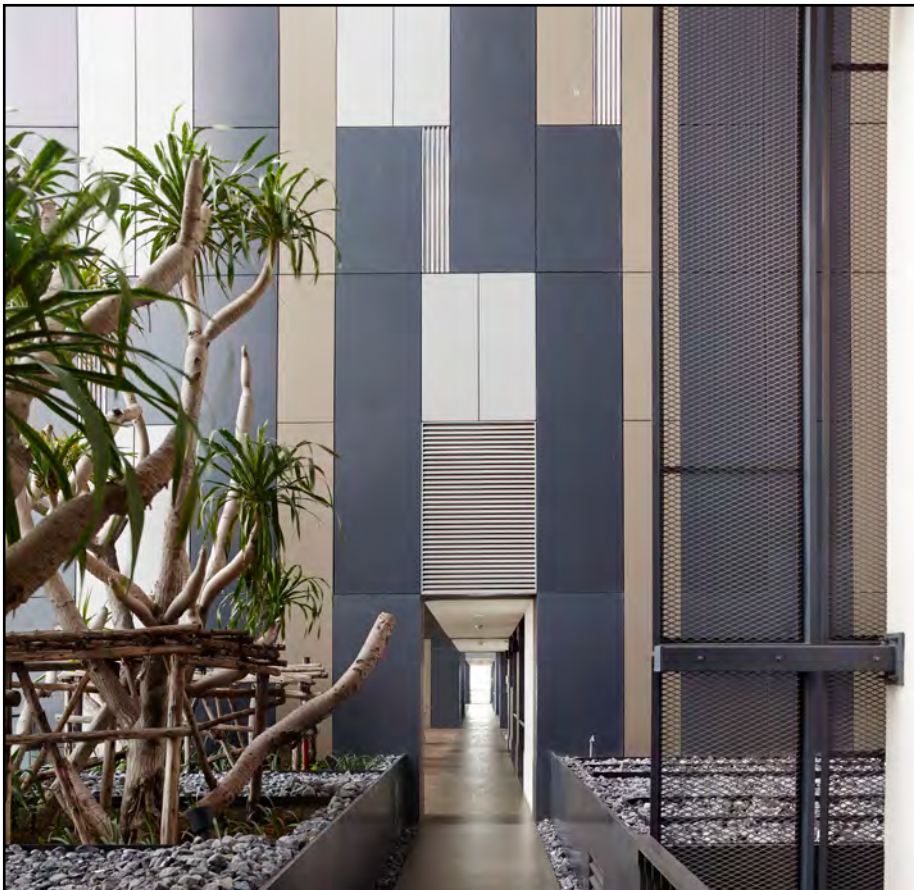
The staggered configuration of the plans coupled with the separation of three towers by air wells provides ample natural ventilation and daylight indoors.



These pleated panels brightly reflect the sun, and were inspired by the mirrors of the facades of Thai temples. The patterns of the aluminium panels were derived from patterns of Thai textiles and screens.



Water gardens are also used at ground level and recreational floors to provide evaporative cooling and store rainwater.



The sky terraces, both private and public, link the blocks every six storeys, creating dramatic yet human-scaled external spaces in the sky. Community sky terraces were again introduced on the 28th and 47th floors. These horizontal connections were also deemed necessary for added level of safety in terms of fire escape.



The apartments in the Met are naturally ventilated, with access to light and air on all four sides because the tower effectively has no circulation core, in the traditional sense.

Private balconies have planters with full-sized Frangipani trees, creating almost 130% landscape ratio.

