HOUSING and CONSTRUCTION news

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inside this issue

Editorial

Dear Reader,

This issue has R&D in Housing and Construction as the local theme. Current R&D activities at HRC and Research foresight are described. Futuristic trends in construction are highlighted in computer-integrated construction. There is an article on indoor air quality and on importance of post occupancy evaluation. It is hoped that the issue will be of some interest to you.

Our next issue focuses on 'Structural Assessment & Repairs'. We would welcome articles from our readers on the above theme. The article should reach us latest by June, 2002.

Prof.Dr.D.N.Trikha

Research & Development at Housing Research Centre

Waleed A. Thanoon
Research & Development Manager
Housing Research Centre

Research is generally carried out in different aspects of our life with an aim to solve the problems faced and the potential needs. Malaysia's dream of an affordable home owning democracy by 2020 can be realised by innovative quality house designs that cut down on costs, labour need and energy requirements to provide environmental friendly, durable and culturally harmonious housing. Comprehensive R&D programmes at HRC aim to encompass the entire spectrum of issues related to housing at national and international levels. Technical aspects of engineering and architecture such as planning, building materials and elements, indoor environment and infrastructure are addressed in a comprehensive manner. Moreover, to get a holistic and realistic solution to housing problems, research on finance, law and sociology underscores the technical input.

To ensure relevancy of research in terms of future projection, HRC has stimulated a research foresight on:

1. Smart Housing
2. Automation in Manufacturing & Assembly of Building Elements
3. Development of Testing Methods and Procedures
4. Development of Sustainable Local Material
5. Design Houses to Fit Youth, Elderly & Disabled
6. Development of Building Services
7. Effect of Tropical Environment and Wind on Housing

continued on page 2

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Promoting the role of Post Occupancy Evaluation in Housing Research and Development

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Abstract:

POE provides the mechanism of feeding back response in a design process in the form of a closed loop circuit. Among other benefits, it could prove to be a self-correcting mechanism for housing design and development. Along with technological research into housing construction, it is just as important to provide a meaningful communication from past mistakes into the design of new housing developments. The article seeks to outline the importance of developing a systematic POE practice for the benefit of housing in Malaysia.

The development of a housing scheme, by any other means, can be described as a design activity. As such it involves the process of conception, design and production. Any completed project has the value of worthy information to be fed back into new design process. The benefit of this concept is all too obvious for housing research and development. This article attempts to illustrate the importance of Post Occupancy Evaluation (POE) in this regard.

Post Occupancy Evaluation (POE) has been in used in building research and development for nearly four decades. The earliest exercise of POE can be traced back to the US in the 1960s, when severe health, safety and psychological problems attributed to built environment, such as hospitals, prisons and mental institutions became a serious issue. These problems gave rise to motivation for researchers and authorities to evaluate the relationship between human behaviour and building design. The term Post Occupancy Evaluation is said to derive its name from the occupancy permit issued when a

continued on page 3

From page one

Major projects undertaken at HRC over the last five years are:

1) The design of single, double and 5-storey putra homes. The unique design is thermally comfortable and socially friendly to fit Malaysian culture.

2) The mortar-less interlocking block building system, sponsored by the Research and Development Division at the Ministry of Housing, Malaysia. The Putra Block received the Gold Medal for invention at Geneva's International Exhibition of Inventions(April 2001) and a Patent has been filed. A single storey demonstration house has been constructed using the innovative block. The system has been proven to hasten the speed of construction and reduce labour requirements.

3) Thermal Comfort research on prototype full-scale single and double storey houses built at UPM site. Four prototype houses have been constructed at UPM using different building systems. The indoor environment inside these houses has been studied experimentally to investigate the airflow, temperature variation and thermal insulation capability of different building systems used in the construction of the houses.

4) Development of an industrialised building system using precast concrete sandwich panels.

HRC research activities will be of interest to housing associations, local authorities, housing developers and professionals in all aspect of housing. The Centre continues to develop and establish links with research institutions and housing practitioners, which consist of government and non-governmental organisations.

From page two

building is completed, inspected and deemed safe according to Building codes and system .

Post Occupancy Evaluation (POE) is the process of evaluating buildings in a systematic and rigorous manner after they have been built and occupied for some time. POEs focus on building occupants and their needs, hence providing insights into the consequences of past design decisions and the resulting building performance. These are usually done by questionnaire surveys and interview of occupants. The accumulated data of information then forms a sound basis for creating better buildings in the future.

For the occupants, POE offers a mechanism by which their views and concerns can be fed back into future development or into remedial actions of existing problems. In effect, POE offers occupants more humane, pleasant, safe and healthy buildings, which respond to their needs and values.

POE benefits more than just individual occupants. At the organisational level, for example in an office building, POE offers increased efficiency and productivity by providing a more responsive working environment. Early studies in the 1960s by Building Performance Research Unit at University of Strathclyde in Scotland had shown that a small increment in building cost may result in a large return or efficiency over time. POE plays an important role in identifying where and how the increments should be spent in order to achieve the intended performance.

In view of these benefits, it is not surprising to see some consultants adopting POE as a commercial enterprise, providing service for other organizations. BDP of London conducts an example of this type of venture, (est. 1961). It provides, among others, architectural and building related skills. POE for completed buildings to assess their actual performances.

The setting up of dedicated POE centers reflects the importance of this form of research exercise by several Government agencies around the world. An example of this can be seen in California State, the US. The government of California State, under the Department of General Service, set up a bureau dedicated to carry out POE consistently for all developments carried out by the department .

Some establishments focus on conducting POE on specific building types only, refining methodology and reliability in a particular area of expertise. The Building Performance Research Unit (BPRU) at the University of Strathclyde mentioned earlier has been appraising over fifty comprehensive schools in Scotland since 1960s. It provides one of the seminal examples of the post-occupancy evaluation of school buildings. Techniques that relate to space and its organization to people's responses, space use, cost, services and movement has been developed.

In housing, the importance of POE can be evaluated by the benefit it offers to house design and development. POE assesses the performance of completed developments and identifies appropriate recommendation to resolve problems. For example, a survey among occupants in order to study spatial aspects which people find irritating in a typical terrace house, may lead designers or even legislators to specify better design requirements.

Among other benefits, POE offers a proactive housing development approach that is more responsive to peoples needs. Designers and developers would be better informed in the process of decision making and understanding the consequences of design. Over the long term, POE would provide the housing industry with a large body of knowledge that can be utilized to produce design databases, standards, criteria and guidance literature.

Mass housing in Malaysia is entering its 4th decade. The implications of different designs and construction techniques on people, success stories as well as failures, through all these years should provide meaningful insight for any future development. However, these accumulated knowledge could be lost if documentation and evaluation are not properly done. The potential of POE in providing a systematic framework towards achieving this goal should be considered.

As has been seen in other places, it is worth contemplating the creation of a centralized establishment dedicated to POE in housing in Malaysia, from which various key players in the housing industry can refer to, and benefit from. By positive engagement of POE findings in new housing developments, POE can act as a self-correcting mechanism for the industry to produce a more pleasant, safe and enjoyable housing for the ultimate end user i.e. the people.

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[1] Bechtel, R. What Are Post-Occupancy Evaluations? A Laymans' Guide to POE For Housing. Final Draft Report: Environmental Research and Development Foundation (1980).
[2] Woolfang F E Preiser et al, Post Occupancy Evaluation, Van Nostrand Reinhold, New York (1988)
[3] Thorn R, Building Appraisal.Building Performance Research Unit, University of Strathclyde, Glasgow (1980).
[4] Department of General Service, California. In collaboration with Fuller Coe Associates and the Georgia Institute of Technology(http://www.poe.dgs.ca.gov/)

Ventilation, Indoor Air Quality and Housing

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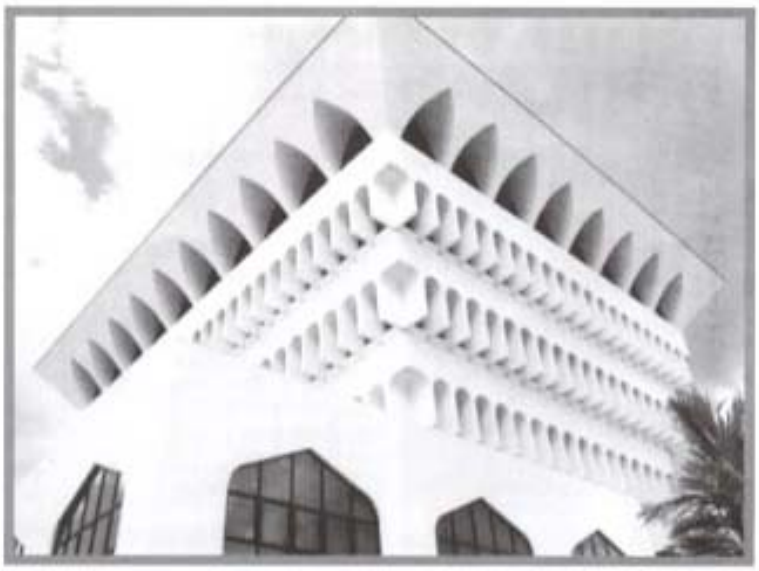
Dwellings and buildings have always been built to provide protection from the environmental elements for the occupants. Historically the combinations of materials and forms were established through trial and error, and indigenous building forms suited to local climate and materials developed over long periods.



Why ventilation? Ventilation is the process of supplying and removing air by natural or mechanical means to and from any space. An efficient ventilation system must establish hazard-free air quality, satisfy user comfort, be energy efficient and yet, cost effective. This is proven from standards and guidelines set out by the ISO (International Standards Organisation), ASHRAE (American Society of Heating, Refrigeration, Heating and Air Conditioning Engineers), CIBSE (Chartered Institute of Building Services Engineers) and the AIVC (Air Infiltration Ventilation Centre) and our very own Uniform Building By Law UBBL (1984).

How is ventilation quantified? The air exchange rate is defined as the number of times a room air is being replaced by the outdoor air independent of shape and volume, with unit per hour. This means if smoke is vented out of a room in ten minutes, then the air exchange rate is 6-air change (ach) or 6 h-1. UBBL By Law 41 part 12 mentions that for residential buildings the recommended air exchange rate is 0.14 cmm (cubic metre per minute) per person for re-circulated, filtered, and air-conditioned air or 2-air change. ASHRAE recommends 0.5 – 3 ach for naturally ventilated dwellings.

In Malaysia the ambient (outdoor) temperature is 35° C. Literature shows that it is difficult to get a temperature difference of 5° C between indoor and outdoor temperatures. Work conducted at UPM has shown that the best air exchange rate obtained in a bedroom was 1.5 ach using the tracer-gas technique, while the rest of the house has air change of below 1 ach. Some work also revealed room air change can be as low as 0.01 ach in residential areas that lies in between tall buildings.

The tracer-gas technique involves injection of a tracer i.e. gas (e.g. sulphur hexafluoride, SF6) which is not usually found in the environment to tag the air movement in a room or space. There are many techniques involved, but the easiest and most convenient for naturally ventilated rooms is the concentration decay technique. This involves injection of known tracer concentration into a space, mix it with room and monitor the decay. The slope of log concentration versus time gives the air change value.

Use of air conditioning may give high initial and operating cost besides increasing thermal pollution. There are many mechanical aids such as ceiling fan, desk fan and exhaust fan in the market. Perhaps a thorough study on suitable location and guidelines to improve air change in rooms can be done using experimental as well as computer fluid dynamics packages to justify sound advice to users and house owners. Such work is currently undertaken at HRC for exhaust fan and kitchen hood to identify suitable location as well as short-circuiting of airflow in a kitchen. Further reporting on this subject shall be presented in other issues.

COMPUTER INTEGRATED CONSTRUCTION:

An Introduction and Challenges

Prof. Madya Dr. Abdul Aziz Abdul Samad
Prof. Dr. D.N. Trikha

Since the Second World War, construction practices have been undergoing a tremendous process of modernization, thus replacing the more conventional building techniques. Arising from scarcity of skilled and semi skilled workers, rapid advances in prefabrication of building components and industrialised building systems have been made in the European countries over the last few decades. Further, globalisation has dismantled the boundaries between countries and the advancements in the development and usage of computers and IT has changed the attitude of most developing countries so that they seek to become knowledge driven nations within a short period of time.

The advancement of computers and IT has also managed to influence the construction industry through the development of computer integrated construction or CIC.

Computer integrated construction is not a specific system but rather a broad concept to exploit the computers and IT to integrate various construction processes including project management, planning, design, construction and the operation of construction facilities through automation and robots. CIC maximizes the output, improves quality and minimizes the dependence on human resources thus overcoming the unavailability of skilled or semi skilled workers.

CIC is generally divided into three broad components; these are:

(i) Information Management System (IMS)

This activity includes, among others, planning, design, procurement, scheduling, contracting, construction, maintenance, cost control and sales.

(ii) Computer Integrated Manufacturing (CIM)

CIM encompasses the production of prefabricated building components by automation and use of intelligent robots. These activities may include moulding, concreting, curing, spraying and painting. The use of sensors and microprocessors with embedded knowledge base built into the system allows the processes to be controlled automatically.

(iii) Computer Integrated Construction (CIC)

CIC is the development of the existing construction facilities such as dredgers, forklift, mixer and pumping plants into fully or partially automated systems with built-in sensors and microprocessors to control the tasks that are programmed for the machines.

CIC is a challenging area as it is an advanced multi-disciplinary activity comprising tasks requiring real-time linkages. A high degree of expertise in the areas of structural engineering, project management, architectural design, building systems and construction practices is expected. It also requires an excellent knowledge in the advanced computer technology, information technology and in Artificial Intelligence such as Expert System, Neural Network and Fuzzy Logic. CIC further requires the use of CAD/CAM processes, CNC machines and robots.

It is quite obvious that CIC is highly capital intensive, but the process guarantees a higher return in terms of quality, durability, speed and long-term reduction in construction cost. CIC at present is in embryonic state in the country. Expertise in individual disciplines is scattered thinly. Only recently, a beginning has been made at UPM to create a forum on CIC where experts in different areas have met and to focus on developing a viable CIC. It is strongly felt that the country needs to make a conscious decision to support such a programme by facilitating strong linkages between research institutions, industry and Government bodies.

ENGINEERING INNOVATION AND SUSTAINABILITY: GLOBAL CHALLENGES AND ISSUES

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

REGISTRATION

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).

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: iemvb@po.jaring.my

For General Information and Enquiries, Please contact :

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HRC News

15 January 2002

National Workshop on Affordable Quality Housing (AQH2002)

Jointly organised by HRC and The Institution of Engineers, Malaysia (IEM) and was held at the Equatorial Hotel, Bangi, Selangor Darul Ehsan.

Officiated by Y.B. Dato' Seri Ong Ka Ting, Ministry of Housing & Local Government, Malaysia. Over 80 participants from private sector and various government agencies including researchers attended the workshop.

16 January 2002

AQH Executive Meeting

In conjunction with the workshop, first meeting among researchers involved with the National Programme on Affordable Quality Housing was held at the same venue. Nearly all teams involved in the programme attended the meeting/discussion.

15-17 February 2002

HRC 2001 Retreat/Annual General Meeting

This annual event was held at The Riviera Bay Resort, Tanjung Kling, Malacca this year. Assoc. Prof. Dr.Waleed. A. Thanoon led the programme with the theme 'Research Foresight'.

19-21 February 2002

3-Day Bridge Specialist Course 2002

The specialist course was organised at the Mines Beach Resort and Spa, Seri Kembangan, Selangor Darul Ehsan. Over 30 participants from various government agencies as well as from the private sector attended the course.