GII Visit to Broad Sustainable Buildings (BSB)

Changsha, Hunan, China - June 30-July 1, 2017

Context

The first Site Visit of 2016 was to BROAD Group, focusing on the innovations related to Broad Sustainable Buildings (BSB) and prefabricated, prefinished volumetric construction.

One June 30 and July 1, approximately thirty executives from around the world participated in a visit to BROAD Group and BSB in Changsha, China. The objectives were to explore the following themes:

- Understand the mechanics and benefits of the BSB technology
- Explore the applicability and constraints of BSB (or related construction) in other markets
- Quantify the potential benefits for the E&C sector
- Discuss the potential go-to-market strategy in relevant markets

Company and technology overview

Established in 2009, BSB manufactures pre-fabricated modular buildings that are touted as five times more energy efficient (through thermal insulation), 10-30% cheaper to build, and contain 20 times cleaner air (99% PM2.5 filtration). Ninety percent of the construction process takes place in a controlled environment in the factory, resulting in precision quality and only 1% waste. BSB buildings use a steel structure whichBSB claims will last 10 times longer than conventional buildings, has been tested to survive a 9.0 magnitude earthquake, and up to 96 percent of the building is recyclable at end of life.

The salient features of this technology include:

- Identical construction modules for faster fabrication and installation
- Preinstalled MEP fixtures on ceilings/walls
- Efficient logistics solutions from the prefab factory to site and completely thought through construction sequencing
- Accelerated assembly on site, along with smooth finishing

A brief summary of the technology, design, construction, cost and business models follow. ***Please note that McKinsey & Company does not endorse the organizations hosting the Innovation Site Visits or validate their claims, and their inclusion does not contain legal or investment advice. For any clarification on the materials within this document, please contact BSB directly.***

A. The Technology

Fabrication

Fabrication of the panels takes place at the BSB factory in Hunan Province, approximately 1.5 hours by road from BROAD Town. Participants observed three types of panel technology.

1. Current System – the panel is constructed in steel and the concrete cast on the uppermost level
2. New System – the panel is assembled in stainless steel
3. Honeycomb - we were only able to view the preliminary assembly as the technology is in the very early stages of development but will offer strength, anti-corrosion and soundproofing benefits.

B. Design

The Design Process

- Design Software - SAP2000, Midas and YJK
- Floor Panel Clear Spans - Honeycomb panels allow buildings to enjoy a 12m x 12m column grid. The whole building is stainless steel structure (or carbon steel as required by the client), and the second design of facade is more convenient than that of reinforced concrete buildings, even balconies can be added or removed as required.
- Earthquake Resilience - BSB is able to meet respective national building standards.
- Anti—corrosion treatment - BSB state that it is not necessary for honeycomb buildings as they use stainless steel which only corrodes by 0.1mm per 2000 years under normal atmosphere (5000 times better than that of steel)
- Fire Protection - The BSB fire protection design and construction shall comply with the local fire codes. BSB columns are 3-h fire resistant, complying with the Chinese requirements for the steel structure. Other fire security designs are the same as those with conventional buildings.

C. Construction

Logistics and Transportation

- Container example: All components (including assembled main boards) are placed in a container for long distance transport. Each container can accommodate 120 m^2 of structural parts or 90m^2 of components like exterior façade or 70 m^2 with interior wall doors
- Truck loading example: 3 columns (12m X 0.8M X0.4M) at the bottom and 3 main board (12M X 4 M), 8 cross beams and 1 staircase on top

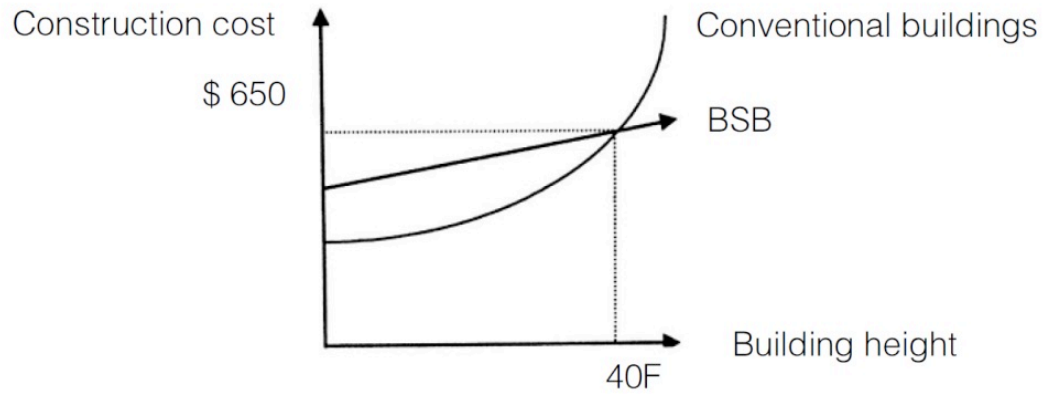
Construction duration by phase

- T30 - estimated timetable for a 30-story, 20,000 m^2 project:
  - Design and permit application: **3 months**
  - Foundation construction and component production (simultaneous), **4 months**
  - Transportation and installation: **2 months**
  - Total : **9 months**
- J57 - estimated timetable for a 180,000 m^2 project:
  - Design, review and permit application: **6 months**
  - Foundation construction and component production (simultaneous): **6 months**
  - Transportation and installation: **2 months**
  - Total: **14 months**.
  - 3 stories / day –this mainly refers to the structure and facade installation.
  - As building's MEP is integrated inside the floor slabs, interior decoration only includes installation and painting of interior walls. Because the building parts are factory-made, BSB's construction period saves more than 200% of the time compared to conventional buildings.

D. Cost

Cost Advantage

- BSB enjoys distinct cost advantages in the areas where labor cost is high
- Where the labor cost is lower, BSB's advantages can be displayed more clearly only when the building exceeds a certain height. In China, for reference, the construction cost of conventional buildings would go through a huge increase when the building surpasses 100m.



J57 Cost

- The total cost of J57, a 57 story building in Changsha, was USD 960/m^2, which is broken down by phases of construction, as follows
  - USD 336/m^2 for structure,
  - USD192/m^2 for installation,
  - USD 144/m^2 for MEP,
  - USD 144/m^2 for interior decoration,
  - USD 96/m for facade,
  - USD 28/m^2 for design review and
  - USD 20/m^2 for transportation.

E. Business Models

At present, BSB offers four business models for customers:

1. **Franchisee**
   - Package franchisee - BSB transfers its technology and management system while the client is responsible for factories set-up and all operations in the designated market.
   - For example, package franchisee fee for Malaysia is USD 50 million.
2. **Sales and installation franchisee:**
   - The client takes charge of the installation and sales of BSB products in the designated market.
   - Sales and Installation franchisee fee is 50% of the Package franchisee fee mentioned above.
3. **Sales representative:**
   - The client takes charge of the sales of BSB products in the designated market.
   - Sales franchisee fee is 30% of the Package franchisee fee mentioned above.
4. **BSB undertakes individual projects via EPC model**
   - With a current focus on projects over 40 floors.

Factory Setup costs and operations

- An investment of USD 30 million and 500 people (400 for installation) is required to run a factory with an annual capacity of two million m^2.

For more information:

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Sources

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