Stepping Towards Modular Integrated Construction

Goman Ho
Arup Fellow, Director of Innovations
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.
Now, we have heavy duty tower cranes.

Is the method of construction same as before?
Can we make bigger bricks?
Victoria Hall, Wolverhampton, UK

The tallest modular building in Europe
Extensive Coordination with Multi-Disc Work

Structures

+MEP

+Architecture

Step 1 - Structural Steel

Step 2 - Pod Assembly

Step 3 - Framing/MEP
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
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
Exhibition Space
Elderly Home
Hotel Room
Hostel (e.g. Student)
Three Bedroom Unit
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
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)
Typical Floor and Ceiling Details

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

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

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<th>Vehicle</th>
<th>Overall Length (m)</th>
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<td>Pedestrian-controlled Vehicle</td>
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Source: Transport Planning & Design Manual Vol 2, Transport Department, 2018
Must modules be steel?
How about concrete?
Thank You

goman.ho@arup.com