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LOOKING FOR AN OPTIMAL URBAN RESIDENTIAL BUILDING SYSTEM?

Roger-Bruno RICHARD

School of Architecture, Université de Montréal, P.O. Box 6128 Centre-ville Station, Montréal (Québec) H3C 3J7, Canada. Email: roger.richard@umontreal.ca

Abstract
To face the dilemma of buildings being site-related and technology factory-related, three building systems strategies are available, each one generating a family of Building Systems: the site intensive Kit-of-Parts; the Factory-Made 3D Module and the Hybrid. Whereas the first involves elaborate site operations and the second pays to transport "air", the third gets the best of both worlds: the Hybrid, and in particular the Load-Bearing Service Core, concentrates the complex work at the factory and leaves only simple space generating operations on the site.

In a Load-Bearing Service Core system, all the complex and sophisticated equipments and services forming the "Serving" area of a dwelling unit are industrialised as 3D compact modules completely finished at the factory. Once at the site, they support the "Served" area, which can be built with the available local technology or through factory-made sub-systems (mainly Slabs and Envelope panels).

Keywords
Industrialised building systems, factory production, serving and served spaces.

INDUSTRIALISATION OFFERS A SOLUTION

Industrialisation has demonstrated a capacity to reduce cost and improve quality in order to make available to the vast majority of people almost all the products offered on the market, including most construction materials and components (trusses, pre-stressed slabs, curtain walls, etc.). But, generally, it is not the case for the building itself.

Industrialisation is first and foremost a mathematical equation: a large market ("quantity") will amortise (divide into fractions) the initial investment in a technology capable of simplifying the production of a finished product, thereby reducing the costs and facilitating the delivery of affordable quality units to the vast majority of people.

In an industrialised construction industry, the "Products" are not buildings but preferably Building Systems. A Building System is a set of parts and accompanying rules where the details are solved before actual buildings are planned [Richard, 2004.05]: construction is not re-invented each time a building is planned, as is still the case with the typical set of "working drawings" in the traditional "Service" approach where each building is treated as a prototype.

To generate individualisation within mass production, the Building Systems can apply the same four strategies developed by other industries: Flexibility of the Product, Flexibility of the Tools, Multipurpose and Combinability (Richard, 2004.01]). Individualisation is not an

AN ECONOMICAL SOLUTION

A major cost saving can be projected with the Load-Bearing Service Core. A recent feasibility study done in Montreal demonstrates an economy up to 20 % for the Richardesign System (Figure 8) when compared to traditional cast in place concrete construction of the same quality (medium to high priced condominium). Five factors are contributing to that economy:

- A single material can be used to meet the fireproofing and soundproofing criteria, as well as to form some of the equipments and to facilitate maintenance (round corners and polymer finish).
- The 3D Core can be produced by a single moulding operation, through collapsible formworks.
- All the complex and sophisticated equipment and services being completely produced and finished at the factory, the full qualitative and economical advantages of prefabrication are available.
- The transportation costs are marginalised by the geometry of the typical Core (its width and length are exactly those of a container) and by the fact that most of its content would have to be transported to the site anyway.
- The site activities can be limited to simple and mostly "dry" operations: casting the foundations, installing the Cores, fixing the Slabs between them, connecting the plumbing and electrical conduits between the Cores, attaching the Envelope panels, completing the roofing (thermal insulation, drainage and membrane), etc.

CONCLUSION

Full of value-added elements and compatible with the geometry of a container, the Load-Bearing Service Core can easily be transported anywhere in our globalised world, to developed or developing countries alike and/or be the object of technology transfer.

As an architectural language, the use Load-Bearing Service Core does involve a strict planning discipline. Yet, by locating the Core perpendicular to the façade, the Served areas are totally open and transversal: offering natural cross-ventilation, full day-lighting, broad view from both sides and planning flexibility. And a basic set of Cores can generate a plurality of housing forms and urban networks.

REFERENCES

Richard, R. B. (2004.01). "Industrialised Building Systems: The Palette of Options", *International Journal for Housing Science and its Applications,* 28(1), 1-7.

Richard, R. B. (2004.05). "Applying Industrialised Strategies and Technologies to the Production of Building Systems", *Proceedings of CIB World Building Congress 2004*, Paper 841, Toronto, Canada, May 6.

Richard, R. B. (2004.09). "Industrialised Building Systems: Reproduction before Automation and Robotics", *Automation in Housing Journal,* (14), 442-451.

Utida, Y. (2002). *"The construction and culture of architecture today: a view from Japan,"* Ichigaya Publications Co. Ltd, Tokyo, Japan, 53.

Yeang, K. (2000). "Service cores", Detail in Building collection, Wiley-Academy, Chichester, Great Britain, 9.