Stepping Towards Modular Integrated Construction

Goman Ho
Arup Fellow, Director of Innovations

Credit: Grand Raids History & Special Collections, Archives, Grand Rapids Public Library, Grand Rapids, MI

Once upon a time….

We invented bricks and started to build multi-story buildings.

To build multi-story, we used “tower cranes”. At that time, the cranes were made of timber.

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Now, we have heavy duty tower cranes.

Is the method of construction same as before?

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Can we make bigger bricks?

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Victoria Hall, Wolverhampton, UK



The tallest modular building in Europe

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Extensive Coordination with Multi-Disc Work

Structures

Step 1- Structural Steel

+MEP

Step 2- Pod Assembly

Step 3- Framing/MEP

+Architecture

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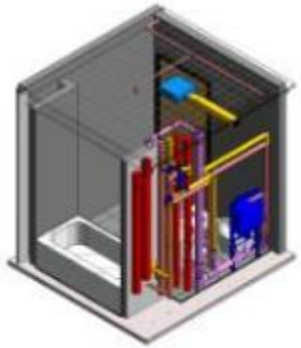
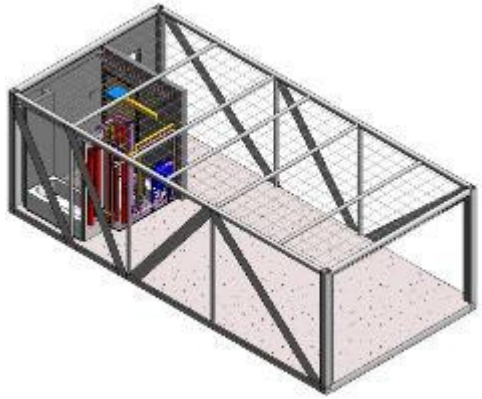
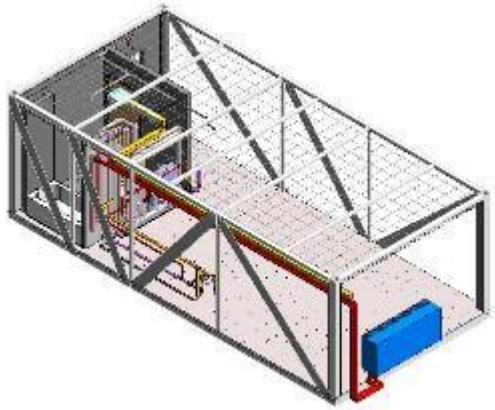
4D Production Sequencing



Phase 1. Bathroom Pod Fabrication

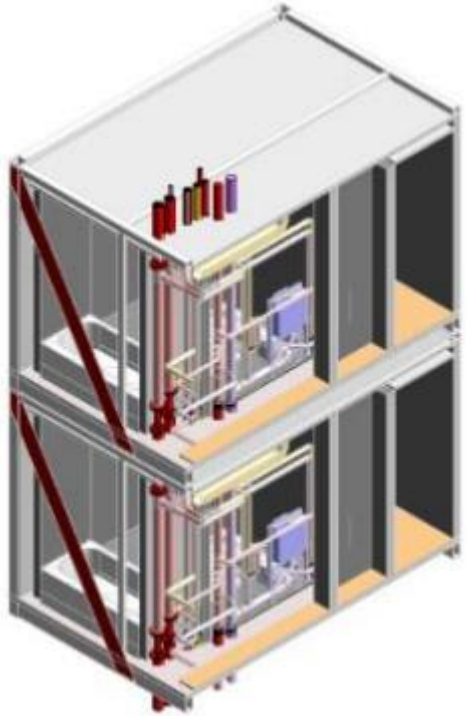


Phase 2. Factory installation of Pod into Module



Phase 3. Factory Module MEP Work

Phase 4. Module Factory Finish Work



Phase 5. Mateline Connections in Field

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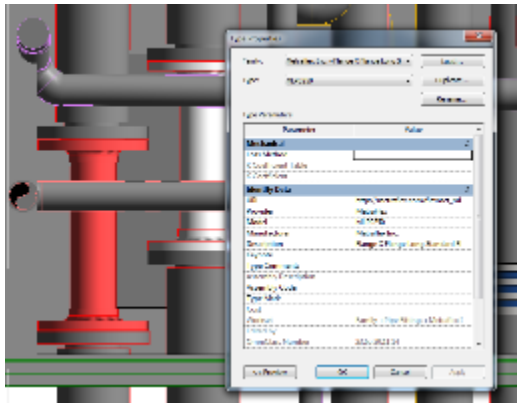
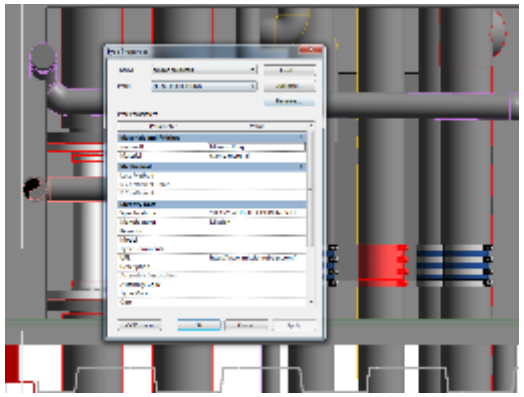
Embedded design data within model

- Intelligent “families”
- Parametric grouping
- Modular constraints require accurate representation of services and geometry
- Ability for:
  - Spec integration
  - Equipment schedules
  - Quantity scheduling
- Coordination





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CIC MiC Display Centre

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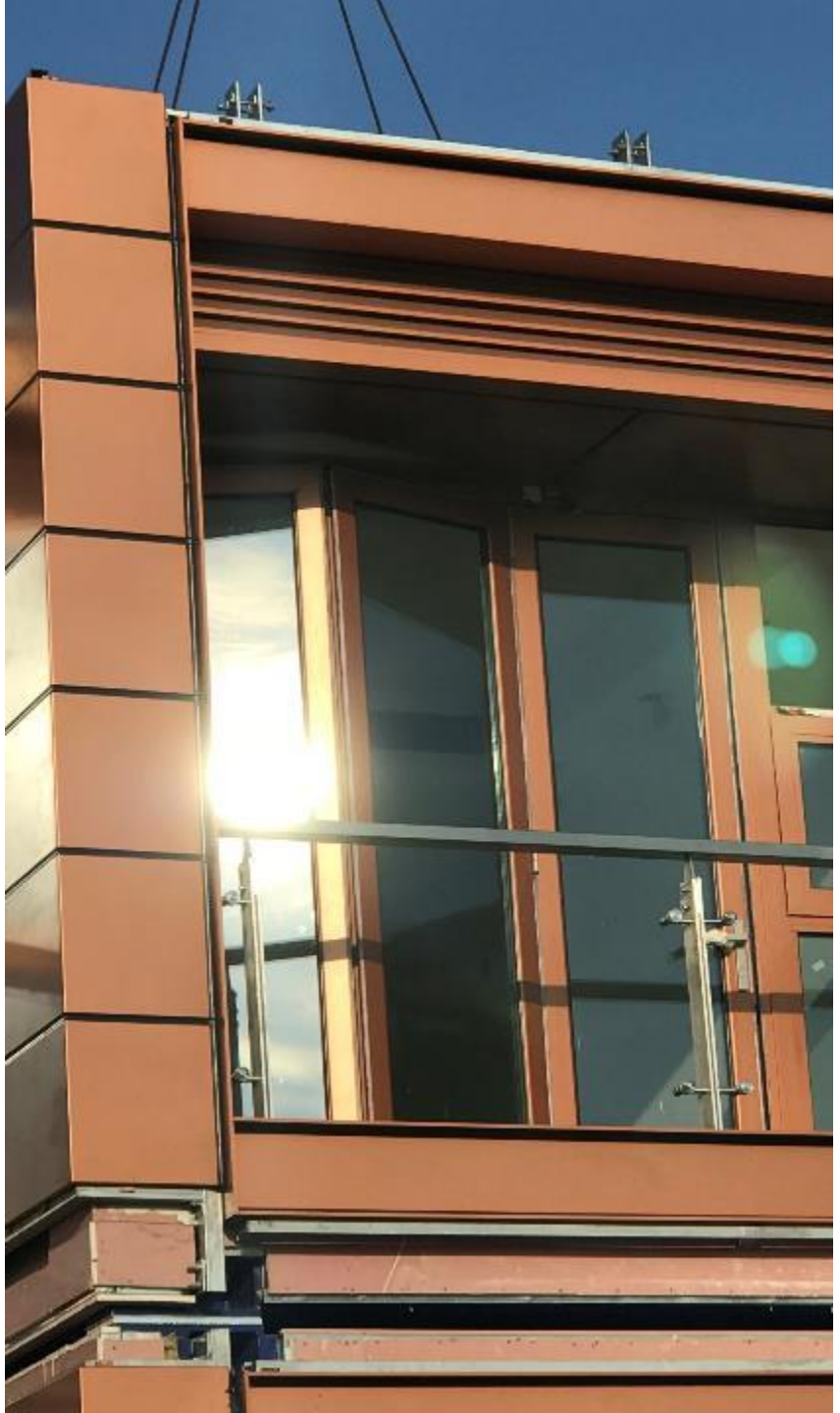


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CIMC


CIMC
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Exhibition Space

Elderly Home


Hotel Room
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Hostel (e.g. Student)

One Bedroom Unit

Three Bedroom Unit

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Potential for MiC in Hong Kong

Modular Construction in Hong Kong: Drivers?

- Productivity greater efficiency
- Increases in labour costs
- Rapid development-Strong demand for housing, student residence, nursing and student home, etc
- Sufficiently large market/sector
- Advances in technology in design tools and manufacturing process
- Safety
- Better risk control
- Improved Sustainability
- Weather condition
- *Policy – incentive to encourage investment, research, training.*

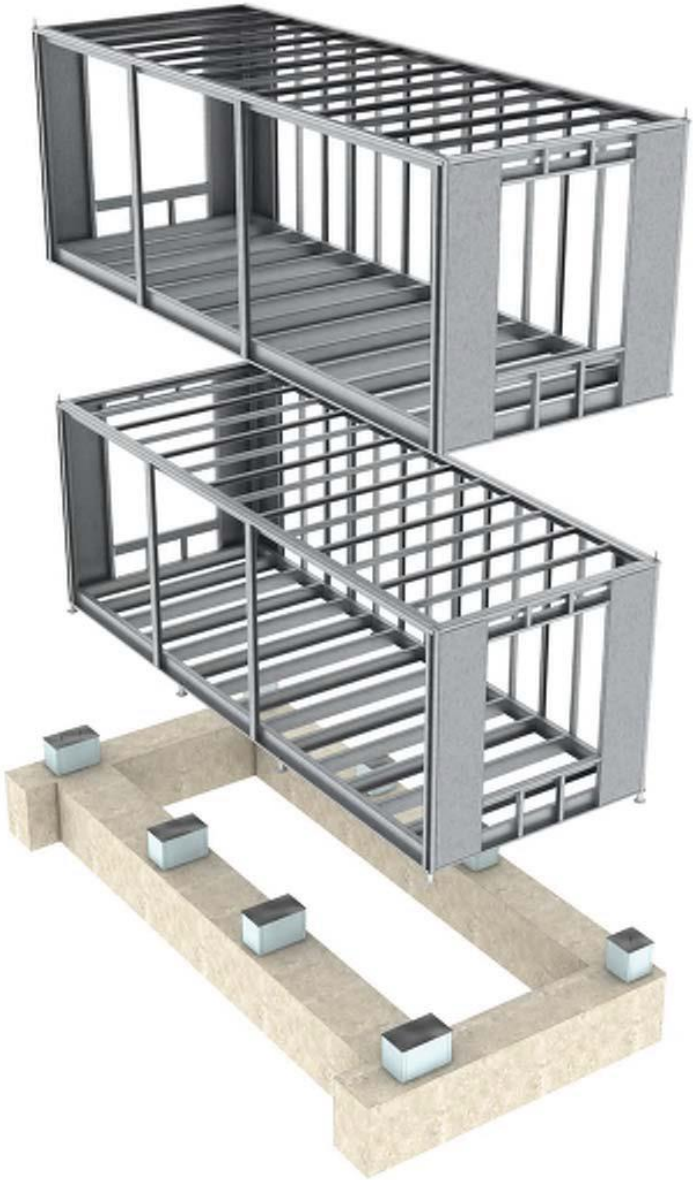
Modular Challenges

Mind set, Investment & Design Issues

- Consumer confidence - Patchy track record and perceived negatively
- Skeptical – long term flexibility
- Dimension and weight of units

- Robustness – vertical and horizontal ties.
- Service interfaces
- Fire rating, Acoustic performance
- Current regulation constraints

Typical Modular Arrangement



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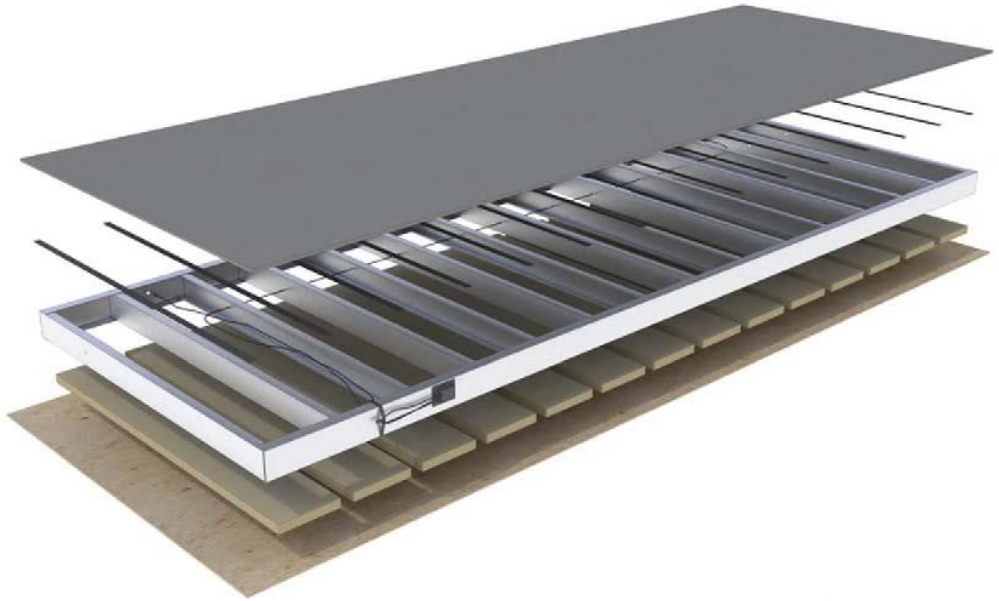
Structural Floor System for Modular Construction

Steel Floor Cassette Option

- 22~25mm Cement floor board
- 3~5 mm neoprene anti-squeak strips provide damping
- steel joists
- standard cold-rolled steel edge beams
- foam concrete/ sound insulation (optional)
- base protection board (optional)



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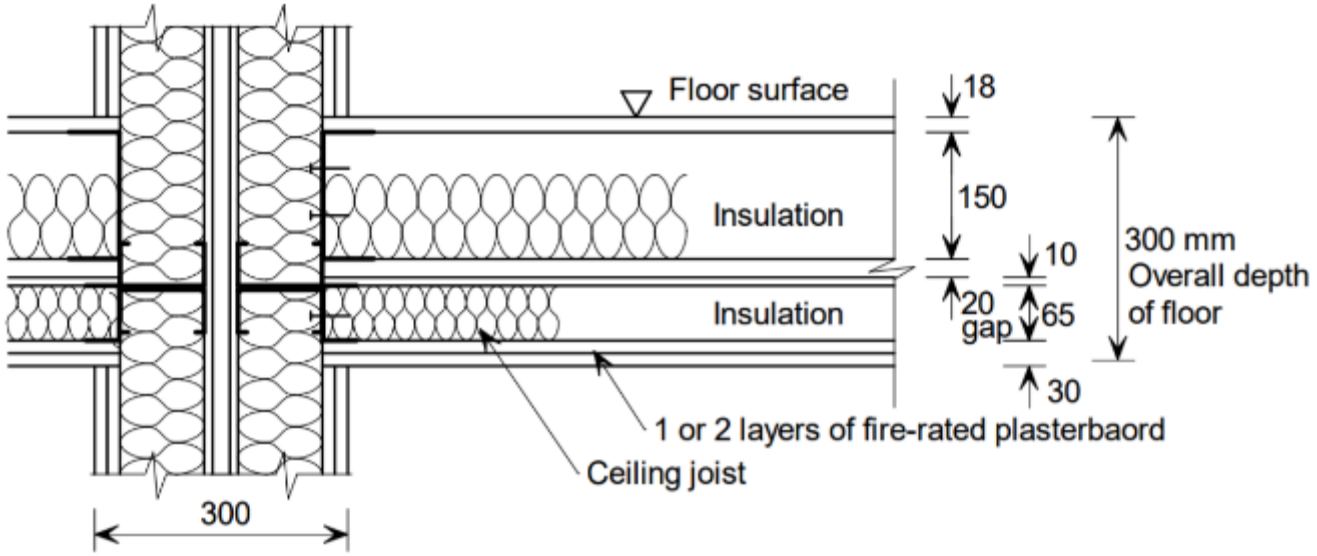
Typical Floor and Ceiling Details



(b) Cross - section through floor and ceiling

Details of 4-sided modules showing recessed corners with additional angle sections

SCI

Building Design Using Modules

R M Lawson
BSc PhD CEng MICE
MIStructE MASCE ACGI

Introduction

The use of modular and other lightweight forms of building construction is increasing. The benefits of off-site prefabrication and improved quality in manufacture are being realised for residential buildings, for mixed commercial/housing projects, educational and health sector buildings.

The various design issues related to compliance with the Building Regulations, including structural action, acoustic and thermal insulation, were explored in the SCI publication: *Residential Buildings using Modular Construction* (SCI P302).

This publication reviews the basic principles of design using modular construction and addresses the opportunities to achieve a sensible level of standardisation, covering basic dimensions for planning interfaces with cladding, services and other details.

The main sectors of application of modular construction are:

- Private housing
- Social housing
- Apartments and mixed use buildings
- Educational sector and student residences
- Key worker accommodation and sheltered housing
- Public sector buildings, such as prisons and MoD buildings
- Health sector buildings
- Hotels

Unite Project in Plymouth; Modules supported by inclined tubular columns
Courtesy, Unite Modular Solutions

KEY BENEFITS

The market characteristics that influence the choice of modular construction, are:

- Economy of scale through repetitive manufacture.
- Speed of construction.
- High level of quality control.
- Site constraints and methods of working require more off-site manufacture.
- Minimum disruption to the locality is paramount.
- Suitability for use in building renovation projects, such as roof-top extensions.
- Consistency of supply (quality of supply in larger projects).
- Adaptability for future extensions.

Courtyard view at Murray Grove, London showing pre-fabricated balconies
Courtesy, Cartwright Pickard Architects and Yorkon

Project sponsored by:
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Modular Challenges

Fabrication, Erection & Maintenance

- Crane tonnage & on-site storage of modules overnight
- Logistic and Access – dimension of units controlled by traffic, road access.

- Waterproofing/Leakage control
- Maintenance crew familiar with the system

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Transportation

- In HK, for vehicle not exceeding the limit as listed in table 2.2.1.1 do not require escort and permit.

Table 2.2.1.1
Overall Dimensions of Vehicles

Vehicle	Overall Length (m)	Overall Width (m)	Overall Height (m)
Private Car	6.3	2.3	2
Taxi	6.3	2.3	2
Invalid Carriage	6.3	2.3	2
Light Bus	6.9	2.3	3
Bus			
(i)Single Deck	12	2.5	3.5
(ii)Double Deck	12	2.5	4.6
Articulated	15	2.5	3.5
Light Goods Vehicle	10	2.5	3.5
Medium Goods Vehicle	11	2.5	4.6
Heavy Goods Vehicle			
(i)Rigid	11	2.5	4.6
(ii)Articulated	16	2.5	4.6
Special Purpose Vehicle	12	2.5	4.6
Tricycle	-	1.1	-
Trailer	13.5	2.5	4.6
Pedestrian-controlled Vehicle	4.3	1.6	-

Source : Transport Planning & Design Manual Vol 2, Transport Department, 2018

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Must modules be steel?

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How about concrete?

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Thank You

goman.ho@arup.com