

Lifestyle / Arts & Culture

## 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.



Publication: South China Morning Post

Publication Date: 10 August 2020

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

## 从临时建筑到高层豪宅，组装建筑能提升速度、安全及环保程度

- 有建筑师表示，组装建筑在香港虽然发展缓慢，却可能是推动循环经济及可持续发展的关键
- 组装单元可以重用到其他建筑之中，减少建材浪费，而且组装过程简单，可减轻劳动力老龄化压力

（节录）

疫情初期，适逢“组装合成”建筑法（Modular Integrated Construction, MiC）在香港崭露头角，有数个进行中的试验项目，而疫情的紧急状态更促使本地业界全速投入。

由于当局急需在西贡搭建临时检疫设施，这项标榜比传统做法更快捷的新兴技术便得以小试牛刀。

三栋三层高的建筑物在 77 天内平地而起，而今次采用 MiC 的便是香港建筑事务所 LWK + PARTNERS，以及承建商保华建业及新加坡工程企业 iMax SG 属下联营公司 Paul Y. - iMax。

MiC — 普遍称为组装建筑或装配式建筑，在新加坡又简称 PPVC — 是指先在厂房组装及装修独立模块单元并进行检测，然后再运送到工地进行装嵌。

这虽然并非甚么新概念，但全因技术改良才能在市实践，加上适合的经济及社会条件才能成事。

LWK + PARTNERS 董事吴国辉讲述：“厂房组装期间，工地可以同时展开基础工程等现场工序，大大提高建造效率及质量控制水平。”

其实在过去 10 年，MiC 的实践例子已出现在美国、英国、中国和新加坡，但吴国辉就形容香港的状况“审批需时，过程繁复”。

去年 LWK + PARTNERS 和 Paul Y. – iMax 合作设计了一套获得香港屋宇署预先认可的 MiC 组装系统，使今次西贡检疫设施得以高速建造，让设施早日就绪。

是次临时检疫设施位于西贡户外康乐中心小型足球场，提供 99 个单位，以钢制楼梯及阳台通道连接。

每个单元为 3 米乘 6 米，内有床、衣柜、书桌及卫生间，已有墙纸及胶地板等装修，湿区使用瓷砖。项目采用了单边走廊设计，即使该处爆发疫情，也可减少病毒散播。

吴国辉解释：“我们把所有廊道设在建筑物正面，而卫生间的通风口就设于背面。三栋建筑物并列布置，避免任何建筑物的正面与另一栋的背面相向，实践洁污分离 [ 冷气机的进气口及出风口 ]，避免交叉感染。”

为广泛推动 MiC 的本地应用，香港政府已制定政策，要求某些公共工程的投标项目必须融入 MiC 技术。

吴国辉形容，MiC 其中一个优点就是质量控制较佳，另外就是将不少工序移到室内进行：“厂房环境防风防雨，改善工作环境，让业界更容易吸收新血，巩固行业承载力和韧性。”

由于 MiC 的应用缩短了建造时间，不但节省劳动成本，也减少工地碳排放及对社区的影响，同时加快高密度城市的住房及功能空间供应。不过吴国辉认为，更重要的是成为业界可持续发展和循环经济的推动力。

吴国辉说：“MiC 能减少建材浪费，提升整体成本效益。模块单位也可以重返供应链，延长建材的生命周期，减轻对地球资源的压力。”

吴国辉续称，西贡户外康乐中心临时检疫设施的单位提供充足弹性以组合不同元素，甚至可以加装厨房，未来可以重用作为中转房屋。

吴国辉相信，建造业界即将经历一场由 MiC 带动的革命。的确，这项技术的潜在年初武汉爆发新冠疫情时就体现出来，让拥有 1,000 张病床的火神山医院在短短 10 天内就建成及交付。