



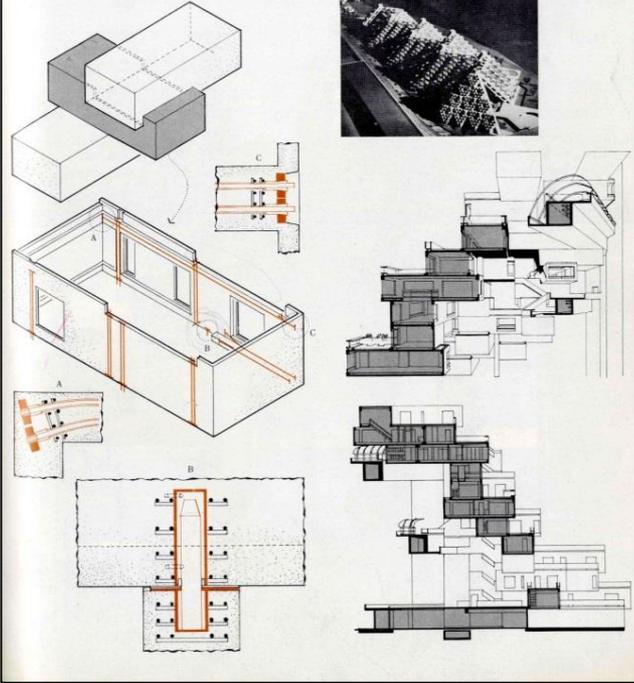
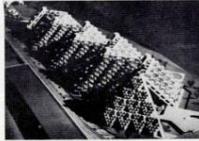
MODULAR INTEGRATED CONSTRUCTION

24 APR 2018

Early Modular Buildings – Habitat 1967, Montreal

design: Moshe Safdie and David, Burrows, Boulos, Associated Architects
general contractor: Anglin Norcross, Quebec, Ltd.
interior design: Canadian Home Furnishing Industry
structural consultant: Dr. A. E. Komendant Haza & Thibault and
Nicholas Fodor & Associates, mechanical & electrical engineers.

below: The way the prefabricated boxes are joined.
right above: Special crane for lifting the prefabricated boxes into place.
right center: Safdie's first proposal for Habitat 67.
right below: Sectional charts.



354-modules modular housing constructed for Montreal Expo 1967. However couldn't start the intended modular construction trend due to high costs.



(Source: <https://www.archdaily.com/404803/ad-classics-habitat-67-moshe-safdie>)

(Source: <http://onsomething.tumblr.com/image/49346585744>)

Modular Integrated Construction

Early Modular Buildings – Habitat 1967, Montreal

ROBERT STEPHEN LEFEBVRE REAL ESTATE BROKER 514-715-7010 VERSION FRANÇAISE

HOME SERVICES PROPERTIES ALBUM INFORMATION CONTACT TESTIMONIALS WEB LINKS



Properties

"The architecture of Moshe Safdie: A man of the world"

Habitat 67, Montreal

2600 Pierre-Dupuy avenue #514

MLS #28758108



Luxury means quality in every aspect. You will find such quality in this Unit of 3 cubes with its large Solarium, which has been totally and masterly renovated, down to the smallest items. You do the honours to discover it!

1 495 000\$

[See the listing](#)

NEW

Habitat 67, Montreal

2600 Pierre-Dupuy avenue #1027

MLS #26314997

Present status

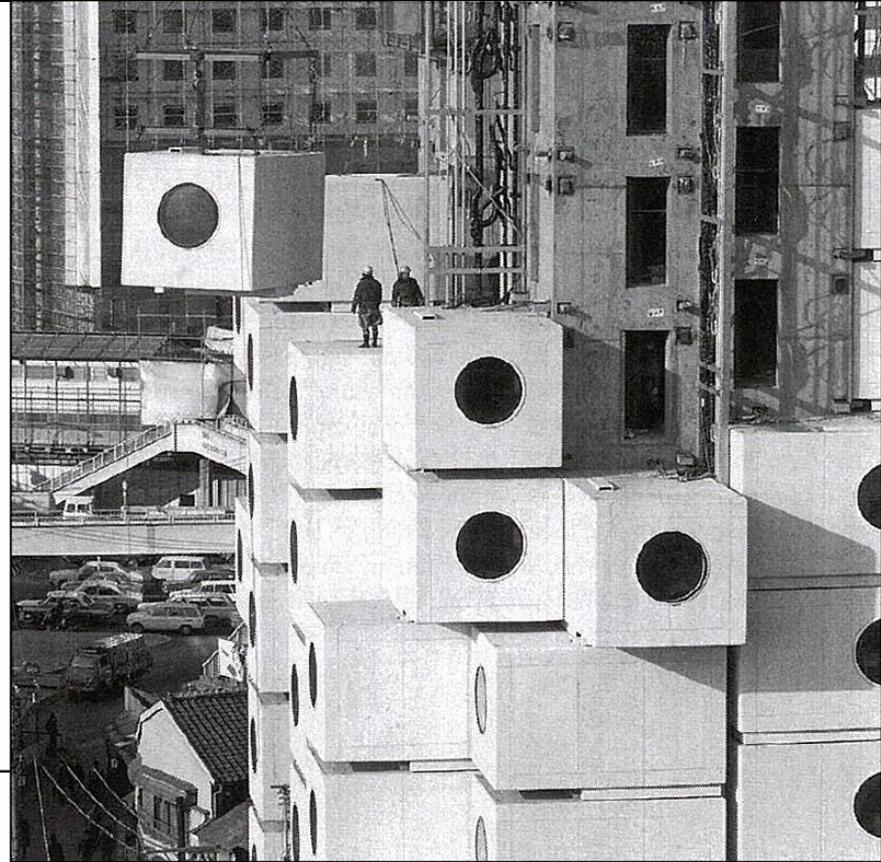


(Source: <http://estateinfo.ca/20170601/19841.html>)

(Source: <http://www.rslefebvre.com/Properties-for-sale-habitat-67.html>)

Modular Integrated Construction

Early Modular Buildings – Nakagin Capsule Tower 1972, Tokyo



Ginza, Tokyo. Still in use but fallen into relative disrepair. (can be rented from Airbnb)

(Source: <https://www.airbnb.com.hk/rooms/1305889>)

(Source: <http://archeyes.com/nakagin-capsule-tower-kisho-kurokawa/>)

Macau, Hong Kong's close neighbor, had a 440-module hotel in 1980 and it's still in operation



Regency Art Hotel Macau

(Source: [Google](#))

Current projects include supplying 440 modules for a 10-story Hilton Hotel in the Portuguese colony of Macau, off the China coast, as well as 368 modules more for another Hyatt hotel in Malaysia. 📱

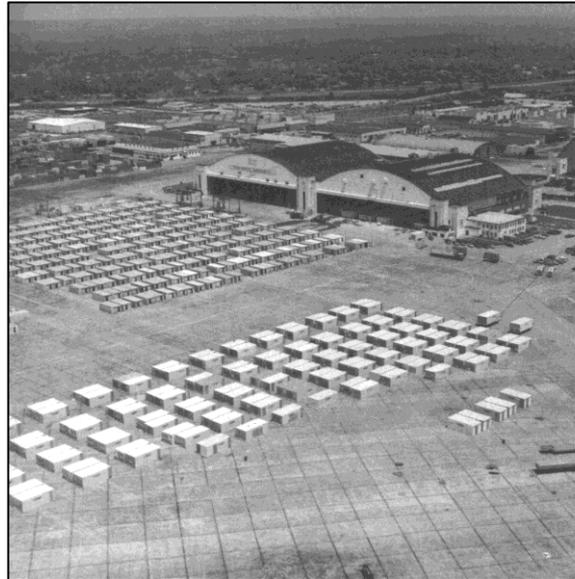
International Systems in Mobile, Ala. is mass-producing room-size units that are shipped to all parts of the world

Precast module factory works on a global scale

by Bill Blahal

CONCRETE PRODUCTS

November, 1980



(Source: <http://imcyc.com/biblioteca/ArchivosPDF/Coordinacion%20Modular/4%20Precast%20module%20factory%20works%20on%20a%20global%20scale.pdf>)

Modular Integrated Construction

MiC - No major success in the past

Paradigm shift now:-

- 1) Safety – Society now demand much higher safety standards.
- 2) Cost – Hong Kong is the second most expensive place to build in the world.
- 3) Labour shortage – Despite high wages, construction labour shortage is still severe. Sites seen as unsafe, harsh, dirty, filthy, and unwelcoming.
- 4) Quality expectations – Quality expectations arise as property price surges.
- 5) Environmental alertness – Site conditions heavily handicaps green efforts.
- 6) Productivity drop – Site workers' hours have now vastly shortened as a trend. Coupled with inefficiency on sites, productivity is low.

Paradigm Shift:-

- Safety

Society now demands much higher safety standards,

Our conventional construction sites can meet that high demand?

Segregation failures land principal contractor with £500,000 fine

UK, 2018

A groundworker suffered broke several bones in both legs and feet, resulting in amputation, because MV Kelly failed to put in place an up to date traffic management plan, the HSE has said

(Source: Google)



(Source: <https://www.thesun.co.uk/news/5875102/ukip-keith-crawford-ignored-health-safety-jailed/>)

Empire State Building 1930



(Source: <http://historycollection.co/20-incredible-photos-construction-empire-state-building/>)

(Source: <https://www.policyaddress.gov.hk/2017/eng/pdf/PA2017.pdf>)

The Chief Executive's 2017 Policy Address

Occupational Safety and Health

203. The Government attaches importance to occupational safety and health (OSH) of employees. While the overall OSH situation in Hong Kong has seen continuous improvement, the industrial accident rate of the construction industry remains relatively high. The Government is particularly concerned about the fatal construction accidents which occurred during the year. In view of this, we will adopt a three-pronged approach to enhance the OSH of the construction industry by **stepping up inspection and enforcement**, publicity and promotion, as well as education and training. We are also aware that the relatively lenient penalties for non-compliance of OSH legislation have failed to reflect the seriousness of the offences. We therefore consider it necessary to **impose heavier penalties against breaches of OSH legislation**, as appropriate, in order to achieve a greater deterrent effect and further enhance OSH protection for workers. We are **pressing ahead with the review on relevant legislation** and are seeking advice from the DoJ. We aim to put forward the broad directions of the proposed legislative amendments within this year.

.....**stepping up inspection and enforcement**.....

.....**pressing ahead with the review on relevant legislation**.....

.....**impose heavier penalties against breaches of OSH legislation**.....

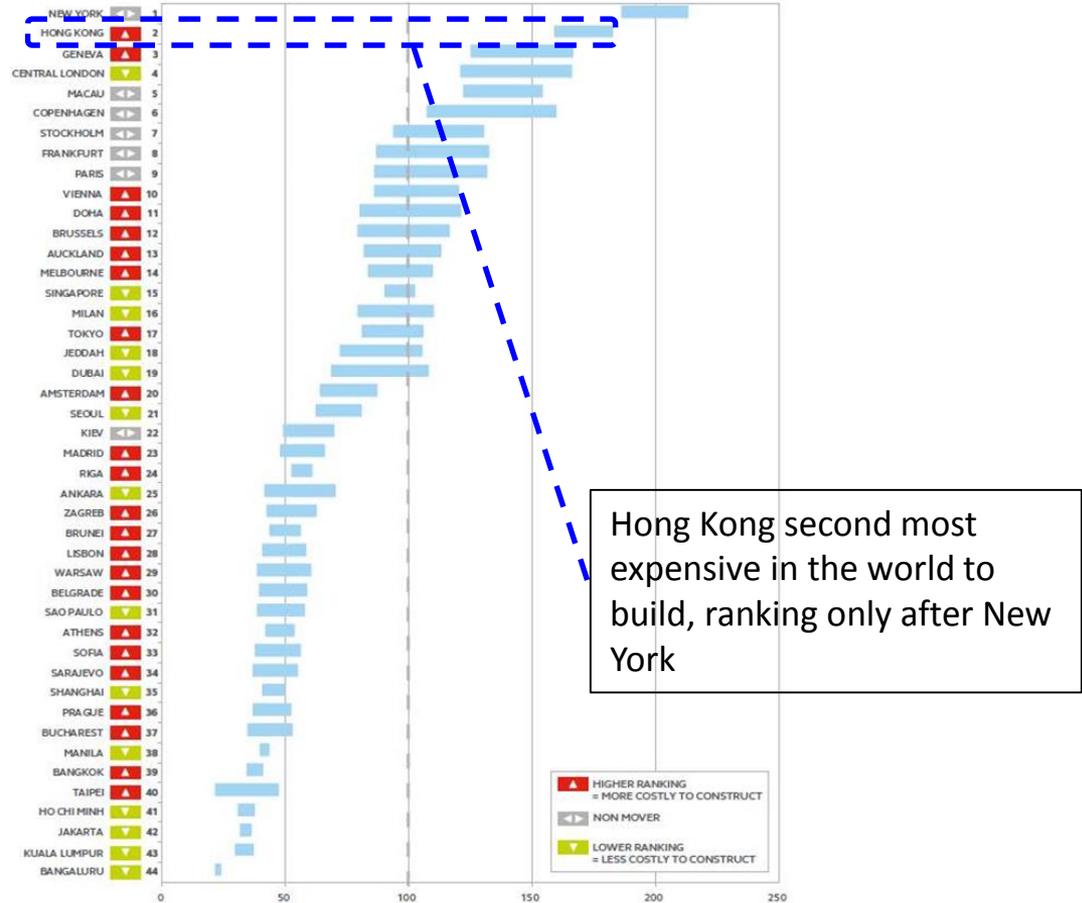
Modular Integrated Construction

Paradigm Shift:-

- Cost



FIG. 1: RESULTS TABLE - INTERNATIONAL COST COMPARISON INDEX



Hong Kong second most expensive in the world to build, ranking only after New York

(Source: https://www.arcadis.com/media/3/6/8/%7B368131AD-E31B-4552-821B-1F66DC62F805%7DICC%202017_FINAL_singles.pdf)

Paradigm Shift:-

- Cost



Substituting the words NYC by Hong Kong, the statement will be equally correct.

Building in such a dense urban environment like **NYC** means expertly handling material storage, transport and staging..... **Modularized construction** solutions may be the right answer for many in NYC to contain costs and keep the project moving. In New York City, contractors and developers must continue to take the lead in finding innovative, custom solutions to their build approach to mitigate the rising hard construction costs.

(Source: https://www.arcadis.com/media/3/6/8/{368131AD-E31B-4552-821B-1F66DC62F805}JCC_2017_FINAL_singles.pdf)

Paradigm Shift:-

- Labour shortage

4.2 ASIA

The effects of China's continuing transition away from an investment-driven economy are having a particular impact on Asian markets that have previously seen Chinese inward investment. In some cases real estate markets are suffering from over-supply exacerbated by a slowdown in demand from Chinese tourists and investor occupiers. Whilst economic growth levels in emerging Asian economies such as Malaysia, Indonesia and Philippines are way in excess of the developed world, growth rates in established hubs including Hong Kong and Singapore are similar to those seen in the US and Eurozone.

Growth rates in many construction markets have eased significantly over the past 18 months as commercial and residential development rates have peaked. Whereas double-digit growth has been common across the region, expansion at around 5% per year is the best prospect for many construction markets. Looking forward, demand is expected to be tied into large-scale investment in energy and transport infrastructure (such as the One Belt One Road project), much of which will need to be funded by PPP, and affordable housing, which will need central government support. Given the importance of private funding, the maintenance of investor confidence in the face of potential turbulence from China will be vital for the health of Asian construction markets.

HONG KONG

RANKS # 2 / [NON-MOVER]

Hong Kong markets are stabilizing at peak levels of activity, which have seen projects affected by significant resourcing challenges. Output in 2015 reached yet another record – up by 100% compared with 2010. While big projects such as the Zhuhai-Macau bridge link and the Guangzhou-Shenzhen High-Speed Rail link are well advanced, new programs – the third runway at Chek Lap Kok, expansion of the East Kowloon central Business District and maintenance of a large-scale housing programme totalling 480,000 units over 10 years – are expected to sustain workload at current levels. Hong Kong's residential, hospitality and commerce markets depend on

complementary mid-air freight. The private sector represents around 30% of overall activity, so the health of the construction market is closely linked to wider Chinese markets. Operating at peak levels spells a problem for Hong Kong's authorities because of the shortage of construction operatives available. This shortage, estimated to be over 10,000 people, has been driving up prices and delaying project completions. However, the ageing workforce and labour force problem is difficult to solve as solutions based on migrant labour are not acceptable to the local population. As a result, initiatives to increase industry productivity are gaining a higher profile in Hong Kong.



SINGAPORE

RANKS # 15 / DOWN FIVE PLACES (PREVIOUSLY #10)

Singapore's construction market has seen a continuing correction since 2014 triggered by over-supply and a slowing economy. The residential sector has the highest vacancy levels since 2005 and public housing delivery has also been scaled back down to around 18,000 units compared with 22,000 delivered in 2014. 2017 is currently forecast to be between US\$2.7bn and US\$3.2bn – down on previous forecasts but representing a stable market after a steep correction. Sustained workload in the public sector in areas such as public housing and civil engineering has supported the industry during the correction, and as a result, prices have remained broadly stable.

Looking forward, continuing investment in aviation, metro, road and high-speed rail through projects such as the Changi Airport Terminal construction and High-Speed Rail terminus is planned to sustain both the local industry and Singapore's competitive position. Output is forecast to increase by about 2% per year, showing the trademark resilience of the economy. However, like Hong Kong, Singapore also faces a labour shortage. In an effort to incentivise local contractors to invest in their workforce, the Singapore government has increased the cost of visas charged on the wages of mid-skilled overseas workers to encourage talent retention in the city-state.

Shortage of construction workers in Hong Kong is beyond doubt.

.....Operating at peak levels spells a problem for **Hong Kong's** authorities because of the **shortage of construction operatives available**. This shortage, estimated to be over 10,000 people, has been driving up prices and delaying project completions. However, the **ageing workforce** and labour force problem is difficult to solve as solutions based on migrant labour are not acceptable to the local population.....

(Source: https://www.arcadis.com/media/3/6/8/%7B368131AD-E31B-4552-821B-1F66DC62F805%7DICCC%202017_FINAL_singles.pdf)

Modular Integrated Construction

Paradigm Shift – Quality, green construction at higher productivity

- Present MiC projects

461 Dean Street, New York

Factory to site <10km



(Source: <https://citylimits.org/2015/08/31/documents-reveal-woes-at-pioneering-atlantic-yards-building/>)



(Source: https://www.google.com.hk/search?q=atlantic+yards&source=lnms&tbn=isch&sa=X&ved=0ahUKEwj-iMj1oLbaAhVDKZQKHq2AaoQ_AUICigB&biw=1684&bih=796#imgrc=RMttTac09_x4TM:&spf=152358837598)



(Source: http://1.bp.blogspot.com/ZkRqAkVjgY4/VWHpKBvDQFI/AAAAAAAAIQ/UG_S9MLaxE/s1600/Capsys%2Bmodular%2Bapartments%2B1.jpg)

Modular Integrated Construction

Paradigm Shift – Quality, green construction at higher productivity

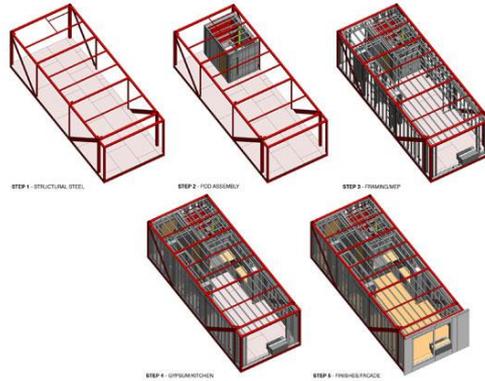
- Present MiC projects

461 Dean Street, New York

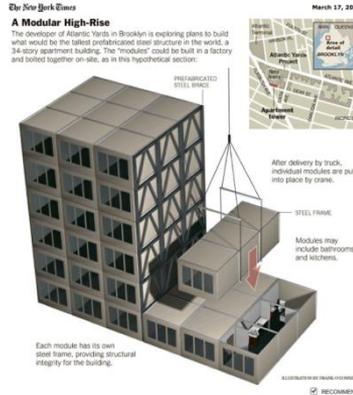
Factory to site <10km



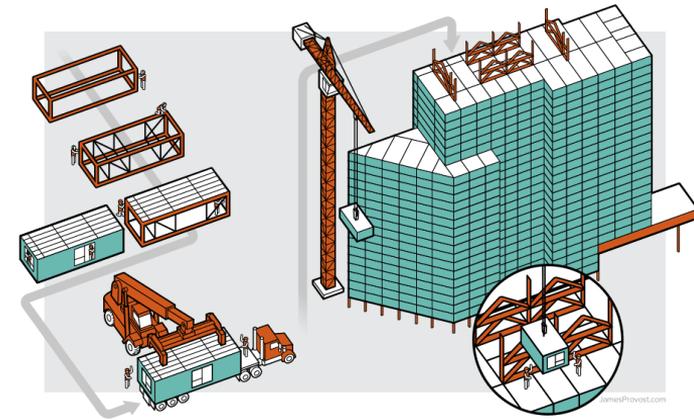
(Source: <http://www.skyscrapercenter.com/building/461-dean-street/14897>)



(Source: <http://www.ctbuh.org/Events/CTBUHRelatedEvents/AtlanticYardsB2MularontheRise/tabid/4814/language/en-US/Default.aspx>)



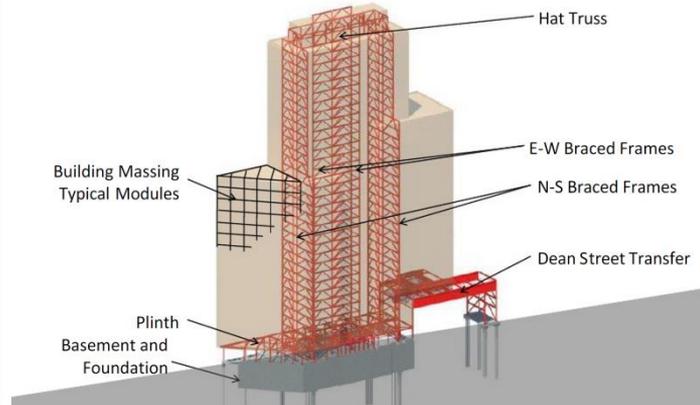
(Source: <https://thinkwingradio.com/2011/03/28/modular-construction-the-future-of-high-rise-building/>)



(Source: <https://jamesprovost.com/portfolio/modular-construction>)

Building 2 Design: Engineers

Structural Scheme



(Source: <https://www.brownstoner.com/development/first-ay-tower-breaks-ground-today/>)

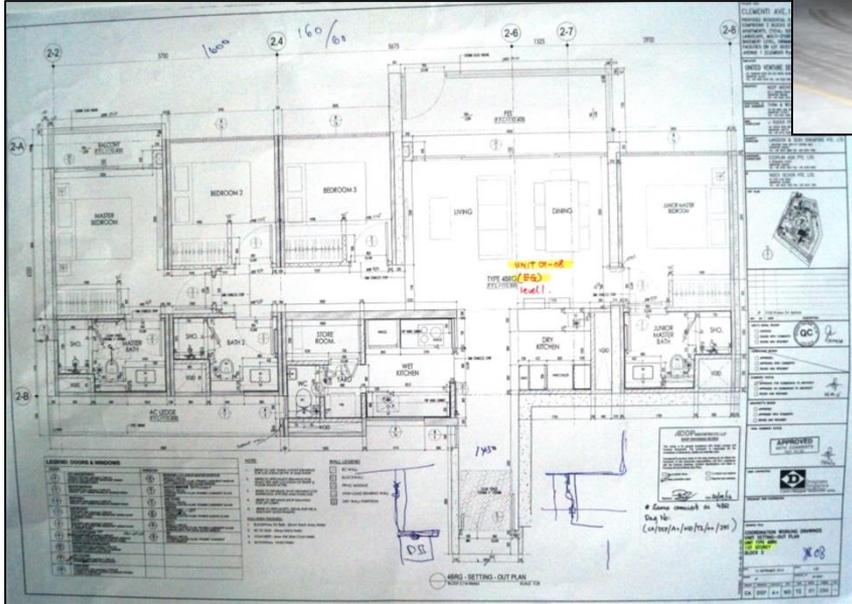
Modular Integrated Construction

Paradigm Shift – Quality, green construction at higher productivity

- Present MiC projects

Singapore Clementi Canopy

Factory to site <50km



(Source: http://dragages.com.sg/projects-post/clement-canopy/?related_page=3)

Modular Integrated Construction

Paradigm Shift – Quality, green construction at higher productivity

- Present MiC projects

(Source: https://www.google.com.hk/search?q=clementi+canopy&source=lnms&tbn=isch&sa=X&ved=0ahUKEwi22YOius_aAhUFKJQKHrgwD7IQ_AUICigB&biw=1684&bih=796#imgrc=YWx-IRD1en90cM:&spf=1524454156203)

Singapore Clementi Canopy

Factory to site <50km



Modular Integrated Construction

Paradigm Shift – Quality, green construction at higher productivity

- Present MiC projects

NanJing 新城香悅瀾山

ZhenJiang factory to site 120km



Modular Integrated Construction

Paradigm Shift – Quality, green construction at higher productivity

- Present MiC projects

NanJing 新城香悅瀾山

ZhenJiang factory to site 120km

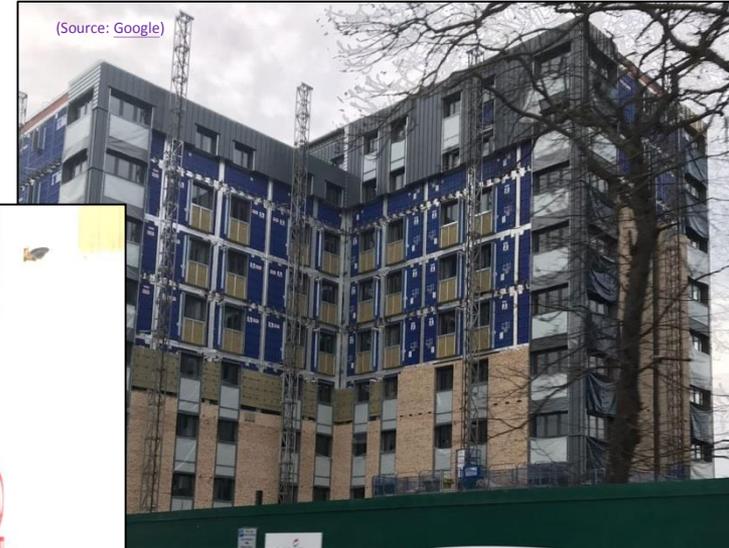


Modular Integrated Construction

Paradigm Shift – Quality, green construction at higher productivity
- Present MiC projects



Newcastle University Parkview Student Village
GuangDong factory to site 11000km



Modular Integrated Construction

Paradigm Shift – Quality, green construction at higher productivity - Present MiC projects

Institute of Clerk of Works Local Chapter Meeting

Institute of Clerk of Works Local Chapter Meeting is held at Park View Student Village

The Institute of Clerk of Works holds a Local Chapter Meeting every second Saturday of the month. Our Local Chapter Chairman is Michael Grange, who is also our Clerk of Works for Park View Student Village.



During the site walk around, everyone expressed how impressed they were with the site and works in general. Colin was amazed our new bedrooms were being constructed in China and then shipped over to the UK - very different to his days on site!

(Source: <http://www.ncl.ac.uk/accommodation/university/park-view/item/newsinstituteofclerkofworkslocalchaptermeeting.html>)

Newcastle University Parkview Student Village GuangDong factory to site 11000km



(Source: <https://www.chroniclelive.co.uk/business/business-news/newcastle-universitys-75m-student-accommodation-12857315>)

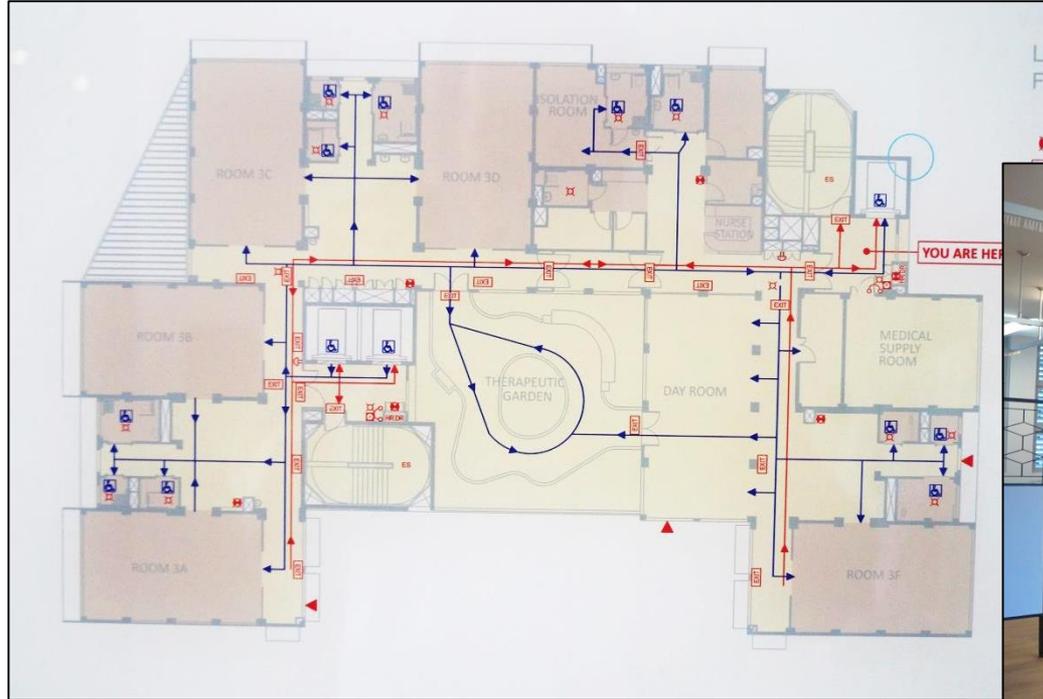


(Source: <http://www.ikopolymeric.com/case-studies/modern-accommodation-newcastle-university/>)

Modular Integrated Construction

Paradigm Shift – Quality, green construction at higher productivity
- Present MiC projects

Woodlands Nursing Home, Singapore



Modular Integrated Construction

Paradigm Shift – Quality, green construction at higher productivity

- Present MiC projects

Woodlands Nursing Home, Singapore



(Source: <https://smart-health.sg/nursing-home-director/solutions-for-nursing-home-directors/>)

Modular Integrated Construction

Paradigm Shift – Quality, green construction at higher productivity

- Present MiC projects

The Wisteria, Residential-for-sale, Singapore



Modular Integrated Construction

Paradigm Shift – Quality, green construction at higher productivity

- Present MiC projects

The Wisteria, Residential-for-sale, Singapore

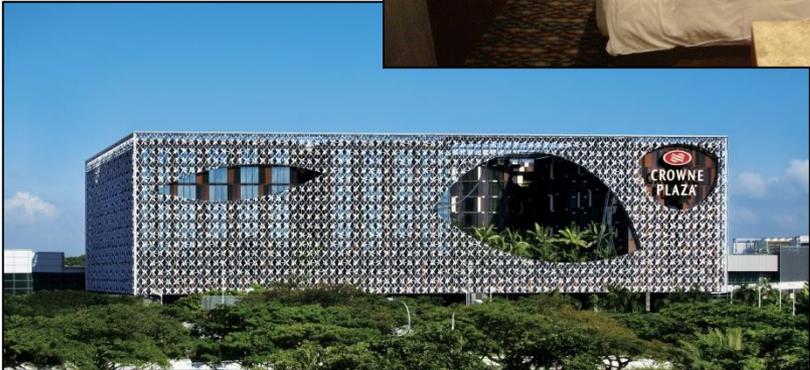


Modular Integrated Construction

Paradigm Shift – Quality, green construction at higher productivity

- Present MiC projects

Crowne Plaza Changi Airport, Singapore



(Source: https://upload.wikimedia.org/wikipedia/commons/f/fa/Crowne_Plaza_Changi_Airport%2C_Singapore_-_20120320.jpg)

Lego-like building method to speed up Crowne Plaza Changi Airport hotel extension

By STACEY LIM

SINGAPORE — By the time they are hoisted up by cranes and assembled “Lego-style” to form a building, these prefabricated units are already fitted with carpeting and other plush fixtures found in a hotel room.

(Source: <https://www.todayonline.com/singapore/extension-crowne-plaza-changi-airport-slated-completion-june>)



(Source: <https://www.channelnewsasia.com/news/singapore/extension-of-crowne-plaza-changi-airport-hotel-hits-halfway-mark-8179130>)

Modular Integrated Construction

Competitive advantages

- 1) Factory environment – Better safety, productivity, quality. Moves risky site activities to safer factory. Greener construction from reduced waste and site nuisance.
- 2) Amount of site works significantly reduced, enabling cleaner and safer site.
- 3) Cost competitiveness can be expected for the right project as scale increases.
- 4) Product premises can be highly finished / furnished / decorated.
- 5) Ideally suited to BIM and Design for Manufacturing and Assembly.

Issues to resolve

- 1) Detailed design must be fixed “early”. Reduced flexibility for post-production design changes.
- 2) Additional floor area taken up by module walls.
- 3) Users / Clients / Stakeholders’ perception.
- 4) Construction cost as % of Total Cost (Incl. Land) governs “risk taking”.
- 5) Statutory / regulatory control – Hong Kong Laws Cap 123 (Buildings Ordinance), 406 (Electricity Ordinance), 572 (Fire Safety [Buildings] Ordinance), 102 (Waterworks Ordinance).
- 6) Supply chain, logistics, design / site skills to be developed.

Market Perception / Suspicion?

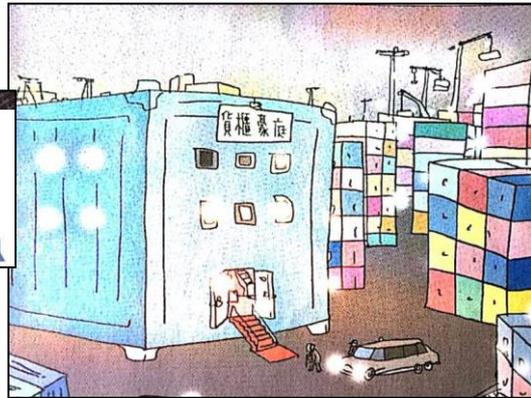
- *Hong Kong home prices world's highest.*
- *People regard homes as most valuable asset / investment.*
- *Some media inadvertently presenting modular construction as temporary housing for the needy.*
- *Will home-buyers pay the regular price for modular housing, given the probable misconception?*
- *Mortgages same for modular and conventional construction?*
- *Probability of adverse market rumours on modular housing?*
- *For MiC to be accepted by home-buying individuals, public perception must be aligned with facts.*

Hong Kong's home prices are the world's highest. Can the city fix it?

PUBLISHED : Saturday, 23 December, 2017, 8:16am
UPDATED : Saturday, 23 December, 2017, 11:33am

COMMENTS: 57

(Source: <http://www.scmp.com/property/hong-kong-china/article/2125379/can-hong-kong-untie-gordian-knot-citys-home-prices>)



(Source: Apple Daily)



(Source: South China Morning Post)

Modular Integrated Construction

Hong Kong private sector housing – Construction Cost as % of Total Cost

- *Land cost is very high, rendering construction cost secondary for private sector.*
- *Most recent Tsing Yi land sale – land cost some 3 times construction cost, on per unit area basis.*

Tender awarded for site in Tsing Yi – HK\$867.3 million for site 1335m² site area of residential site.

(Source: <http://www.info.gov.hk/gia/general/201804/11/P2018041100788.htm?fontSize=1>)

宏安8.673億套青衣商住地，樓面呎價8491元貴絕。Land costs \$8491 psf of floor area.

(Source: <https://www.midland.com.hk/property-news/%E6%9C%80%E6%96%B0/%E5%AE%8F%E5%AE%898-673%E5%84%84%E5%AA%E9%9D%92%E8%A1%A3%E5%95%86%E4%BD%8F%E5%9C%B0%E3%80%80%E6%A8%93%E9%9D%A2%E5%91%8E%E5%83%B98491%E5%85%83%E8%B2%B4%E7%B5%95/>)

With construction cost at say 1/3 of land cost, and say 1/6 of eventual sale price, private sector can be expected to be hesitant on MiC

Statutory contractor / supervision / tradesmen requirements in Hong Kong

What if these works executed off site with MiC?

| <u>Hong Kong Laws</u> | <u>Ordinance</u> | <u>Statutory Contractor</u> | <u>Statutory Supervisor/Tradesmen</u> |
|-----------------------|------------------|-----------------------------|---------------------------------------|
| Buildings | 123 | Reg. Bldg Contractor | Technically Competent Persons |
| Electrical | 406 | Reg. Elect. Contractor | Reg. Elect. Worker |
| Plumbing | 102 | nil | Licensed Plumber |
| Fire services | R95A | Reg. FSI Contractor | nil |
| Ventilation | R123J | Reg. Spec. Contractor | nil |

Another area of concern specific to Hong Kong – Wind Load

Mic Current Building Projects:-

- NanJing – 0.40
- UK – 0.5
- Singapore – 0.65
- New York – 1.15

| Wind loading categories | |
|-------------------------|------------------|
| | N/m ² |
| Extra Heavy | 576 |
| Heavy | 466 |
| Medium | 429 |
| Light | 396 |
| Specialist | Contact Abacus |

The rationalized wind loading factor, Rwf, are all stated at 10m above ground level, and for a mean return period of 25 years.

Abacus standard columns are based on:

Terrain Category II - 8m and above.

Terrain Category III - less than 8m.

Note: coastal sites, sites above 250m or sites subject to funnelling will require special consideration.



(Source: <http://www.gb-hisa.si/pdf/objekt%20UK.pdf>)

These UK winds approximate to around 0.5KPa

Table 1 : Design wind pressure

HK is high at 2.0KPa

| Height above site-ground level | Design wind pressure q _z (kPa) |
|--------------------------------|---|
| ≤ 5m | 1.82 |
| 10 m | 2.01 |
| 20 m | 2.23 |

(Source: <http://www.bd.gov.hk/english/documents/code/windcode2004.pdf>)

| Type of loads | When adopting Singapore or British design standards | When adopting Eurocodes |
|---|--|--|
| (b) Imposed floor and ceiling loads, dynamic loads due to crowd movement, loads on parapets and balustrades, loads on vehicular barrier for car parks, accidental loads | (i) Loading for buildings. Code of practice for dead and imposed loads – BS 6399: Part 1; and (ii) Industrial type flooring and stair treads – BS 4592. | (i) Actions on structures – General actions - SS EN 1991; and (ii) Industrial type flooring and stair treads – BS 4592. |
| (c) Wind loads | (i) Code of basic data for the design of buildings. Loading. Wind loads – CP 3 Chapter V Part 2, using 33 m/s as the basic wind speed (3 second gust speed); and (ii) Loading for buildings. Code of practice for wind loads – BS 6399: Part 2, using 22 m/s as the basic wind speed (hourly mean speed). | (i) Actions on structures – General actions - Wind actions - SS EN 1991-1-4. |

(Source: <https://www.bca.gov.sg/Publications/BuildingControlAct/others/Approveddoc.pdf>)



Chapter 16 – Structural Design

Section 1609 Wind Loads

– Based on NYC regional climate value for basic wind speed (V)

- V = 98 mph

(Source: https://www1.nyc.gov/assets/buildings/pdf/chapter_17_of_2008_construction_code.pdf)

For Singapore's 33m/s, wind load translates to 0.65KPa

Another area of concern specific to Hong Kong – Wind Load

For comparison:-

- HK Code: HK 2.0 KPa
- Chinese Code:-
 - HK - 0.9
 - ShenZhen - 0.75
 - NanJing - 0.4

续表 E.5

| 省市名 | 城市名 | 海拔高度 (m) | 风压 (kN/m ²) | | | 雪压 (kN/m ²) | | | 基本气温 (°C) | | 雪荷载准永久值系数分区 |
|--------|------|----------|-------------------------|------|-------|-------------------------|------|-------|-----------|----|-------------|
| | | | R=10 | R=50 | R=100 | R=10 | R=50 | R=100 | 最低 | 最高 | |
| | | | | | | | | | | | |
| 广东 | 五华 | 120.9 | 0.20 | 0.30 | 0.35 | — | — | — | 4 | 36 | — |
| | 汕头市 | 1.1 | 0.50 | 0.80 | 0.95 | — | — | — | 6 | 35 | — |
| | 惠来 | 12.9 | 0.45 | 0.75 | 0.90 | — | — | — | 7 | 35 | — |
| | 南澳 | 7.2 | 0.50 | 0.80 | 0.95 | — | — | — | 9 | 32 | — |
| | 信宜 | 84.6 | 0.35 | 0.60 | 0.70 | — | — | — | 7 | 36 | — |
| | 罗定 | 53.3 | 0.20 | 0.30 | 0.35 | — | — | — | 6 | 37 | — |
| | 台山 | 32.7 | 0.35 | 0.55 | 0.65 | — | — | — | 6 | 35 | — |
| | 深圳市 | 18.2 | 0.45 | 0.75 | 0.90 | — | — | — | 8 | 35 | — |
| | 汕尾 | 4.6 | 0.50 | 0.85 | 1.00 | — | — | — | 7 | 34 | — |
| | 湛江市 | 25.3 | 0.50 | 0.80 | 0.95 | — | — | — | 9 | 36 | — |
| | 阳江 | 23.3 | 0.45 | 0.75 | 0.90 | — | — | — | 7 | 35 | — |
| | 电白 | 11.8 | 0.45 | 0.70 | 0.80 | — | — | — | 8 | 35 | — |
| 台山县上川岛 | 21.5 | 0.75 | 1.05 | 1.20 | — | — | — | 8 | 35 | — | |
| 徐闻 | 67.9 | 0.45 | 0.75 | 0.90 | — | — | — | 10 | 36 | — | |

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续表 E.5

| 省市名 | 城市名 | 海拔高度 (m) | 风压 (kN/m ²) | | | 雪压 (kN/m ²) | | | 基本气温 (°C) | | 雪荷载准永久值系数分区 |
|-----|-----|----------|-------------------------|------|-------|-------------------------|------|-------|-----------|----|-------------|
| | | | R=10 | R=50 | R=100 | R=10 | R=50 | R=100 | 最低 | 最高 | |
| | | | | | | | | | | | |
| 台湾 | 宜兰 | 9.0 | 1.10 | 1.85 | 2.30 | — | — | — | — | — | — |
| | 台中 | 78.0 | 0.50 | 0.80 | 0.90 | — | — | — | — | — | — |
| | 花蓮 | 14.0 | 0.40 | 0.70 | 0.85 | — | — | — | — | — | — |
| | 嘉义 | 20.0 | 0.50 | 0.80 | 0.95 | — | — | — | — | — | — |
| | 马公 | 22.0 | 0.85 | 1.30 | 1.55 | — | — | — | — | — | — |
| | 台东 | 10.0 | 0.65 | 0.90 | 1.05 | — | — | — | — | — | — |
| | 冈山 | 10.0 | 0.55 | 0.80 | 0.95 | — | — | — | — | — | — |
| | 恒春 | 24.0 | 0.70 | 1.05 | 1.20 | — | — | — | — | — | — |
| 香港 | 阿里山 | 2406.0 | 0.25 | 0.35 | 0.40 | — | — | — | — | — | — |
| | 台南 | 14.0 | 0.60 | 0.85 | 1.00 | — | — | — | — | — | — |
| | 香港 | 50.0 | 0.80 | 0.90 | 0.95 | — | — | — | — | — | — |
| | 横澜岛 | 55.0 | 0.95 | 1.20 | 1.40 | — | — | — | — | — | — |
| 澳门 | 澳门 | 57.0 | 0.75 | 0.85 | 0.90 | — | — | — | — | — | — |

注：表中“—”表示该城市没有统计数据。

续表 E.5

| 省市名 | 城市名 | 海拔高度 (m) | 风压 (kN/m ²) | | | 雪压 (kN/m ²) | | | 基本气温 (°C) | | 雪荷载准永久值系数分区 |
|-----|-----|----------|-------------------------|------|-------|-------------------------|------|-------|-----------|----|-------------|
| | | | R=10 | R=50 | R=100 | R=10 | R=50 | R=100 | 最低 | 最高 | |
| | | | | | | | | | | | |
| 山东 | 兖州 | 51.7 | 0.25 | 0.40 | 0.45 | 0.25 | 0.35 | 0.45 | -11 | 36 | II |
| | 晋县 | 107.4 | 0.25 | 0.35 | 0.40 | 0.20 | 0.35 | 0.40 | -11 | 35 | II |
| | 临沂 | 87.9 | 0.30 | 0.40 | 0.45 | 0.25 | 0.40 | 0.45 | -10 | 35 | II |
| | 日照市 | 16.1 | 0.30 | 0.40 | 0.45 | — | — | — | -8 | 33 | — |
| 江苏 | 南京市 | 8.9 | 0.25 | 0.40 | 0.45 | 0.40 | 0.65 | 0.75 | -6 | 37 | II |
| | 徐州市 | 41.0 | 0.25 | 0.35 | 0.40 | 0.25 | 0.35 | 0.40 | -8 | 35 | II |
| | 赣榆 | 2.1 | 0.30 | 0.45 | 0.50 | 0.25 | 0.35 | 0.40 | -8 | 35 | II |
| | 盱眙 | 34.5 | 0.25 | 0.35 | 0.40 | 0.20 | 0.30 | 0.35 | -7 | 36 | II |
| | 淮阴市 | 17.5 | 0.25 | 0.40 | 0.45 | 0.25 | 0.40 | 0.45 | -7 | 35 | II |
| | 射阳 | 2.0 | 0.30 | 0.40 | 0.45 | 0.15 | 0.20 | 0.25 | -7 | 35 | III |
| | 镇江 | 26.5 | 0.30 | 0.40 | 0.45 | 0.25 | 0.35 | 0.40 | — | — | III |
| | 无锡 | 6.7 | 0.30 | 0.45 | 0.50 | 0.30 | 0.40 | 0.45 | — | — | III |
| 连云港 | 泰州 | 6.6 | 0.25 | 0.40 | 0.45 | 0.25 | 0.35 | 0.40 | — | — | III |
| | 连云港 | 3.7 | 0.35 | 0.55 | 0.65 | 0.25 | 0.40 | 0.45 | — | — | II |

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Modules – Imported or Home-made?

As markets mature and volumes increase, home-city factories are possible.

31 Dec 2017

UK housebuilders to prefabricate hundreds of homes in factories

Berkeley Homes, which builds 4,000 homes a year, is planning to **create a facility in Kent next year** where builders will work to produce up to 1,000 houses and apartments annually which will then be craned on to sites.

Another company, **nHouse**, is **setting up a factory in Peterborough** with the capacity to build 400 homes a year, complete with light fittings, bathrooms, bookshelves and kitchens. Production is expected to start in January.

(Source: <https://www.theguardian.com/business/2017/dec/31/uk-housebuilders-factories-prefabricating-homes>)

Chinese builder in \$3.4b agreement for UK homes

By Cecily Liu | China Daily | Updated 2016-12-21 07:45



China National Building Materials Group Corp struck a 2.75-billion-pound (\$3.41 billion) joint venture deal on Monday to open six highly cost-efficient pre-fabricated house-building factories in the United Kingdom, capable of producing 25,000 homes a year.

(Source: http://www.chinadaily.com.cn/business/2016-12/21/content_27728528.htm)

YHG pulls plug on modular housing JV

13 Feb 2018, 08:36

Your Housing Group and its partner WELink have abandoned their joint venture into modular housing delivery.

The business is backed by China's National Building Material Group, which as part of the JV agreement was to fund six modular housing factories in the UK.

(Source: <https://www.placenorthwest.co.uk/news/yhg-pulls-plug-on-modular-housing-jv/>)

Modular Integrated Construction

The Chinese Central Government has issued various innovation and modernization directives for the construction industry. Along the lines of the Central Government's directives, provincial and city authorities have set up further measures to mandate specific percentages targets for prefabricated construction.

中共中央 国务院关于进一步加强对城市规划建设管理工作的若干意见

2016-02-21 18:26 来源：新华社 

Feb 2016, Directive by Chinese Central Government. #9-11, Improve construction quality and safety. Increase industrialized and prefabricated construction.

国务院办公厅关于促进建筑业持续健康发展的意见

国办发〔2017〕19号 

Feb 2017, Directive by Chinese Central Government. #5-7 Improved construction quality, safety, and inspection. #14-16 Increase use of innovative, industrialized and prefabricated construction. Use Building Information Modelling Technology.

国务院办公厅关于大力发展装配式建筑的指导意见

国办发〔2016〕71号 

Sep 2016, Directive by Chinese Central Government on vastly increasing prefabricated construction

To conclude:

MiC's nature:

- Highest proportion of factory-manufacturing amongst industrialized construction methods
- Enables much structural, architectural, building services, ID, furnishing works to be pre-manufactured-and-preinstalled
- Achieves high quality, better safety, less waste, and minimizes site nuisance

MiC competitiveness increases with:

- Extensiveness of fitting-out, inclusive of architectural, building services, interior design, and furnishing in product-premises
- Construction cost as % of total project cost (i.e. inclusive of land)
- Ability for detailed design to be pre-determined and frozen
- Client / occupants being immune from whatever market perceptions of MiC

Road map ahead:

- “Demo house” expected to open around Jul to stakeholders and public
- Some projects already in statutory process. This will set examples to authorities and stakeholders alike
- Have to rely on market-forces, a better product at comparable cost, possibly assisted by government’s approval measures
- Rental properties, hotels, medical facilities may have greater suitability for MiC