HOUSING and CONSTRUCTION news

ISSN : 1511-497X
March 2001
Volume 3/ Issue 1

NEWSMAGAZINE OF THE HOUSING RESEARCH CENTRE, UNIVERSITI PUTRA MALAYSIA

Editorial

The sucess of the nation's resolve of becoming a 'fully industrialised home owning democracy' hinges largely on industrialisation of its construction industry which in turn presupposes adoption of modular coordination in house designs and prefab building elements. This issue of the Newsletter is devoted exclusively to modular co-ordination in construction with articles from experts to answer 'what' and 'why'. We hope that the readers will enjoy going through these articles. Your views on any of the issues raised may be sent to the Secretary of the Editorial Board for possible publication in later issues under the column 'Reader Write'.

Dr. Jawahar Nesan, the earstwhile editor, has left the country and a new Editorial team has been put in place, as indicated elsewhere. We at the Housing Research Centre express our sincere thanks to Jawahar for his pioneering efforts. We wish him well.

A regular feature under the title 'Latest in Construction and Housing' will be introduced in the next issue of the Newsletter. We depend on you to send us interesting developments including research activities in construction and housing for publication for the benefit of the readers.

Prof. Dr. D.N. Trikha
Chief Editor

Modular Coordination in the Building Industry

Towards a More Productive Construction Industry

Construction Industry Development Board (CIDB Malaysia) – Ir. Elias Ismail, Senior Manager, R & D Unit, CIDB

The dimensional control of building has always been important because it is necessary to place the building parts in such a way that they fit and function properly. In traditional building practice, control of dimensions is relatively simple. The materials used such as bricks, timber, mortar, concrete, plaster etc, can be cut, shaped, casted and set up easily as the building is being erected. However, with increasing industrialisation of the building industry, a steadily larger part of buildings is made up of prefabricated components, delivered to the building site from the factories. Evidently, some sort of dimensional coordination of these components themselves and with the design is of paramount importance. The full benefit of industrialisation is impossible without standardisation. No effective standardisation is possible, in the building industry, without dimensional coordination.

What is Modular Coordination?

Modular coordination is the concept of coordination of dimension and space, in which buildings and components are dimensioned and positioned in terms of a basic unit or module. This basic module is known as '1M' which is equivalent to 100 mm. It is internationally accepted by the International Standards Organisation and many other countries including Malaysia. Such dimensional coordination is therefore known as *modular coordination.*

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For enquiries and contributions, contact the editor :

Prof. Dr. T.N. Trikha
Faculty of Engineering, Universiti Putra Malaysia,
43400 UPM, Serdang, Selangor Darul Ehsan, Malaysia.
Tel: 03-89486101-2113 Fax: 03-89488939
Email: jawahar@eng.upm.edu.my
http://www.eng.upm.edu.my/~hrc

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Socio-Economic Aspects of IBS

Mohd Fakri Zaky bin Jaafar
Dept. of Architecture, Faculty of Design & Architecture, UPM

Introduction

The idea of coordinating dimensions and modularisation of building components should bring some good news for the construction industry. Reducing waste and miscommunications would be the immediate benefits. However, there are certain issues which need to be addressed when MC and industrialised building systems are to be implemented as a national agenda. The impact of this approach on construction has a socio-economic bearing which needs to be examined.

To Mass Produce or Not to Mass Produce.

The need to mass produce houses is not new. The industrial revolution provided mankind with the capability to produce goods in large numbers and at a much shorter time than ever before. During the first era of Industrial Revolution, the sociological impact of urbanisation gave rise to the need for mass housing to accommodate the workforce in new industries. Following the Second World War, Europe and the US were looking for a quick means to provide housing for the population whose homes were destroyed. To achieve the benefit of economies of scale of mass production, two important concepts, i.e. standardization and mass manufacturing of building components needed particular attention.

Problems later ensued from this approach to housing. Peter Rowe sums up this problem in his book *Modernity and Housing*.

"...when it came to the making of housing, certain simplifying assumptions that formerly appeared necessary for high volume housing production were called into question......development by rote of technically efficient though architecturally reduced, no matter at what volume, was becoming clearly unacceptable....people, it appeared, needed more than simply a place to live. They needed a home, an environment they could call their own and associate proudly with a broader cultural enterprise. Too narrow an extrapolation of modern housing, along with many other forms of contemporary building, had resulted in overdetermination, misfit and a crisis of meaning." *(p.172).*

The answer to this malady has been offered in the concept of an open system. In this concept, smaller components are mass produced, but at the same time offer variety in the final design of the whole unit. This solution helps to a certain degree. However, the pressure to tap the economies of scale of manufacturing plants means a large degree of standardisation is unavoidable. It is therefore necessary to ensure the maximum possibility of variety in the final design, as it will respond better to different user needs. The balance between the need to mass produce and the need to provide the sense of meaning in housing had to be achieved.

Socio-economic Impact.

Modular co-ordination in the current form might require certain materials to be produced in new sizes, while some may need a high degree of accuracy. As such, new manufacturing equipment may have to be acquired. This involves a significant amount of capital re-investment. This could pose a problem to small manufacturers.

The upfront capital requirement to manufacture large prefabricated components in some IBS will also probably leave the small manufacturers incapacitated.

These scenarios might lead to monopoly of a small group of large manufacturers in the market. To pre-empt monopolisation of certain building products, the system adopted must take into account the issue of accessibility for manufacturers with a smaller capital set up. These can be re-solved by the provision of financial services which are more capital friendly.

Alternative Open System

An alternative approach to modular coordination would be the one, which carries the benefit of reducing waste and miscommunication while at the same time is socially and economically friendly to manufacturers and buyers. In the 1970s, an architect by the name Walter Segal was

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concerned with the inefficiency of the then prevailing construction system, which resulted in much waste in terms of material, energy, finance and efficiency. He resorted to designing houses using modular grid dictated by material uncut sizes as found in the market. He treated building materials such as brick, timber, glass, and panel as basic building blocks in construction. As such, there was no need for the manufacturer of materials to resize the casts in their production machines. This is truly an open system, where the reliance on upstream industry product does away with the need for a sophisticated downstream, energy-consuming industry.

Conclusion

Adoption of MC and IBS is certainly the way forward for developing nations who need fast and efficient construction systems. However, in order to iron out any possibility of social and economic pitfalls, the concept should be:

1. 'Open' in the sense it provides variety in design to suit various needs, as well as interchangeability between different building products.
2. Economically friendly, so as to ensure 'democracy' in the production of construction materials and components. Ironing out these small potential 'glitches' would lead to a more economically and socially friendly construction industry, in keeping with the global awareness of sustainable concept in development.

Bibliography:

James Steele. 1997. *Sustainable Architecture; Principles, Paradigms, and Case Studies.* New York : McGraw Hill.

Peter G. Rowe. 1995. *Modernity and Housing.* London : The MIT Press.

M. Jaafar. 1996. *The Segal Method: An Alternative to Malaysian Housing Scenario,* Graduate dissertation, University of Manchester, England.

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The module that has been developed has the following characteristics :-

- Industrially friendly i.e. able to cater for manufacturing, transportation and assembly requirements.
- Small enough in terms of size in order to provide the necessary flexibility in design.
- Large enough to promote simplification of the number of sizes for various components.
- Internationally accepted to ensure that it can be mass produced to cater for a global market.
- Ergonomic i.e. able to improve people efficiency by providing adequate space for human living and working conditions.

Why Modular Coordination?

The principal objective of implementing modular coordination is to improve productivity in the building industry through industrialisation. Modular coordination can facilitate the achievement of industrialisation through :-

- Providing a guide to building component sizing: this can reduce as much as possible the need to further trim and shape the materials to fit together in construction; thus, reducing wastage of labour and materials.
- Mass production of building components at factories: thus, ensuring good and consistent workmanship and quality.
- Permiting standardisation: this encourages the use of standardised building components for the construction of different types of buildings; it simplifies site operation by rationalising, setting out, positioning and assembling of building components at the site.
- Ensuring dimensional coordination between installation (equipment, storage units, other fitted furniture, etc) as well as with the rest of the building.
- Encouraging "open systems" : the interchangeability of components, whatever their material, form or method of manufacture.
- Establishing a basis for the computerisation of the building industry

How Can Modular Coordination Improve Productivity?

The principal component in modular coordination is the standardisation of the building components and structures. This is important as standardisation facilitates the attainment of the three objectives of all industrial development :

1. Mass production of selected components by specialist firms thus achieving economies of scale.
2. Sale of the components on the open and possibly international market, as they are of standard dimensions.
3. Concentration of other specialist firms on the assembly of components into a final consumer product.

Standardisation not only leads to flexibility in the manufacturing and assembly processes but also promises savings in time, energy, material and therefore cost to the designers and the builders.

Through standardisation, an increasing number of building components may be prefabricated. The key consideration here is to achieve a suitable degree of accuracy in the components so that they may fit together and slide into position without further modification. Prefabrication also makes it possible for the manufacturers to produce in quantities as required by demand. This will ensure a higher and guaranteed turnover in their products enabling them to make long term plans and thus, lowering the cost of the components. Consequently, this is in tandem with the Government's policy to develop and promote the automation and industrialisation of the construction industry.

Conclusion

Modular Coordination can facilitate the achievement of greater productivity in the building industry by virtue of its ability to discipline the dimensional and spatial coordination of building and its components, thus allowing for a more flexible open industrial system to take shape.

Use of Putra Block™ in the Construction of a Modular House

Ir. Dr. Mohd Saleh Jaafar
Head, Department of Civil Engineering, Faculty of Engineering, UPM

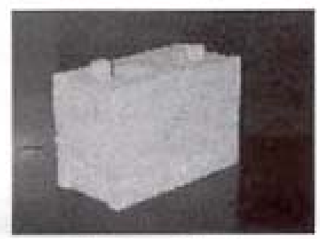
The Construction Industry and Development Board (CIDB) and Jabatan Perumahan Negara (JPN), Malaysia are determined to ensure the use of modular coordination in the building industry. A Parliamentary act on the adoption of Modular Design Rules for buildings is being proposed to mandate the use of industrialised components and construction in the industry. The Modular System is expected to also encourage the industrial production of building components where the Open Concept for Building Construction can be implemented, so that building components produced by any manufacturer could be used in any building project, subject to the architectural specifications. Thus the large initial capital investment usually required for industrialisation gets distributed over several projects, when the architects adopt Modular Design Rules in their building design.

Realising the importance and advantages of the use of the Modular System in construction industry, the Housing Research Center (HRC) of Universiti Putra Malaysia has adopted modular coordination as a key element in developing its 'Open' Industrialised Building Systems (IBS). Regarded as one of its important achievements, the HRC had developed and patented a system that uses interlocking load-bearing hollow blocks called the Putra Block™.

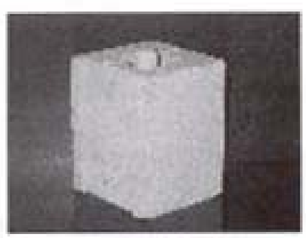
This system employs three different types of blocks, called the Stretcher Block, the Corner Block and the Half Block (Figure 1). The Stretcher and the Corner Blocks have overall dimensions of 300x200 x150mm, while the Half Block has overall dimensions of 150x200x150mm. These dimensions have been selected as they are expected to be most modular friendly as they conform to the Modular Design Rules requiring the horizontal controlling planes to be in the modular dimension of 3M or 300mm, and the vertical controlling planes to be 1M or 100mm.

To demonstrate the versatitility of the Putra Block in catering to the demands of 'Open' IBS, a sample house has been constructed at the UPM campus.

(a) Stretcher block



(b) Corner block



(c) Half block

Figure 1 : Putra Block™ developed by the Housing Research Centre UPM

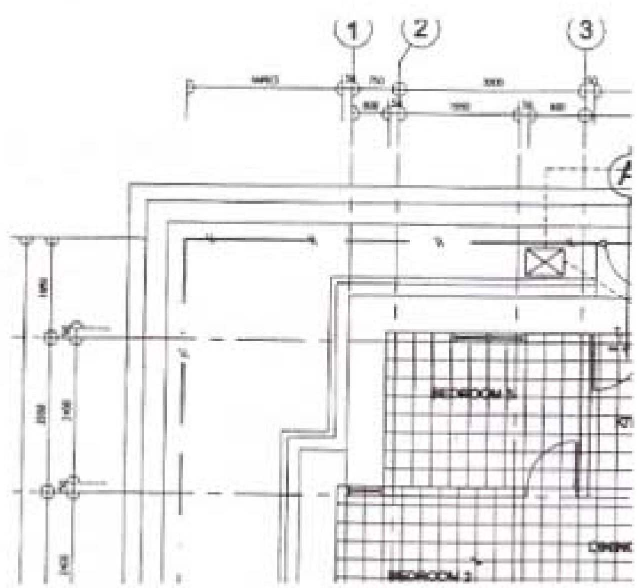


Figure 2 : Part of the plan for the sample house

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The Half Block with a length of 150mm can be conveniently put in the technical zones of 150mm as shown in Figure 2. This allows other spaces in the house to have modular dimensions, thus facilitating the use of other modularly coordinated building components such as windows, doors and built-in cabinets. It may also be seen that if the typical room heights of 2800mm or 3000mm are adopted, there is not a single block that needs to be broken to fit into the spaces required. Thus there is no wastage of materials, and indeed, exact number of blocks required for a specific house could be estimated from the architectural drawing.

Putra Block™ has not only been found to be modular friendly, but also suitable for adoption in the 'Open' building system of construction. In the sample house, it may be seen that HRC only produces the blocks, but other components in the house construction are readily obtainable from the market. The Putra Block construction has other features that help reduce construction time and labour. The blocks are self-aligned and adopt mortarless construction. The system also requires minimal in-situ concreting and no formwork. When on site concreting is required e.g. to cast lintels and tie beams, the blocks are used as permanent formwork, thus avoiding the need for the timber formwork. Figures 3-8 show some of the important steps in the construction of the sample house using the Putra Block™.

Acknowledgement:
The Housing Research Centre (HRC) of Universiti Putra Malaysia wishes to thank the Ministry of Housing for the research grant provided to develop this system. The author wishes to thank all members of HRC who have provided assistance for the construction of the sample house.

Figure 3. Preparing the ground slab

Figure 4. Mortarless construction and self-aligned features of the Putra Block™

Figure 5. Walls with window opening

Figure 6. Construction up to the roof level

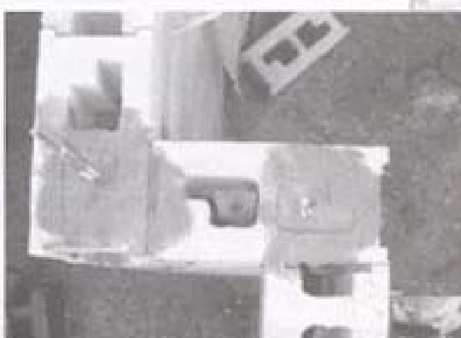

Figure 7. Sample use of minimal on-site concreting

Figure 8. Completed sample house

HRC NEWS

13 January 2001

Jamuan Hari Raya
Alumni Kejuruteraan Awam (Putrawam)

Organised by HRC at Bilik Seminar, Kompleks Kejuruteraan Awam, UPM, the function was officiated by the Dean. All Civil Engineering staff were invited and about 150 alumni members/associate members turned up for the function.

15 February 2001

Handing-over Ceremony

The sample house of the The Putra Block Research Team was finally completed. The keys to the house were officially hand over to the HRC management, marking another accomplishment by the Putra Block research team. This small handing-over ceremony included breakfast with Pn. Dang Anom of th Ministry of Housing.

9-11 March 2001

HRC 2001 Retreat/Annual General Meeting

All members including family members were invited to this annual event. This year's main event was the presentation of HRC Annual Report for year's 2000. Also discussed was the Business Plan for year 2001 with the main agenda being commercialisation of Putra Block.

Forthcoming Events

30 Oct. - 1 Nov. 2001
3-Day Specialist Course on Bridge

Highlights of the course:

- Overview of the structural behaviour of different bridge types
- The critical stress-resultants for structural cracking
- The latest non-destructive techniques for possible causes
- A computer algorithm to assess bridge condition
- Proven methods of repairs and strengthening
- Discussion of two recent case studies of bridge assessment and rehabilitation in Malaysia

17 September 2001

One day National Seminar on Industrialised Building System (in conjunction with CIDB's Construction Week)

Objectives:

- To discuss the latest developments in the building industry
- To provide a platform for collaboration and networking amongst Industry, Researchers and the Government
- To enhance the features of IBS through Modular Coordination
- To initiate Open Building Implementation
- To introduce the concept of Automation and Robotics in Construction

ENGINEERING INNOVATION AND SUSTAINABILITY: GLOBAL CHALLENGES AND ISSUES

22nd - 25th July 2002, Kuching, Sarawak, MALAYSIA

CALL FOR PAPERS CALL FOR PAPERS CALL FOR PAPERS

Theme and Objective: The World Engineering Congress was originally proposed after the Institution of Engineer's Malaysia (IEM) study on the formation of engineers in Malaysia in 1999. The present Congress is the second Congress. The first Congress was held in 1999 and was attended by more than 500 participants from all over the world with more then 400 technical papers presented.

The theme of this congress *WEC2002*, is '*Engineering Innovation and Sustainability: Global Challenges and Issues*'. WEC2002 is to provide an avenue for deliberations on key issues on new and innovative areas of engineering for technological progress. Equally important is the issue of sustainability, which can be defined as a process of change in which the orientation of technology and the allocation of resources which is needed to meet the present needs and aspiration of mankind. WEC2002 is also meant to provide a forum for discussion on appropriate and innovative technology for development, particularly for the developing countries, meeting the need to help eradicate poverty, and bridging the technological gap between the developed and developing world. This congress shall therefore provide a good opportunity for a gathering and sharing of experiences amongst an international community of engineers and other professionals in related fields, academics, researchers, scientists as well as policy makers interested in addressing issues related to the theme of the congress. The congress is organised into eight (8) technical sessions and papers are invited under the followings disciplines:

- Biological, Agricultural and Food Engineering
- Chemical and Environmental Engineering
- Civil and Structural Engineering
- Information Communication Technology
- Electrical and Electronic Engineering
- Engineering Education, Training and Policy
- Manufacturing Engineering, Automation and Robotics
- Mechanical and Aerospace Engineering

Invited Speakers: Renowned international experts will be invited to deliver keynote and special lectures related to the theme of the congress. They include Prof. J. Allen (Manchester), Prof. J.J.O'Connor (Oxford), Prof. M. Gregory (Cambridge), Prof. S. Pallegrino (Cambridge), Prof. M.H.Rashid (Florida), Prof. A. Karaali (Istanbul), Prof. C.Christopoulos (Nottingham) and Prof. J.N.Reddy (Texas A&M).

Key dates:

- **Dateline (Extended) for submitting abstract** (about 300 words) **30th June 2001**
- **Notification of provisional acceptance**
  30th August 2001
- **Dateline for submitting camera-ready manuscript**
  29th December 2001

Exhibition: There will be a concurrent exhibition at the conference venue. For more details please liase with Ir. Peter Chong Chung Ping at Tel: 082 – 428506 Email: iemsb@po.jaring.my

For General Information and Enquiries:
Please contact:
Secretary of the Organising Committee
(A/Prof. Dr. Bujang Bin Kim Huat)
c/o Faculty of Engineering, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, MALAYSIA.
Tel: 03 – 89486101 ext. 2091/2017 Fax: 03 – 89488939 Email: bujang@eng.upm.edu.my
Homepage: http://eng.upm.edu.my/wec2002/

Geneva Gold Medal for HRC's Putra Block

"*Putra Block*TM" which is the result of a RM1.58 million research and development programme on Interlocking Loadbearing Hollow Block Building System at the Housing Research Centre (HRC) in Universiti Putra Malaysia, sponsored by the Malaysian Housing and Local Government Ministry, has won the Gold Medal Award at the 29th International Exhibition of Invention – New Techniques and Products on 4–8th April 2001 in Geneva, Switzerland. The project group which is led by Prof Abang Abdullah Abang Ali, Director of HRC was represented in Geneva by two key group members namely Associate Prof. Ir. Dr Mohd Razali Abdul Kadir and Ir. Dr Mohd Salleh Hj Jaafar during the exhibition and competition. Heartiest congratulations to all the HRC members involved in the Project.

Editor

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TESTING SERVICES FOR CONSTRUCTION AND BUILDING MATERIALS

Metallic Products

a. Reinforcing bars
b. Steel fabrics
c. Steel wire, wire ropes
d. Steel pipes and fittings
e. Ductile and cast iron pipes and fittings
f. Conveyor chain
g. Manhole cover and frame
h. Ceiling suspension system
i. Access raised floor system
j. Road studs and etc
k. Bolts and nuts

Concrete Products

a. Aggregate
b. Cement testing
c. Fresh concrete mixing and testing
d. Hardener concrete testing
- Strength and density
- Drying shrinkage
e. Fresh grout mixing and testing
f. Mortar mixing and testing
g. Concrete product testing
- Masonry block/brick-clay brick
- Paving block
- Concrete pole, pipe, pile, box culvert and manhole
h. Concrete panel
i. Scaffolding
j. Tile adhesive

CREDIBLE
COMMITTED
COMPETENT

Plastic Products

a. Water tank - PE & FRP
b. Pipes and fittings - PE, UPVC, PB, ABS
c. Electrical conduits
d. Flushing cistern
e. Composite materials
f. Table top, sanitarywares, laminates and etc

Ceramic Products

a. Wall and floor tiles - Glazed and Unglazed
b. Sanitarywares
c. Roofing
d. Safety glass tempered and laminated

SIRIM

Construction and Building Materials Testing Section
Testing Services Department
SIRIM Berhad
1, Persiaran Dato' Menteri
P.O. Box 7035, Section 2
40911 Shah Alam
MALAYSIA
Tel: 03-556 7450
556 7460
E-mail: mohd.fauzi_ismail@sirim.my

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