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From temporary housing to luxury high-rises, modular construction is a faster, safer, greener way to build

- Hong Kong has been slow to adopt modular construction, but it could be key to creating a circular economy and making development sustainable, architect says
- Because homes are modular they can be reused in another building, thereby reducing waste, and their ease of assembly could ease pressure of ageing workforce



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Published: 7:15pm, 10 Aug, 2020 ▾

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Two of three blocks at a quarantine facility in Sai Kung, Hong Kong, built in 77 days using modular integrated construction (MiC). Several pilot projects are under way in the city, a late adopter of factory built homes. Photo: LWK + Partners

Hong Kong had been dipping its toes into an emerging building method known as modular integrated construction (MiC) when the Covid-19 epidemic began, with several pilot projects under way. The health emergency pushed the city to dive right in.

The urgent need for a temporary quarantine facility in the Sai Kung district meant that the touted time savings achievable by MiC, as compared to conventional construction, could be put to the test.

Using the technique, three three-storey blocks were built from scratch in just 77 days by Hong Kong architecture firm LWK + Partners and Paul Y. – iMax, a joint venture between Hong Kong contractor Paul Y. and Singaporean engineering company iMax SG.

MiC – commonly referred to as modular or prefabricated construction, and in Singapore as prefabricated pre-finished volumetric construction (PPVC) – involves free-standing, integrated modules being fabricated, finished and inspected in a factory, then transported to a building site for installation.



The Sai Kung quarantine facility built in 77 days using modular integrated construction. Photo: LWK + Partners

Though it is not a new concept, technological improvements have made this method more palatable in the urban context, especially as it meets certain economic and societal demands.

“On-site processes like foundation works can be carried out while fabrication takes place, substantially raising the levels of efficiency and quality,” explains Paul Ng, a director of LWK + Partners.



The Brownstone condominium development in Singapore was the first there to be built from precast concrete modules. Photo: Rendy Aryanto/VVS.sg

Examples of this type of construction have been seen in the past 10 years in the United States, United Kingdom, China and Singapore, but it is still in its early stages in Hong Kong – where, according to Ng, “the approval process takes much longer and involves complicated preparation”.

Last year the same companies collaborated to develop an MiC installation system that had pre-approval by the city’s Buildings Department. This enabled rapid construction of the facility in Sai Kung, which is ready to be used when needed.

Built on a mini soccer pitch at the Sai Kung Outdoor Recreation Centre, the temporary quarantine facility comprises 99 units, with connecting steel staircases and open-air corridors between the blocks.



Modular units can also be brought back to the supply chain to be reused, extending the life cycle of building materials and relieving the pressure on the planet's resources

Paul Ng, a director of LWK + Partners



Each module, which measure 3 metres by 6 metres, contains a bed, wardrobe, desk and a bathroom. Finishings include wallpaper, vinyl flooring, and tiling in the wet area. A single-corridor design was adopted to contain the spread of coronavirus in the event of an outbreak at the facility.

“We placed all corridors at the front of the building and the bathroom vents at the back,” Ng says. “The blocks are arranged front-to-front or back-to-back to ensure a clear divide of ‘clean’ and ‘dirty’ air [the intake and outlet of the air conditioners], thus avoiding cross-contamination.”

To promote the wider adoption of MiC in Hong Kong, the government now requires it to be included in tenders for various public works.



An artist's rendering of InnoCell, a modular construction project under way at the Hong Kong Science Park. Photo: courtesy of Leigh & Orange Limited

Pilot projects include residential quarters of the Fire Services Department at Pak Shing Kok, Tseung Kwan O; InnoCell, a block providing workspace and affordable staff housing for start-up companies at Hong Kong Science Park; a University of Hong Kong student hostel at Wong Chuk Hang; and a transitional social housing project on Nam Cheong Street, Sham Shui Po. All are currently under construction.

Two homes for the elderly, in Sha Tin and Kwu Tung North, have also been approved.

One of the benefits of MiC is more effective quality control, Ng says. Another is that much of the construction takes place indoors. “Factories are weatherproof and provide a better work environment, potentially drawing new blood into the industry, which bolsters both capacity and resilience,” he says.

By shortening the time it takes to construct buildings, MiC saves on labour costs, reduces carbon emissions and possible nuisance to the community. It can speed up the supply of housing and functional space in densely built cities, but more importantly, Ng says, it can be a driving force for sustainable development and a circular economy.

“MiC leads to less construction wastage and raises cost-effectiveness overall,” he says. “Modular units can also be brought back to the supply chain to be reused, extending the life cycle of building materials and relieving the pressure on the planet’s resources.”

The units at the Sai Kung facility are flexible, he adds, allowing for different combinations to be put together or kitchens added so they may be reused as transitional housing.



A PhyeFly modular housing unit providing 270 sq ft of space that can be erected by one person in 30 minutes. Image: iMax SG

Ng believes the building industry is set for an MiC-led revolution. The potential was demonstrated in Wuhan, China, during the Covid-19 outbreak at the start of the year when the 1,000-bed Huoshenshan Hospital was built and handed over within 10 days using MiC construction.

And last September, iMax SG introduced the PhyeFly, a PPVC modular home developed to meet demand for affordable, high-quality housing that can be delivered swiftly. The external dimensions of the galvanised-steel home, which is priced at US\$40,000, are 3 metres by 6 metres, considered optimal for easy transportation anywhere in the world.

Once anchored on site, a pivot mechanism enables two side “wings” to slide out, providing 270 sq ft of living space with a fitted kitchen, bathroom, and room for up to four beds. The “instant” house, which Desmond Poh, iMax SG founder and managing director, says can be assembled by one person in 30 minutes, then hooks up to power, water and sewerage connections on site.



PhyeFly modular homes stacked to form three-storey blocks. Image: iMax SG

Poh envisages the full range of PhyeFly modular homes – which includes a smaller, 2.4 metre by 6 metre, shipping-container-sized version – being used for institutions, leisure concepts, and even disaster relief.

“We’ve designed it so that it’s easy to store and deploy, fast to set up, and provides a desirable solution for various users,” he says.

The technique may also be the way forward for luxury residential projects. In Singapore, regarded as a prefab leader in Asia, The Brownstone executive condominium by City Developments Ltd (CDL) and TID Pte. Ltd, completed in 2017, was the first application of concrete PPVC for a large-scale private residential development. The 638-unit development is built from 4,098 precast concrete modules.



The interior of a PhyeFly modular home. Image: iMax SG

CDL began work on its second PPVC residential development, The Tapestry, in 2018. The 861-unit development is being assembled from 2,500 prefabricated modules and is expected to be completed in 2021. The company says this form of modular prefab construction brings a 30 per cent increase in productivity compared with conventional construction methods.

Last year, Singaporean developer UOL Group completed 40-storey-high The Clement Canopy, billed at the time as the world's tallest residential development built using the PPVC method. It will top that with the 56-storey Avenue South Residence, currently under construction.

Jesline Goh, chief investment and asset officer of UOL Group, says PPVC produces higher quality homes and promotes sustainability because there is less wastage, higher productivity and improved worker safety.



A rendering of Avenue South Residence, a 56-storey luxury development in Singapore that will be the tallest there so far built using the modular construction method. Image: UOL Group

“As buyers are becoming more discerning and environmentally conscious, we believe they will appreciate the value of these projects,” she adds.

Ivy Lee, managing director of Leigh & Orange, the architectural firm responsible for InnoCell at the Hong Kong Science Park, believes MiC could resolve two pressing issues: the need for social housing in Hong Kong, and the city’s ageing construction workforce.

For MiC to be viable for private developments, Lee feels more manufacturers should apply for pre-acceptance of their systems. “A wider supply in the market would result in more competitive pricing and eventually make this construction method more attractive for developers to consider,” she says.



A rendering of The Tapestry, an 861-unit modular development under construction in Singapore.

For all its advantages, is there scope for architectural creativity when identical boxes are stacked together like giant Lego towers? Lee believes MiC can allow architects to express their ideas by responding to specific site planning and building design factors.

“The obvious restrictions around the size of the modules – which normally arise from transportation constraints – may be seen as a challenge, but also create opportunities for a new approach to design and potentially a new living style for the future,” she says.

InnoCell serves as an example, Lee says. It comprises four types of unit, ranging in size from roughly 14 square metres for a co-living unit, to a standard studio accommodating one occupant, to a 36-square-metre family unit, with occupants sharing the kitchens and dining areas, and both co-working and living spaces provided on each floor.

They will also have access to a roof garden, designed to encourage urban farming, and amenities such as a gymnasium, music/games room and laundry.