

Commentary

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Part II: Modular Integrated Construction for sustainable future

COVID-19 has brought both challenges and opportunities, as innovation flourished and new technologies found their ways to advance further. In April 2020, LWK + PARTNERS completed the temporary quarantine facilities in Sai Kung Outdoor Recreation Centre in collaboration with Paul Y. Construction and Paul Y. - iMax to assist the government's response to COVID-19. It is one of Hong Kong's pilot cases for **Modular Integrated Construction (MiC)**, and it took only 77 days to design and build three blocks of three-storey facilities from scratch, setting the city's record.



Sai Kung Outdoor Recreation Centre Temporary Quarantine Facilities, Hong Kong (Photo credit: Paul Y. - iMax)

Paul Ng, LWK + PARTNERS' director who oversees the quarantine facilities project, explained, "MiC is an innovative construction method based on the concept 'factory assembly followed by on-site installation'. Free-standing integrated modules are fabricated, finished and inspected in the factory before being transported to the site for installation. On-site processes like foundation works can be carried out all the while the above take place, substantially raising the levels of efficiency and quality."



Photo courtesy of Paul Y. - iMax

Piloting an efficient, quality design in Hong Kong

Three blocks of three-storey temporary quarantine facilities were built in the mini soccer pitch of Sai Kung Outdoor Recreation Centre. Every building consists of 33 temporary units, making up a total of 99, all with their own toilets and connected through steel staircases and open-air corridors. While all the modular units were made in factories, steel staircase and semi-open corridors were built on site.

Paul shared, "A single corridor design was adopted to contain virus spread. We placed all corridors at the front of the building and the bathroom vents at the back. The blocks are arranged front-to-front or back-to-back to ensure a clear divide of 'clean' and 'dirty' air."

Transporting huge modular units posed a major difficulty. "Due to their massive size comparing to ordinary construction material, these units must be transported by sea and then overland. Site constraints must also be overcome to get them properly delivered. Border restrictions during the pandemic also meant that the modules could not be manufactured on the mainland. The team quickly turned to Malaysia and managed to complete the project within a limited time frame," said Paul.



Photos courtesy of LWK + PARTNERS

Raising industry resilience and sustainability

With MiC, a lot of on-site work can be transferred to the factory. Quality control becomes more effective, improving the standards of delivery. Factories are weather-proof and provides a better work environment, potentially drawing new blood into the industry, which bolsters both capacity and resilience.

As the total construction period is shortened, MiC brings down the costs of labour and building materials, while carbon emissions and possible nuisance to the community are reduced. It will also speed up market supply to better accommodate long-term demand for housing and function space in dense cities.

But more importantly, it presents a potential driving force for sustainable development and circular economy.

"MiC leads to less construction wastage and raises cost-effectiveness overall," Paul noted. "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. At the Sai Kung temporary quarantine facilities, the project team has designed certain flexibility in the units so that they can be reused in transitional housing in the future."



Photo courtesy of Paul Y. - iMax

Architecture will never be the same

The global trend of MiC points to a new approach to building, shaping workflows and the way projects are planned and designed. The building industry is set for a revolution.

In a bid to promote wider use, the Hong Kong government announced a policy in March, making MiC a requirement in future tenders for specified types of public capital works projects, including staff quarters, hostels, residential and care homes, schools, office buildings and medical facilities, as well as staircases and communal areas of the above where possible. This applies to tenders where the total construction area exceeds 300 square metres.

Though MiC is now predominantly used in the public sector, it is expected to expand to different types of real estate as technology progresses, affecting the industry in Hong Kong, the Greater Bay Area, the whole mainland China and Southeast Asia. The expanded use of MiC promises efficiency and quality, helping firms respond with agility and timeliness to the rising demands for the built environment on the back of a growing urban population across the world.

Read Part I of the post-disaster/recovery story of COVID-19 here:
<http://www.futurarc.com/commentary/covid-19-an-urgent-need-for-emergency-architecture/>

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“组装合成”建筑法导向可持续未来城市

2019 冠状病毒病为全球各界带来各种挑战，但同时也加速了思维创新，为新技术提供试炼的机会。为协助香港特区政府適切应对疫情，LWK + PARTNERS 与保华建筑及 Paul Y. - iMax 合作，成功应用“组装合成”建筑法（Modular Integrated Construction, MiC），于 77 天内迅速完成西贡户外康乐中心临时检疫设施的设计及建造，三栋三层高的建筑于 2020 年 4 月底竣工后启用，可谓香港业界创举。

首批在港实践的建筑事务所

负责西贡项目的 LWK + PARTNERS 董事吴国辉解释：“MiC 透过‘先装后嵌’的概念，预先在厂房制作一个个模块单元，完成其组装、装修及检测，然后再将各个单元运到工地现场装嵌，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。”

香港先导案例 高效率高质量

西贡户外康乐中心临时检疫设施位于该中心的小型足球场，由三栋三层高的建筑物组成，每栋建筑物提供 33 个附设卫生间的暂住单位，以钢制楼梯及阳台通道互相连接，共提供 99 个单位供有需要人士暂住。暂住单位由厂房制作，而钢制楼梯和走廊就在现场建造。

吴国辉表示：“为把病毒散播风险降至最低，项目采用了单边走廊设计。我们把所有阳台通道设在建筑物正面，而卫生间的通风口设于背面，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。”

项目期间，其中一个主要困难就是模块单元的运输。吴国辉称：“相比一般建材，模块单元体积庞大，必须结合海路及陆路运输，并克服场地限制，才能运送到工地。加上疫情期间，由于边境限制措施的关系，原来由内地订制的模块单元无法运到工地，团队当机立断，改由马来西亚订制，最后顺利在有限时间内迅速交付项目。”

增加业界韧性 促进可持续发展

采用 MiC 使多个工序改到厂房环境进行，质量控制更准确，从而提升交付质量。厂房不但不受天气影响，更有助改善工作环境，吸引更多青年人加入建造业界，巩固行业承载力和韧性。

缩短工期不但降低项目整体的人力及建材成本，减少工地碳排放和工程期间对社区的影响，更可以加快地产市场供应，满足高密度城市对房屋及其他功能空间的长线需求。

更重要的是，MiC 是业界可持续发展及迈向循环经济的潜在推动力。

吴国辉说：“相较传统建筑模式，使用 MiC 能有效减少施工期间产生的建筑废料，提升项目成本效益。组件单元也具备一定的‘再用性’，可以拆卸重用，重新回到供应链当中，延长建材及组件的生命周期，减低对地球资源造成的压力。以今次临时检疫设施为例，我们在单位设计中保留了相当弹性，让组装单元可在疫情过后用于建设中转房屋。”

全球建筑业态即将改变

MiC 指引一套新的建筑模式，不但改变工作流程，未来更将会颠覆传统项目规划及设计思维，改变全球建筑业态。

现时香港政府着力推动 MiC 的广泛应用，发展局更于今年 3 月制定新政策，规定员工宿舍、旅舍、住宿及护理院舍、学校、办公楼和医疗设施六大范畴的政府基本工程投标项目，以及于以上建筑适用之楼梯和公共空间，只要总建筑楼面面积高于 300 平方米，未来必须融入 MiC 技术。

MiC 主要应用于世界各地的公共建筑，但随着技术日渐成熟，其应用范围及建造规模将会逐步扩大至各类型项目，影响香港、大湾区以至整个中国内地和东南亚地区的建筑业界。