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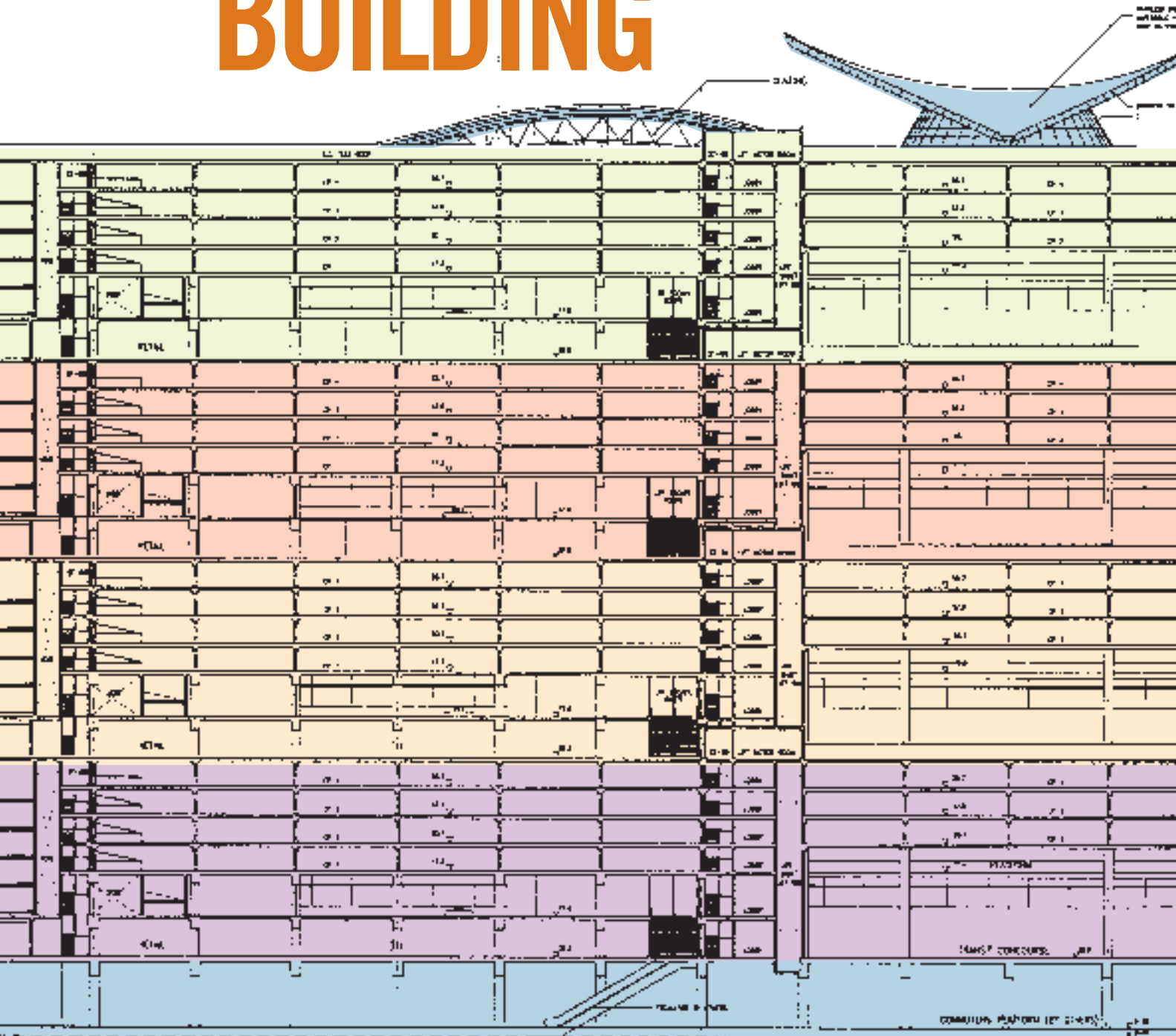


LEMBAGA JURUTERA MALAYSIA  
BOARD OF ENGINEERS MALAYSIA

# Ingenieur

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## BUILDING

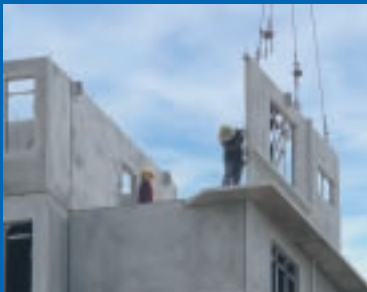




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## President's Message



Building codes are essentially sets of safety regulations in respect of structure, fire, and health. They were originally developed in response to frequently occurring hazards of structural collapse, catastrophic fires, and the spread of disease. Along with other developments, building by-laws have been very effective in reducing markedly the probabilities of disaster. Closely related to the life of the community, these matters became the responsibility of the city council or municipality.

There are some who protest the restrictions that building codes impose and argue that they are not needed. Yet, every time there is loss of life from fire or collapse of scaffolding in the news, there is public outcry against the laxity of laws or officials and a demand that something be done to prevent recurrence. Legislation to promote safety continues to be demanded and building codes will probably be necessary for some time, despite the many difficulties encountered in their formulation and application.

Codes, by themselves, can never be made to guarantee any consistent level of safety so long as there is freedom to choose the form that the building and its parts may take. The designer may also be concerned about the various choices that provide somewhat more than the minimum called for in the codes. This, in fact, ought to be the normal case, the tolerable probabilities envisaged by the codes being reached only on occasions when the advantage to be gained by compromising safety in a particular choice is worthwhile. Maximum freedom in design becomes possible only when safety can be included and adequately treated as a design consideration.

This philosophy can be associated quite closely with the present situation in structural design. It is now obvious that no practical set of restrictions can guarantee complete structural safety. It is also fairly clear that design codes, applied without thought, are inadequate. A satisfactory compromise is only obtained by the application of a design code in the hands of a competent professional. The design code reflects the best general guide that can be produced from the cumulative experience of the professional group which developed it. The professional consultant must be further concerned with the specific design case and must introduce his own knowledge and judgment in dealing with any new or unusual features.

Dato' Prof. Ir. Dr. Wahid bin Omar  
President  
BOARD OF ENGINEERS MALAYSIA

## Editor's Note



Recent policy issues relating to buildings, such as replacing CFO with CCC, Professional Indemnity Insurance and the "build then sell" concept for housing development have attracted great interest among related professionals especially engineers and architects. The Publication Committee will publish the outcome of firm decisions on these issues in due course. Meanwhile, we welcome any views or suggestions in this regard.

In conjunction with the national effort to promote good and sanitary public toilets through the recent toilet design competition and the national forum cum exhibition, the two articles published here cover the international and local perspectives of good toilet design, trends and innovation.

With regard to the 'Engineering Nostalgia' section, we are getting fewer contributions from readers. As this is understandable, we are considering supplementing this section with photographs of interesting engineering features and/or projects, and are looking forward to contributions to this section of the bulletin.

Ir. Fong Tian Yong  
Editor

## Publication Calendar

The following list is the Publication Calendar for the year 2006 and 2007.

While we normally seek contributions from experts for each special theme, we are also pleased to accept articles relevant to themes listed.

Please contact the Editor or the Publication Officer in advance if you would like to make such contributions or to discuss details and deadlines.

**December 2006:** ENVIRONMENT

**March 2007:** AGRICULTURE

**June 2007:** WASTE

**September 2007:** POWER



The Board of Engineers Malaysia  
wishes all readers



*Selamat Hari Raya  
Aidil Fitri*

&

*Happy Deepavali*

### International Energy Conference for Sustainable Asia

**Date:** 26 - 28 November 2006

**Venue:** Sunway Pyramid Convention Centre, Kuala Lumpur

**Jointly Organised by:**

AAET Asean Academy of Engineering and Technology  
The Associated Chinese Chambers of  
Commerce and Industry of Malaysia

**CPD Hours:** 16 hours for Day 2,3 & 4

### ASME SECTION VIII Pressure Vessel: Design Fabrication, Inspection, Flaw Detection & Repair

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# Structural Concrete Design: Should BS 8110 Be Replaced By Eurocode 2?

By Wahid Omar, Assoc. Prof., Faculty of Civil Engineering, Universiti Teknologi Malaysia, Skudai

With effect from 2010, BS 8110 <sup>(1)</sup>, the British code for the structural use of concrete, will be withdrawn to give way to the full implementation of Eurocodes in the United Kingdom. The shifting to Eurocodes is the result of a long term effort to harmonise the structural design and construction practices throughout all countries in the European Union (EU) which was first initiated in 1974.

The publication of the final version of Eurocode 2 (EC 2), BS EN 1992-1-1:2004, with a full title of Eurocode 2: Design of Concrete Structures, Part 1-1: General Rules for buildings, in 2004 by the British Standard Institution (BSI) and similar publications in other EU countries, signifies that the shifting to EC 2 is now confirmed. Although many other parts of Eurocodes that are related to EC 2 are still at the drafting stage and yet to be published in the final document, the development in the UK clearly indicates that there will be no turning back. The use of EC 2 will be mandatory in 2010 after a period of about 10 years of familiarisation in which EC 2 is encouraged to be used voluntarily in design work parallel with BS 8110.

How should Malaysia especially engineers react to the development in the UK? The following can be the alternatives:

- (a) Continue to use BS 8110 and do nothing about the change in the UK
- (b) Consider code of practice from other countries such as USA, Australia or Japan
- (c) Develop our own code of practice
- (d) Follow the development in the UK and adopt EC 2

This article discusses the issues above and puts forward some thoughts for reflections among civil engineers in Malaysia. Some detail aspects of EC 2 are also presented as in the author's opinion it will be a good early exposure for local engineers.

A long period of British colonisation resulted in Malaysia inheriting many aspects of engineering practices from the British. After almost 50 years of independence, Malaysia still very significantly relies on the British codes in design and construction practices. The earlier generations of Malaysian engineers had been very familiar with CP 114 and CP 110 and the present generation is comfortably using BS 8110. In bridge design BS 153 and later BS 5400 are the main references used by local engineers. The dependency on British codes went to the extent that,

it was stated in the Malaysian Uniform Building By Law (UBBL) that the design and construction of Malaysian buildings shall comply with Malaysian or equivalent British codes.

At the level of tertiary education in Malaysia, the teaching of design courses in the Civil Engineering programme, to the author's knowledge is based on British codes and for the design of structural concrete, BS 8110 is the main reference used. In design and construction practices, perhaps more than 80% of local engineers and consultants carry out their work based on BS 8110. Government agencies such

as local authorities are more familiar with the British codes.

## IMPLICATIONS OF BS 8110 WITHDRAWAL

The scenario presented above shows that there will be a huge impact in Malaysia with the withdrawal of BS 8110. There will be wide-ranging implications that will affect almost the whole segment of the design and construction industry. Below are some of the scenarios that may happen for each of the alternatives mentioned above:

## ■ Continue with BS 8110

This will certainly save a lot of resources. One can imagine the resources in terms of money, manpower and time that are required to shift to another code. Judging from the above scenario, shifting from BS 8110 to a different code will involve a total change in the design practice and a major re-educating process for engineers and other related parties. It will require huge resources.

Continuing with BS 8110 means that engineers and authorities will continue with the present practice and maintain the status quo. However the question to be asked is: Can we survive with the continuing use of BS 8110? It should be realised that eventually BS 8110 will be obsolete as there will be no upgrading of the code once EC 2 is fully adopted in the UK. Continuing with BS 8110, Malaysian engineers may risk losing to international competitors in that we may produce uneconomic designs.

Thus, the saving in resources by not shifting may not be enough to compensate for the loss incurred in the long run in the form of business opportunities and economic benefits of the global market. Malaysia has a very small domestic market and to sustain and survive, local engineers and consultants are expected to venture in the global market. From another angle, globalisation brings international consultants to do business in Malaysia. They may have the advantage of designs based on a



more advanced code of practice and consequently will be more competitive than local consultants.

Continuing with BS 8110 means that there will be no changes in the curriculum of local universities and the future local graduate engineers will only be familiar with BS 8110. This will lead to a point where Malaysian engineers will eventually be isolated from global competition and the cost and consequences will be unbearable to the country's economy.

## ■ Adopt Other Countries' Codes

The concern here is that shifting to codes other than EC 2 may require as much resources and effort, if not more than that needed if Malaysia adopts EC 2. Unless the chosen code, in terms of its technical advancement and standing among international

codes, are much more superior to EC 2 and BS 8110, the move can be considered as unwise.

Familiarity with British codes among most Malaysian engineers makes it extremely difficult to switch to another code that has no historical relationship with us. British codes such as BS 8110 is widely practiced in Malaysia. Besides the code itself, many other documents and references have relationships with the British codes.

## ■ Develop Our Own Code of Practice

Before one thinks of doing this, one has to scrutinise many facts. Perhaps the most important fact to examine is whether Malaysia has enough and relevant experts to develop the structural concrete design standards. Previous experience has shown that when we tried to develop Malaysian concrete design code, MS 1195; it ended up with almost a total adoption of BS 8110.

A good standard needs to be developed based on extensive research and observations. Lack of research is a very well acknowledged fact in Malaysia. Observations made are seldom properly (read scientifically) investigated and reported. In many situations, even those investigated, the reports would not be easily available. Proper documentation and record keeping for future reference is not yet widely practiced. In this circumstances, work to develop a good code will be



extremely difficult. Another issue is whether we are willing to invest a substantial amount of money for the development of standards. The current policy shows that effort to develop standards in Malaysia are more on a voluntary basis. The policy would not be able to attract or encourage enough experts to participate in code development.

### ■ Follow the Development in the UK and Adopt EC 2

It seems this is the most viable option available under the present circumstances, although some people may think differently. For some engineers this option shows that we will never be ahead of others, as far as the design practice is concerned. At this point of time, prolonging the discussion on this issue will not bring any benefit and lead us nowhere. Changes and something more practical should be done rather than discussing a topic that may result in finger pointing.

As mentioned above, for Malaysian engineers to participate and benefit from globalisation and to have the ability to sustain competitiveness in the global market, the design practice should be based on the most advanced knowledge. In the near future, BS 8110 could not provide this need and the most appropriate means available is to adopt EC 2.

The whole range of structural Eurocodes was developed jointly by experts throughout countries in the EU for a period of 30 years and is regarded as one of the most technically advanced code in the world<sup>(2)</sup>. Recently, EC 2 has been accepted as meeting ISO standards and this opens greater opportunity for the code to be accepted worldwide alongside other well known codes.

Once Malaysia decides to adopt EC 2, the next course of action is only to focus on its implementation. Strategies need to be properly planned and efficiently executed. Some proposed strategies are outlined elsewhere<sup>(3)</sup>. As far as the information and supporting documents such as guidelines in using the code are concerned, sufficient documents are available and can be taken directly from the



UK. Since the approach in UK is usually to compare the EC 2 with BS 8110, the way the subjects are explained and discussed should be easily adaptable to Malaysian engineers.

One distinct feature in EC 2 which is a great advantage to Malaysia is the provision of National Annex. In the National Annex, different countries are allowed to use their own values for certain design parameters and safety factors to reflect differences in climatic conditions and also recognise that the level of safety in a country remains the country's prerogative. National Annex provides flexibility and opportunity and should be fully utilised to make EC 2 relevant and used in Malaysia.

## EUROCODE 2 IN BRIEF

EC 2 are part of the whole range of structural Eurocodes that have been developed by EU countries and intended to harmonise the design and construction practices within EU. The harmonisation provides equal opportunities to all engineers, consultants and contractors to practice within all the countries in the EU. It took almost 30 years of development and is claimed to be the most technically advanced in the world.

There are 10 design standards of Eurocode to be used in construction as listed in *Table 1*.

Besides those listed in *Table 1*, there are many other parts of Eurocodes connected to EC 2 and may require cross-referencing during the process of design and construction. One example is BS EN 206, a standard for concrete materials. The existence of many parts makes the process of shifting to EC 2 look rather complicated, especially during the early stage of familiarisation.

Only BS EN 1990: Basis of structural design, has been produced in a single part. This basic document (occasionally known as EC 0) contains principles and requirements for safety, serviceability and

**Table 1: Eurocodes in Construction**

Eurocodes	Contents/Description
BS EN 1990: Eurocode: Basis of structural design	Structural safety, serviceability and durability
BS EN 1991, Eurocode 1: Actions on structures	Actions (loads) on structures
BS EN 1992, Eurocode 2: Concrete	Design and detailing
BS EN 1993, Eurocode 3: Steel	
BS EN 1994, Eurocode 4: Composite	
BS EN 1995, Eurocode 5: Timber	
BS EN 1996, Eurocode 6: Masonry	
BS EN 1999, Eurocode 9: Aluminum	BS EN 1998, Eurocode 8: Seismic design
BS EN 1997, Eurocode 7: Geotechnical design	
BS EN 1998, Eurocode 8: Seismic design	

**Table 2: Eurocode 1**

Eurocode 1	Title	Standards superseded
BS EN 1991-1-1	Densities, self-weight and imposed loads	BS 6399: Part 1 and BS 648
BS EN 1991-1-2	Actions on structures exposed to fire	
BS EN 1991-1-3	Snow loads	BS 6399: Part 2
BS EN 1991-1-4	Wind actions	BS 6399: Part 3
BS EN 1991-1-5	Thermal actions	
BS EN 1991-1-6	Actions during execution	
BS EN 1991-1-7	Accidental actions	
BS EN 1991-2	Traffic loads on bridges	BD 37/01
BS EN 1991-3	Actions induced by cranes and machinery	
BS EN 1991-4	Silos and tanks	

**Table 3: Eurocode 2**

Eurocode 2	Title	Standards superseded
BS EN 1992-1-1	General rules for buildings	BS 8110: Parts 1 and 2
BS EN 1992-1-2	Fire resistance of concrete structures	BS 8110: Parts 1, Table 3.2 Part 2, section 4
BS EN 1992-2	Bridges	BS 5400: Part 4
BS EN 1992-3	Liquid-retaining and containment structures	BS 8007

durability of structures. EC 1 consists of four parts, and part 1 is further subdivided into seven sections. Details are listed in *Table 2*. Some parts are yet to be published by BSI.

EC 2 consists of different parts as listed in *Table 3*. The focus currently will only be on the principal part; Part 1.1 which is to supersede BS 8110 Part 1 and 2. Among the benefits outlined by the UK Concrete Centre in using EC 2 are <sup>(4)</sup>:

- The new Eurocodes are claimed to be the most technically advanced codes in the world
- Eurocode 2 should result in more economic structures than BS 8110
- The Eurocodes are logical and organised to avoid repetition
- Eurocode 2 is less restrictive than BS 8110
- Eurocode 2 is more extensive than BS 8110

Below are some of the notable differences between EC 2 and BS 8110<sup>(4)</sup>:

- The arrangement of chapters in EC 2 are generally laid out to

give advice on the basis of phenomena (e.g. bending, shear etc) rather than by member types as in BS 8110 (e.g. beams, slabs, columns etc).

- In EC 2 'load' is called 'action'. Dead and live loads will appear as permanent and variable actions respectively in EC 2.
- Perhaps the most significant change that may affect the Malaysian designers is that EC 2 measures concrete strength based on cylinder and all design expressions are developed on cylinder strength.
- EC 2 adopts a traditional European approach in design where engineers are expected to refer to other documents such design guides or textbook in order to apply the design principles of the code. As a result, EC 2 does not provide derived formulae (e.g. for bending, only the details of the stress block are expressed). For example, those familiar with Clause 3.4.4.4 of BS 8110: Part 1, would not find the same design expressions in EC 2.
- Unlike BS8110 in which the guidelines provided are limited for normal strength concrete, higher strengths of concrete are

covered by Eurocode 2, up to class C90/105. However, because the characteristics of higher strength concrete are different, some expressions in the code are adjusted for classes above C50/60.

- In shear design of beams, the major difference is that EC 2 does not fix the angle of diagonal shear crack at 45° as proposed by BS 8110. The method used in EC 2 is known as the variable strut inclination method. The method allows engineers to choose the optimum angle in order to achieve the most economic design.
- The punching shear checks are carried at  $2d$  from the face of the column and for a rectangular column, the perimeter is rounded at the corners.
- Serviceability checks can still be carried out using 'deemed to satisfy' span to effective depth rules similar to BS 8110. However, if a more detailed check is required, Eurocode 2 guidance varies from the rules in BS 8110 Part 2.
- The rules for determining the anchorage and lap lengths are more complex than the simple tables in BS 8110. Eurocode 2



considers the effects of, amongst other things, the position of bars during concreting, the shape of the bar and cover.

### National Annex


EC 2 has a supplementary document known as National Annex which allows the use of alternative values that suit individual countries. Malaysia should take full advantage of this as there are many design parameters taken directly from foreign codes that are usually not very suitable to our environment. Concrete cover, which is related to durability and fire requirement; and time-dependent deformation of concrete, such as creep and shrinkage, for example, may require local design values. It is an opportunity for local researchers to carry out study on these topics and other areas.

### THE CHALLENGES

It is admitted that many more aspects should be discussed to assist Malaysian engineers to understand

the EC 2, but this will be done in other publications. In short EC 2 is simply a design guide and engineers have options to exercise their own engineering judgement based on their level of competency in engineering knowledge. The challenges are that engineers are expected to be more competent, have deep understanding of the subject and be fully prepared to acquire new knowledge in order to gain the maximum benefit of EC 2.

### CONCLUSION

It is crucial for Malaysia to decide its destiny in response to the withdrawal of BS 8110. The earlier the decision can be made, the better for engineers and other parties involved in construction. Experience in the UK has shown that the shifting to Eurocode requires tremendous effort and huge resources. It is important for the authorities to work closely with professional bodies as the withdrawal of BS 8110 may cause very significant impact not only to engineers but to the whole economy. 

### REFERENCES

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- (5) Moss, R., Webster, R., *EC 2 and BS 8110 Compared*, The Structural Engineer, United Kingdom, March 16, 2004

# The Way Forward: Construction Industry Master Plan 2006-2015

By Gerald Sundaraj, Construction Industry Development Board

The construction industry is one of the productive sectors that constantly contribute to the economy. However, its growth rates fluctuate between extremities that vary from as high as 21.1% in 1995 to as low as -24% in 1998. Since the 1990s, the contribution of the construction sector to the GDP also fluctuated albeit at a more stable rate varying from a high of 4.8% in 1997 to an estimated low of 2.7% in 2005. This shows that the demand for construction is highly sensitive to developments in other sectors of the economy. It indicates that, since construction involves long term investment and long term risks, it will be the first to be suspended at the first sign of an economic downturn, and the last to be revived during an economic upturn leading to long periods of recession for the construction sector whenever an economic cycle is experienced. This is merely good business sense.

Since the financial crisis in 1998, the construction sector growth rate has not reached anywhere near the pre-1998 growth rates reaching its highest at 2.1% in 2001 and declining to 2.0% in 2002, 1.5% in 2003 and into a contraction of -1.5% in 2004 estimated to improve to -1.1% in 2005. This was at the back of market-price GDP growths of around 4.4%, 5.4% and 7.1% for 2002, 2003, 2004 respectively. It is obvious that the construction sector has been in the doldrums for quite some time. Quarterly reports showed that the construction industry has been in recession since the second quarter of 2004, reaching its minimum of -2.6% in the third and fourth quarters of 2004 and has remained negative up to the fourth quarter of 2005 albeit at a lesser contraction rate.

Our analysis showed that the sub-sectors that contributed to the construction industry's contribution for 2004 and 2005 were residential, commercial and infrastructure with the rest contributing marginally. In terms of value, residential, commercial and infrastructure generated 30%, 12% and 40% respectively in 2004, and 30%, 16% and 31% respectively in 2005. Private sector demand constituted 74% and 66% of the market value in 2004 and 2005 respectively with the remainder coming from the public sector.

The construction sector does not create its own demand. The demand for construction is a derived demand i.e. demand is derived from every other economic sector, and from both the public as well as the private sectors. The demand can generally be classified as wealth creation demand from economic needs for infrastructure and commercial buildings, and quality of life demand such as needs for housing. Demand can also come from foreign markets

for the same reasons as domestic demand. However, fulfilling foreign market demands does not bring with it the multiplier effect to the economy as domestic demand does, although contribution to the construction industry performance may still be accrued. That being the case, why does the construction industry not perform well when other sectors are performing reasonably well in the last three to four years? The answer lies in the fact that a large part of the demand for construction came from the public sector in terms of infrastructure projects. As these projects are governed by the Government budget their availability is finite and limited to the amount planned every five years. Unfortunately for construction in the 8<sup>th</sup> Malaysia Plan some projects had to be implemented earlier in order to rejuvenate the economy, particularly under the Stimulus Package in 2003. As a result, less projects were left to the end of the 8<sup>th</sup> Malaysia Plan resulting in a dearth of public sector



projects at the end of the five-year plan.

This argument is further strengthened by the fact that, as the economy expands, demand for quality of life commodity, such as housing, also expands resulting in the dominating demand for residential sub-sector for both 2004 and 2005. Demand for the wealth creating infrastructure, consequently, became latent demand since it had to be curbed as allocations are exhausted under the 8<sup>th</sup> Malaysia Plan.

If demand for the construction sector is derived demand and, as such, to a large extent, out of the control of the construction industry, can we develop a Master Plan for it? The answer is yes. There are two fundamental dimensions that must be developed for the construction industry to enhance its role, and even its relevancy to the economy. The two dimensions are:

- (a) Increase contribution by increasing market size in new and unexplored developing foreign markets.
- (b) Improve productivity, efficiency and cost-effectiveness of the domestic construction industry in order to provide comparative advantage to the economy

It is for these reasons that the Construction Industry Master Plan (CIMP) was developed by the industry, for the industry.

The CIMP was developed to overcome some of the weaknesses that were inherent in the construction industry before this. They include, *inter alia*, quality deficiencies, over-dependency on foreign labour leading to a leak in the economy as a result of repatriation of earnings by foreign labour as well as numerous ensuing social and health problems, several major catastrophes, and the low productivity of the construction industry. The construction industry gave itself ten years, from 2006 until 2015, to rectify the weaknesses and to improve the industry's performance as well as its image. The following are some of the main features of the Construction Industry Master Plan:



**Vision:** The Malaysian construction industry shall be a world class, innovative and knowledgeable global solution provider

**Mission:** To be a dynamic, productive and resilient enabling sector, supporting sustainable wealth creation and value creation, driven by technologically-pervasive, creative and cohesive construction community.

**Seven Strategic Thrusts** were identified:

1. Integrate the construction industry value chain to enhance productivity and efficiency
2. Strengthen the construction industry's image.
3. Strive for the highest standard of quality, occupational safety and health, and environmental practices
4. Develop human resource capabilities and capacities in the construction industry
5. Innovate through research and development and adopt new construction methods
6. Leverage on information and communication technology in the construction industry
7. Benefit from globalisation including the export of construction products and services

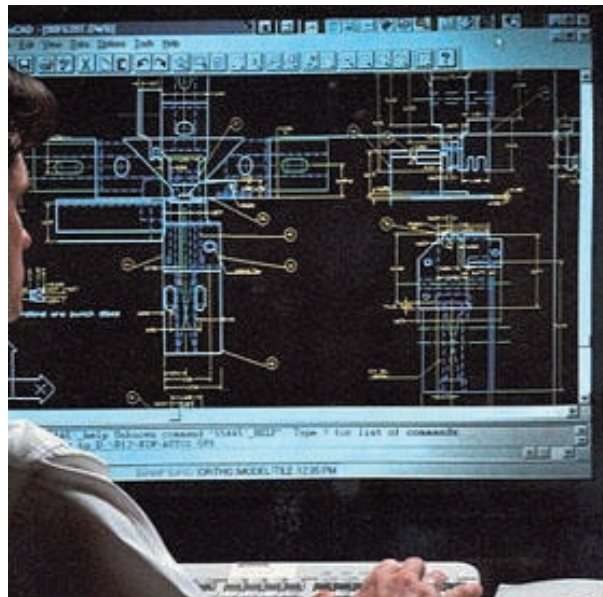
Each of the strategic thrusts must be relevant and contribute to the two dimensions that form the crux of the needs of the CIMP. The rationales are as follows:

- **Strategic Thrust 1:** By integrating the value chain of construction, productivity enhancement can be generated as the various parties that make up the value chain of construction can integrate their functions and save time both during development as well as during modifications. Communication is also facilitated through the integration of value chain. The early identification of members of the project team will also bring about greater understanding of the client's and project's needs. Further, if the integration were to include public sector functions, such as approval and issuance of certificates, the whole development process can be improved. Leveraging on the powers of ICT, these processes can be managed in a productive and effective manner.
- **Strategic Thrust 2:** The poor image of the construction industry arises out of a number of weaknesses in the industry and includes issues such as poor paymaster, a dirty, difficult and dangerous industry, and a sunset industry. The image prevents it

from attracting the best to its fore. To improve the industry's performance attracting the best human capital is essential. To improve the image of the industry all the weaknesses must be rectified. A respectable image of the industry will also attract more locals to join the industry leading to a reduction of repatriated funds by foreign workers.

- **Strategic Thrust 3:** Poor quality, accidents, and destruction of the environment have high costs to both the firms undertaking the project as well as to society. These costs may be hidden or they may be real. Environmental cost is especially heavy to the society if not addressed. In order to nurture a dynamic construction industry these issues must be given priority as they affect the productivity of the industry. The development of high quality industry players will also create a barrier to entry in the market especially if such attributes are taken into consideration when awarding projects.
- **Strategic Thrust 4:** Construction depends to a large extent on human skills. Even technology-intensive construction techniques depend on the skills of its workforce to utilise technology effectively. As such, the development of human resource is one of the most critical aspects of improving the productivity of the construction industry.
- **Strategic Thrust 5:** Research and development is an essential element if we want to maintain our lead in foreign markets as well as develop new products or processes that can improve the productivity of construction. In foreign markets any new construction methodology that provides competitive advantages

are easily copied by competitors especially those from the host countries. To keep ahead of the competitors, new competitive technology must be developed. New products and new processes are also needed to provide comparative advantage to Malaysia's economy that depends on the construction industry to provide the assets for production and other wealth creation activities. If new methods and new materials are able to provide cost-effective solutions, they shall contribute to the competitiveness of the local construction industry and to the economy as these will result in productivity increase.



- **Strategic Thrust 6:** The powers of ICT have, as yet, not been fully tapped to benefit the construction industry, not only in Malaysia, but all over the world. There are many more areas in the construction industry that can capitalise on the powers of ICT and improve its performance. Currently, even digital submission for approval by local authorities is at an experimental stage. Integration of the various softwares needed in the construction industry to achieve inter-operability is still being researched. Utilising the digital world to achieve mass purchase of construction resources has also

not been implemented. These are all activities that will improve both the supply chain management as well as the integration of the value chain leading to improvement in productivity.

The use of ICT will also allow the industry to traverse the digital world. It will provide opportunity for outsourcing and off-shoring. At the same time it allows for the formation of virtual partnership without a need to be physically close. Many projects are secured through the Internet nowadays. As such, focusing on the development of ICT in construction can also provide an opportunity to expand the construction market as well as the market of all the services and products related to it.

- **Strategic Thrust 7:** Globalisation is both a threat and an opportunity for the Malaysian construction industry. Not only does it open doors to other markets, but it also requires that we open our doors to others. In this context it is imperative that Malaysia's construction service providers maintain their edge and competitiveness to stave off greater challenges from other service providers from all over the world and also to capture opportunities in other foreign markets. This strategic thrust will facilitate the expansion of the construction market as well as the contribution to the GDP. However, as mentioned above, foreign projects do not provide the multiplier effect to the economy as much as local projects do.

At the implementation stage, 20 recommendations have been forwarded. These recommendations were the result of consultations with the industry. Each of the strategic thrusts has been fully analysed and the process required to achieve it is formulated in the recommendations.

As a prelude to the successful implementation of CIMP, eight Critical Success Factors were identified. They are as follows:

**For productivity:** Continuous improvement throughout the value chain from inception to operation to facilities management.

**For quality:** Emphasis on quality in the use of manpower, materials, equipment and methods adopted.

**For human resource:** Creation of competent workers through skills-upgrading and knowledge enhancement.

**For knowledge:** Sharing of best practices to upgrade the level of knowledge of the construction community

**For innovation:** Continuous research and development that is vital to introduce new and creative methods, materials, tooling and equipment (i.e. construction technology)

**For environmental practice:** Sustainable practices are the keys to the well-being of future generations.

**For industry sustainability:** Generating new opportunities both in the domestic and overseas markets.

**For professionalism:** Enhancement of professionalism is key to the improvement of the image of the industry.

Twenty-two industry-wide key performance indicators have been recommended. However, it may be necessary to translate the industry-wide key performance indicators to activity key performance indicators to aid implementers in monitoring progress.

The CIMP also comes with 56 recommended action plans for the 20 recommendations mentioned earlier and identified the parties responsible for their implementation as well as the milestone for each action. The



organisational framework for implementation as well as the phases and schedules for implementation were also included.

The CIMP did not try to identify projects for the construction sector. This was never the purpose of the Plan. As mentioned earlier, the construction industry survives on derived demand and is not in control of it. The opportunities for the construction industry from 2006 to 2015 come from the 9<sup>th</sup> and 10<sup>th</sup> Malaysia Plan and the status of the economy during that period. Based on the 9<sup>th</sup> Malaysia Plan we expect the demand therein, and the demand in subsequent Plans, to be substantial. Under the 9<sup>th</sup> Malaysia Plan, the strategy to create Regional Growth Centres, the need for Urban Transportation, the introduction of private finance initiatives are some examples of exciting development that promise to push demand for construction beyond expectation. The Government's move to back up privatisation with PFI will transform infrastructure into a commodity and create more business opportunity.

Ours is not to provide projects. Ours is but to prepare the industry to undertake the tasks and to bear the trust expected of them honestly and successfully.

What the CIMP can do is to supplement the domestic construction demand with foreign demand as the CIMP has identified activities to develop a more concerted and effective strategy to export construction services. What the Plan aims to do in this context is to prepare the Malaysian construction industry for a more penetrative global

role. It does not promise that projects will be secured. What it does promise is that future contractors will be more prepared and more confident to undertake projects overseas.

What the CIMP sets out to do is to make the domestic construction service more productive, more effective, more technologically-pervasive and less labour-intensive, and more confident to venture beyond our shores, and thus become more resilient. By doing these we hope to be a more effective contributor to the Malaysian economy. As stated earlier the demand for construction is derived from other sectors. Putting it differently, we provide the foundation for other sectors to build their activities, be they manufacturing, mining, agriculture, tourism, or services. If we are able to deliver our functions efficiently, cost-effectively, and on time, then our clients from the other economic sectors will benefit from our endeavour. The nation, of course, is the final beneficiary. That, in a nutshell, is what this first ever CIMP for Malaysia sets out to achieve and to deliver. **BEM**

# The Current Trends And Development Of Public Toilets In Kuala Lumpur

By Hooi Yoke Meng, Deputy Director, Architect Department, City Hall, Kuala Lumpur.

Being the premier city and capital of a nation that aspires to be fully developed by the year 2020, Kuala Lumpur's vision, goals, function and growth must contribute strongly to the attainment of the ideals embodied in the nation's *Vision 2020*.

The Vision of Kuala Lumpur is consistent with the national vision i.e.

*"KUALA LUMPUR – A WORLD CLASS CITY"*

Kuala Lumpur will strive to establish the highest quality living, working and business environment benchmarked against the best in the world.

As a world class city, Kuala Lumpur must ensure that the infrastructures, social and community facilities and amenities meet the highest expectations of its residents, visitors and investors. The Kuala Lumpur Structure Plan 2020 is the blueprint that will guide the development of Kuala Lumpur for the next 20 years.

## PUBLIC TOILETS

The provision of public toilets provides a form of infrastructure necessary for the enjoyment of the city by visitors and residents. This can also make a significant impact on the comfort of individuals and families who visit public spaces in the city and their perception of the city as a desirable place to visit.

City Hall Kuala Lumpur recognizes the vital contribution toilet provision and a well managed service can make, both to the quality of life for residents and to the image Kuala Lumpur makes on visitors.



Street Toilet, Architect Department, City Hall Kuala Lumpur

This in turn impacts on the local economy.

## THE CHALLENGES

The challenges of public toilet provision are:

- (1) **Need:** Changing demographic and human activity in the city impose a greater demand for public toilets.
- (2) **Image:** The necessity to provide clean, user-friendly, accessible and safe toilet environment with a high standard of hygiene and maintenance.
- (3) **Ethics:** To raise users' etiquette and to motivate change in the psychological ethics and attitude of users.

## KUALA LUMPUR'S PUBLIC TOILET STRATEGY

To meet the challenges of toilet provision, a public toilet strategy was developed for the city of Kuala Lumpur. The Kuala Lumpur Public

Toilet Strategy establishes the foundation and direction for the provision and development of public toilets, design, management and maintenance, and the development of a 'Clean toilet Culture' in the next five years.

The strategy identifies the deficiencies in the overall network as well as incorporates user's needs in the existing toilet provision and maintenance.

The strategy also identifies what additional facilities may be required to establish an efficient network addressing the needs and desires of residents and visitors, and the works required to upgrade and replace existing facilities. Generally, the scope of the strategies confined to the clear responsibility of City Hall Kuala Lumpur.

## PRESENT POLICIES AND SCENARIOS

Present City Hall Kuala Lumpur policies promote the 'evening

economy', the 'almost' 24 hour city, tourism, and public transport usage. All these have increased the need for more toilets. The public is not automatically entitled or able to use the toilets in public premises, drinking places or restaurants. Access may be restricted to customers only and children may be barred from some premises. Muslims may be wary of using toilets in premises where alcohol or non-halal food is served. Although the monorail has toilet facilities, the facilities are located inside the station, accessible only for commuters and often not accessible to disabled. In some of the light rail transport stations, there are no toilet facilities at all.

Women are particularly in need of public toilets as they are the ones who are out and about in the day time, travelling on public transport more than men and often accompanied by children, the elderly and disabled. Yet there is less public provision for public toilets for women than men.

#### **CURRENT TRENDS AND DEVELOPMENT**

Simply providing the facilities does not address the needs of users. An important part of providing the

facilities is to assess the type of users, suitability of locations and provide appropriately facilities.

The current trends and development of public toilet in Kuala Lumpur are to reflect:

- Wide range of users.
- Residents.
- Tourists
- Commuters.
- Users of associated facilities e.g. public parks.
- Women.
- Disabled.

Even though there are a number of different user groups, there are basic requirements for all of them. These requirements include:

- Safe, hygienic facilities
- Privacy whilst using the facility
- Sense of safety (most facilities have a caretaker)
- Cleanliness.
- Facilities for Muslim users.
- Mobility of users' group.
- Significance of tourism.
- Hierarchy of toilet provisions

The development of a hierarchy of toilet provision would enable facilities to be targeted to an area's needs. Both spatial (geographical location) and temporal (patterns and peaks of usage) consideration are

taken into account in developing a hierarchy of provision to cover the whole city.

The central area is the main focus of the city's business and retail activities and the part tourists are likely to visit. The main transport routes radiate out from the city centre, railway, Light Rail Transport (LRT) and bus stations being the gateway to the rest of the city. The Monorail runs through the heart of the city's tourist belts and shopping outlets. It is within the vicinity of these areas that our priority locations of public toilets are. Other areas are public parks where there are a lot of users during the evenings and weekends.

Directional signage will be provided at 100 metres from the location of the toilets. A City Toilet Map will also be provided for the convenience of users.

City Hall Kuala Lumpur is also looking into including public toilets in planning requirements for new developments. Under the Kuala Lumpur Planning Act 267, 1982, there is no requirement that public toilets be included in town planning policy. Recently, City Hall Kuala Lumpur succeeded in getting a toilet provision for a 'quicker planning approval'. In this case, City Hall Kuala Lumpur entered into an agreement with the developer.

#### **WHY ADDRESS TOURISM?**

One of the strategies of the Kuala Lumpur Structure Plan is to promote Kuala Lumpur as a tourist destination and an international shopping paradise. The provision of adequate and accessible toilet facilities will promote Kuala Lumpur as a 'tourist friendly' city.

In commemoration of 50 years of nationhood, 2007 is designated as 'Visit Malaysia Year' and the country is expected to receive an increased influx of visitors. City Hall is already implementing the programme to provide facilities such as themed lighting, pedestrian walkways, public toilets and landscaping in tourist areas and attractions.





Automatic Street Toilet, City Hall Kuala Lumpur

## STREET TOILET PROGRAMME

Street toilets are toilets facilities placed in central public thoroughfares, footpaths, squares and bus stops usually in open and well lit areas. These types of toilets are necessary to establish an efficient network of toilets along footpath links from transport stations like the monorail, light rail, bus stop, pedestrian crossings and car parks.

Some 20 locations have been identified in the city centre's tourist attraction places, shopping outlets, near the vicinity of transport stations and bus stops. Between 12 and 14 street toilets are expected to be completed and commissioned by the end of the year for 'Visit Malaysia Year 2007'.

Two designs will be used. One is the design done by the Architect's Department of City Hall Kuala Lumpur and the other is designed and manufactured locally by a Malaysian sanitary ware company called the 'Automatic Street Toilet'.

Since the footpaths are of limited space, the design from the Architect's Department consists of:

- Two or three cubicles and a space for a caretaker/cleaner
- Facilities for the disabled

The 'Automatic Street Toilet has several unique features. They include:

- Two cubicles, one squatting bowl type, the other the sitting bowl type.
- Both bowls have sensor activated flush.
- The sitting bowl cubicle is disabled friendly and the bowl has a 'Automatic seat cleaner'. The seat is activated after every single user, sprayed with water, scrubbed and dried after each use. It is 'break resistant and UV resistant', complete with controlled built-in concealed bidet (*for Muslim users*).
- Both cubicles are complete with a 'baby change station' and a 'juvenile waiting seat'. (*Women/ Children Needs*)
- High Tech Automatic Sliding Door
- Hands free operating tap and hand dryer.
- Vanity top for putting shopping bags, briefcases etc.
- Janitor's kiosk
- Coin Box Activated Door entry with independent counter.
- The walls of the toilets can be lighted up for advertisement purposes.

## CONCLUSION

The vision and goals for Kuala Lumpur have been formulated with the aim of creating a sustainable city. Research has showed that public toilet provision constitutes

the vital missing link of sustainable and accessible cities.

The current trends and development of public toilets outlined in the Kuala Lumpur Public Toilet Strategy is aimed towards achieving the long term vision of 'Kuala Lumpur - A World Class City'. Any strategy is a 'live' document that will require revisions and modifications as priorities and circumstances change. Needs and usage also changes over time.

The current priority in the city centre, around main shopping outlets and transportation stations represents only part of the network of public toilets to be provided in the city of Kuala Lumpur. This is to address the present needs of tourists, shoppers and commuters.

As population grows, or more tourist belts are developed in Kuala Lumpur, the need for more toilets are inevitable. Although presently toilet provision is the responsibility of the City Council, City Hall Kuala Lumpur is looking into how the private sector can play its role in delivering this facility in the future. **BEM**

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# Implementation Of Skills Accreditation For Local And Foreign Skilled Construction Workers

From Construction Industry Development Board (CIDB)

All construction workers currently involved in skill trades at the construction sites are required to be certified by CIDB with *Sijil Kecekapan Kemahiran* (SKK) for local workers and *Perakuan Kemahiran Pekerja Asing Binaan* (PKPA) for foreign workers **before 31 July 2006**. Therefore all construction workers who are involved in the listed skill trades are required to register themselves with CIDB for the skill accreditation process.

All foreign construction workers who wish to renew their Visit Pass (Temporary Employment) or PLKS with the Department of Immigration Malaysia after the fifth year in service are also required to undertake CIDB skill assessment and obtain the PKPA. The skill accreditation process is subsequently required to be undertaken every three years thereafter.

Foreign construction workers must apply to CIDB for the skill assessment not later than three months before the expiry of PLKS. CIDB has the right to reject any application which does not meet this requirement or impose a penalty of RM200 for every applicant.

## 1. Definition of Skilled Worker

- 1.1 As stated under Section 2 of ACT 520, a skilled construction worker means a person possessing the accepted level of skill as determined by the *Lembaga*, of one or more trades as listed in the Third Schedule.
- 1.2 Thereby the accreditation of a person as a skilled construction worker is through the conferment of the SKK or PKPA.

## 2. Objectives of the Skilled Workers Accreditation Programme

- 2.1 To ensure that only skilled workers are allowed to perform construction works that require skilled labour.
- 2.2 To meet the requirements set out by the Department of Immigration Malaysia pertaining to the extension of Visit Pass (Temporary Employment) for foreign construction workers.
- 2.3 To fulfill the Government's objective in enhancing workmanship and quality in construction.

## 3. Main Contractors' Responsibilities

- 3.1 Main contractors must ensure that all their workers both local and foreign are registered with CIDB and possess the Green Card.
- 3.2 Main contractors must ensure that their skilled workers possess the SKK or PKPA. Contractors are to forward their application for accreditation to CIDB and CIDB will then inform them of the date and place of accreditation.

3.3 Main contractors must ensure that their foreign workers who have been in Malaysia after the fifth year undergo the accreditation and acquire the PKPA or return to their country of origin if they fail to do so.

3.4 Main contractors must ensure that their subcontractors', nominated subcontractors' and labour only subcontractors' workers fulfill the requirements set out above (paragraph 3.1, 3.2 and 3.3)

## 4. Skill Trades

4.1 At the outset, CIDB have identified 12 trades for the accreditation exercise as listed below.

## 5. Application for Accreditation

- 5.1 Application can be made at any CIDB offices by completing the application form.
- 5.2 The skills assessment will be conducted at *Akademi Binaan Malaysia*, accredited training centres and at worksites.
- 5.3 If contractors wish to accredit their workers for trades other than those mentioned below, they may do so by contacting any CIDB offices.

## 6. Action Against Errant Main Contractors

6.1 Failure by Main Contractors in complying with the directive will result in disciplinary action against them as provided under the Regulation for Registration of Contractors (1995)-Regulation 15(1), LPIPM Act 520, 1994 which can result in their registration being revoked, suspended or withdrawn.

### List of Main Skill Trades

1. Bricklayer
2. Concretor
3. Carpenter (Formwork)
4. Plasterer
5. Barbender
6. Painter
7. Building Internal Plumbing Work
8. Sanitary Fittings Installation Work
9. Building Wiring Installation
10. Drywall Installation
11. Pipe Reticulation Work
12. Tiler

**For further information, contact:**  
**Construction Industry Development Board Malaysia**  
**Tel: 03-2617 0317/318/319**

# Malaysian Standard MS 2015: Public Toilets - Minimum Design Criteria

Prepared by Ling Pei San

**Objective:** To assist in the provision of clean, hygienic, safe and convenient-to-use public toilet facilities of appropriate design and quality and to give guidance on the basic care and maintenance of the facilities.

**Scope:** This MS covers all public toilets whether found in stand-alone structures or inside buildings. It covers statutory requirements, design, location, number, type and quality. Guidance is given on the provision of public toilets of various categories and adequacy, wherever they may be located.

**Use of this MS:** This standard is intended for use by local authorities, Government departments and other providers of public toilets, consultants, designers, builders, toilet facility providers, toilet cleaning service provider and those who are not involved in the building industry.

**Performance requirements:** The function of public toilets is to provide facilities for the public to use in which they may urinate, defecate, clean themselves, groom, perform parenting needs and otherwise attend to bodily needs in a clean, secure, private and hygienic manner. Public toilets may be exposed to the effects of the weather, external loads and pressures and ground movement. In addition, their structure and fittings may be subjected to vandalism. Public toilets shall be designed to withstand weather, vandalism and undesired activities.

**Number:** Sufficient public toilets units shall be provided to meet the requirements of the locality and the expected gender ratio. One measure is to ensure there is no or minimum waiting time before a toilet is available for use.

## Basic requirements

- Safe environment
- Facilities with personal hygiene and privacy
- Usable by all gender, age and parenting needs
- Needs of Disabled persons and care givers are met
- Convenient facilities and fittings
- Construction of fittings that are structurally sound and made from durable materials
- Fittings are vandal resistant
- Well lighted and good ventilation (natural or mechanical)

## DESIGN GUIDE

**Number of toilet units:** Determine the likely population, length of stay, arrival rate, the occupancy time, gender ratio, whether

all-gender or gender specific toilet facilities are to be provided and consider provision for expansion.

For short-term stay, the population at any point of time is totally dependent on the nature and the reason for stopping. Coach tours, for an example, typically allow 15 minutes to 30 minutes for 'comfort' stops, but up to an hour at a scenic spot or other points of interest.

An indication of the likely number of people that may be expected at a particular location may be obtained by studying the intended catchment area and by assessing various factors including the following: traffic volumes (pedestrians and vehicular), car parks, shops, bus stops, taxi stands, tourist attractions, sports and major entertainment venues, amusement parks and places of worship in association with the level of use and associated seasonal peaks.

The arrival rate of the public at a toilet facility will be different for short-term stay locations to that for medium and long-term stay locations.

Length of stay	Arrival rate (% of population)
Short term <1hour	>80
Medium (1hour – 2hours)	5 – 10
Long (>2hours)	10 – 15

Arrival rates are usually determined as an average peak arrival rate over a 15-minute period. This length of time can be varied to suit the location and a 30-minute or 60-minute period could be more appropriate.

**Design occupancy time:** It is recommended that the following design occupancy times be used when determining the number of toilet units that should be provided.

Situation	Gender	Design occupancy time (seconds) (Total = use time+hand wash time)	
		Use time	Hand wash time
No interval effect	Female	150	90 + 60
	Male	100	60 + 40
Limited opportunity to use (interval effect)	Female	130	70 + 60
	Male	90	50 + 40

For further information, please refer to MS 2015: PART 1 : 2006

# Illegality And Breaches Of Consultancy Contracts: Lessons To Be Learnt From *Luxor Holdings Sdn. Bhd. V Hainal-Konyi (M) Sdn. Bhd.*

By Ir. Harbans Singh K.S., B.E. (Mech) S'pore, C. Eng., P.E., LLB (Hons) London, CLP, DiplCARb

Of all the species of contracts encountered in the engineering/construction industry, it is undeniable that the ones that are the most informal or nebulous are the ones involving the consultants, especially the engineers. One may attribute this to mere ignorance of the law, or, the lackadaisical attitude of the profession, but more often than not, most engineers seem to be content with the fact that so long as they are ultimately remunerated for the work done, the legalities are of secondary concern. The end result is consultants working upon the issuance of a mere letter of intent or just oral representations. The more informed consultants, or the ones being risk averse, take the formal route; insisting upon the drawing up of an official consultancy contract<sup>1</sup>. Having entered into such a contract, no matter what its form or content, is no guarantee as to its enforceability. Should such a contract be tainted with illegality, its consequences may be dire; a fact exemplified lucidly in an earlier Court of Appeal's decision of *Sami Mousawi-Utama Sdn. Bhd. v Kerajaan Negeri Sarawak*<sup>2</sup>. Furthermore, should the consultant concerned breach his obligations under the said contract, in particular, if the obligations go to the root of the contract, he may lose his entitlements for the recovery of his professional fees and instead face termination and its attendant ramifications. It has been a general belief by a majority of consultants that such fundamental breaches are confined merely to design work. However, as of recent, the trend has slowly shifted to also encompass supervision and contract administration duties, which, for all intents and purposes, reflect on the ultimate realization of the fruits of the particular contract being implemented.

Both these issues have been amply dealt with in the recently decided case of *Luxor Holdings Sdn. Bhd. v*

*Hainal-Konyi (M) Sdn. Bhd.*<sup>3</sup>; a case on appeal from the High Court. In a carefully formulated judgment, the learned judge, his Lordship Mokhtar Sidin JCA thoroughly reviewed the background and law relating to the issues raised and made some crucial pronouncements that should serve as a useful lesson to consulting engineers' *vis-à-vis* contracts relating to their engagement. This short article has been penned with the objective of informing practicing engineers on the possible approach the courts will take in construing, and thereupon enforcing the consultancy contracts referred to such forums and the areas to be mindful of in ensuring that such contracts are not held against them.

## FACTS OF THE CASE

The appellant (the defendant in the court below) engaged the respondent (the plaintiff in the court below) as their consultant civil and structural engineer. The appointment was made through a letter dated November 14, 1995 which the parties agreed to be the contract. The contract was for a lump sum of RM410,000 comprising of RM242,000 for alternative structural design and RM168,000 for the scope of services under Part A Condition of Engagement, Board of Engineers Malaysia (BEM). Apparently, the structural design by the previous consultant was discarded and the structural design by the respondent was adopted. For the appellant's project, the respondent assigned E1 and E2 (DW2), their two engineers to look after the project.

1. Either based on the 'BEM Model Form' or a 'Bespoke' Form.
2. [2004] 2 MLJ 414, CA.
3. [2006] 3 MLJ 727, CA.

On April 17, 1996, DW2 gave a three-month notice to the respondent to resign in accordance with his contract of service.

Before that, E1 had left the respondent and set up his own consultant firm known as ANZ Sdn Bhd. When the said DW2 tendered his resignation, the relationship between DW2 and the respondent was not cordial anymore because of some accusations and allegations by the respondent in particular by PW1. DW2 denied the allegations and as a result DW2 left the respondent before the three months lapsed. DW2 then joined E1 and the firm's name of ANZ Sdn Bhd was changed to Azman, Lim & Associates, where both E1 and E2 were the substantial shareholders and the only directors.

On May 7, 1996, the appellant gave notice to the respondent to terminate the contract and also informed the respondent that the appellant wished to change their consultants. The appellant then requested the respondent to submit the invoices for all works done up to the date of termination. On May 27, 1996, the appellant proceeded to appoint the firm of Azman, Lim & Associates as their new consultant. On August 15, 1996, the respondent submitted their final invoice for the sum of RM393,750, i.e., the total amount stated under the contract minus RM36,750 already paid by the appellant. The RM36,750 consisted of RM35,000 as fees and the balance 5% service tax. On September 9, 1996, the appellant wrote back stating their refusal to pay the amount claimed by the respondent and again requested the respondent to itemise the claims. By their letter dated September 4, 1996 the respondent refused to itemise the invoice and claimed that since the appellant unilaterally terminated the contract, the appellant should pay the balance of the amount stated in the contract. By this letter, the learned judge was of the view that the respondent were seeking damages for breach of contract and not for works done under the contract.

The respondent instituted the present action when the appellant failed to pay the amount claimed by the respondent. The statement of claim showed that the respondent's claim was for breach of contract in the sum of RM393,750. The respondent claimed that the termination was unlawful, null and void and the respondent were entitled to recover the full amount under the contract.

The appellant in their statement of defence stated as follows:

(1) The defendant used the services of the plaintiff on the basis that the engineers employed by the

plaintiff were registered with the Board of Engineers Malaysia (BEM) in accordance with the Registration of Engineers Act 1967.

(2) The plaintiff had failed to carry out its obligations stipulated in the letter of November 14, 1995 and was in breach of the said agreement; particulars of breach are as follows:

(a) The plaintiff had at all material times used the services of E2 to oversee the project works; E2 being an engineer registered with the BEM.

(b) By the month of April or May 1996, E2 and E1, both registered engineers of BEM with the plaintiff company had resigned.

(c) As a result of the resignations of E1 and E2 the plaintiff did not have the expertise and registered engineers to carry on with the work as civil and structural consultants for the project.

(d) The plaintiff did not appoint other registered engineers to take over conduct of the project and caused the contractor and other workers involved in the project not to be able to proceed with their work.

(e) The defendant then requested the plaintiff to obtain the services of other registered engineers to carry on with the work but the plaintiff failed to do so.

(f) On the basis of the plaintiff's failure to obtain the services of qualified and registered civil and structural engineers to carry on with the project work, the defendant terminated the plaintiff's services vide their letter of May 7, 1996.

The respondent's/plaintiff's claim in the present appeal was that the appellant/defendant had wrongfully terminated the contract and as a result the respondent was entitled to the full sum under the contract. The appellant, on the other hand, claimed that the termination was justified because the respondent was in breach of the contract when no registered engineer was appointed to the project when E1 and DW2 resigned. The appellant in their letter terminating the services of the respondent also informed the respondent that they would be appointing a new consultant engineer in place of the respondent. The appellant

made no secret that they wanted DW2 to be the consultant. Though there is nothing in the record to show that the respondent was not happy with the appointment of DW2, it was clear from the meetings between the respondent, the appellant and the architect of the appellant that the respondent was not happy and not willing to work with the said DW2.

### FINDINGS OF THE COURT OF APPEAL

In allowing the appeal with costs, the Court of Appeal held as follows:

- On the issue whether the agreement between the appellant and the respondent was illegal

PW1 was one of the directors of the respondent; an international company operating in Malaysia. With the coming in force of Section 7A of the Registration of Engineers Act 1967<sup>4</sup>, the respondent became a body corporate whereby it was subject to statutorily imposed prohibitions and restrictions, principal amongst which was, PW1 (being a foreigner) was not allowed to be a shareholder or to hold the office of a director. As the evidence showed, PW1 was the alter ego of the respondent and he was the one who negotiated and concluded the consultancy contract for and on behalf of the respondent. This was in direct contravention of the Act which proscribed such conduct. Hence, the agreement was held to be illegal.

In buttressing his decision, the learned judge said:

*'..... in my view, being an employee only and on top of that a temporary one for a particular project, the power of PW1 differed substantially from that of a director or a shareholder. As an employee of a particular project, PW1 has to take instructions and directions from the director, shareholders or officers of the respondent and that also in respect of the project he was employed. Apparently, in the present appeal, it was the other way round, it was PW1 who gave instructions and directions to the shareholders and directors of the respondent such as the instructions and directions to DW2. It shows that PW1 had exceeded the authority given to him and acted in contravention of the prohibitions and restrictions imposed in the certificate issued to him. The appellant contended that as an employee, PW1 could not negotiate or enter into a contract with any party. The appellant*

*submitted that any contract by an unauthorised engineer is illegal and he cited Raymond Banham & Anor v Consolidated Hotels Limited [1976] 1 MLJ 5 and John B Skilling & Ors v Consolidated Hotels Ltd [1979] 2 MLJ 2 ....'*

He further said:

*'... at the time when the negotiations and the conclusion of the agreement, the appellant did not know that PW1 was not a director, a shareholder or an officer of the respondent and that he had no authority to act for the respondent. Though PW1 claimed that he was authorised by the respondent to do so, the letter of authorization was never produced.*

*Looking at the evidence as a whole, I am in agreement with the appellant that PW1 was the alter ego of the respondent just because he was the one who incorporated the respondent. He should have stopped doing so when the Act was amended because by then he was prohibited from being a shareholder, a director or an officer of the respondent. He should not hold himself as such. Surprisingly, none of the shareholders, the directors or the officers of the respondent stopped PW1 from doing so. This is understandable because the evidence shows that PW1 was the only person with the respondent who could allocate the shareholding, appoint the directors, appoint and terminate the engineers within the respondent in total contradiction to the prohibitions imposed by the Act and the certificate issued to PW1. It is also apparent that PW1 was the only person with the respondent who could negotiate and conclude a contract for the respondent. The Act did not permit PW1 to do so. From the evidence, it is clear to me that the agreement with the appellant was concluded by PW1 on behalf of the respondent. The Act did not permit him to do so. For that reason, I find that the agreement was illegal.'*

- On the issue of whether there was a breach of contract permitting termination of the contract due to the respondent's default in assigning a replacement engineer.

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4. In short 'the Act'.

It was held, that by not naming the replacement engineer who was registered upon the resignation of DW2, there was in fact no consultant engineer assigned to the appellant's project as was stipulated in the consultancy contract. This was supported by cogent evidence which also showed that there was no such assignment even up to the date of termination. It should have been apparent to the respondent that this breach would inevitably result in the appellant's project being delayed. Such a breach was accordingly serious and therefore entitled the appellant to terminate the consultancy contract.

His Lordship, Mokhtar Sidin JCA explained the basis of his judgment in the following words:

*'.... the second issue raised by the appellant was in respect of the number of registered engineers attached to the respondent when DW2 tendered his resignation to the respondent. The appellant contended that under the contract the respondent should assign two registered engineers to the appellant's project at all time. The evidence shows that when E1 left the respondent there was no replacement for him. There was already a breach by the respondent. When DW2 tendered his resignation the respondent failed to inform the appellant the names of the registered engineers to replace E1 and DW2 as consultants. The appellant raised the issue of the replacement of DW2 with the respondent, i.e. PW1. It is apparent to me, even at that time the appellant did not know that PW1 had no authority to represent the respondent. The appellant gave evidence that it was necessary for the project to be completed within time so that they would not be penalised for late delivery....'*

He continued:

*'.... the appellant contended that the learned judge was in error when he said that 'there is no express terms in the contract that the plaintiff must have at all times engineers who are registered with BEM'. It is obvious the learned judge misread the Act in particular Section 7 where it is stated that no person shall practise, carry on business or take up employment as an engineer unless he is a registered professional engineer. Section 2 defines 'registered engineer' to be an engineer under this Act. In my view, an engineer could*

*only practice as an engineer or a professional engineer once he registers himself with BEM under Section 7 of the Act. In the agreement between the parties, when it states that the engineer, meant an engineer registered under Section 7 of the Act. The learned judge was indeed in error when he stated in the judgment the above.....*

*.... when DW2 tendered his resignation, the respondent did not name his replacement. If I am not mistaken, when DW2 tendered his resignation PW1 asked DW2 to stop work immediately in respect of the appellant's project. PW1 knew that the appellant wanted to complete their project in time. By not naming the replacement of DW1 there was no consultant engineer assigned to the appellant's project. According to the evidence, the respondent did not assign any engineer until the appellant terminated the agreement. This was the second breach by the respondent. It was obvious to the appellant that when the respondent failed to name the replacement for DW2, the appellant's project would be delayed. In view of the breaches by the respondent, I am of the view that the appellant is entitled to terminate the agreement ....'*

#### COMMENTS/OBSERVATIONS

From the foregoing judgment, a number of observations can be made which can serve as a lesson to practitioners, especially Consulting Engineers. First and foremost is the fact that the Courts are prepared to enforce the requirements of the Act literally and strictly. This is most laudable as the whole purpose of the Act is to protect the public from the effects of unprofessional practices and instill a sense of integrity to the engineering fraternity; a fact clearly articulated by a previous bench of the Court of Appeal <sup>5</sup>. To this effect, breaches especially of Section 7 & 7A of the Act are held in a very serious light to the extent that any ensuing contract tainted with illegality may result in its unenforceability by the Courts. Furthermore, the word "engineer" is given a restricted meaning (contrary to its common usage); being confined to an engineer or other qualified person registered under the Act <sup>6</sup>. This is consistent

5. See the C.A's judgment in *Sami Mousawi-Utama Sdn. Bhd. v Kerajaan Negeri Sarawak* [2004] 2 MLJ 414.
6. Thereby breathing life to Section 2 of the Act.

with the Malaysian Court's approach for the other professions e.g. the definition of an "architect" in *Gunung Bayu Sdn. Bhd. v Syarikat Pembinaan Perlis Sdn. Bhd.*<sup>7</sup>.

Secondly, foreign engineers practicing in Malaysia should take heed of the Court of Appeal's pronouncement on their status in respect of their registration and involvement in body corporates pursuant to the relevant provisions of the Act and in particular Section 7A. However, in the author's humble opinion, it was not necessary for the Court to follow the Singaporean decisions of *Raymond Banham & Anor v Consolidated Hotels Limited*<sup>8</sup> and *John B. Skilling & Ors v Consolidated Hotels Ltd.*<sup>9</sup> (which are merely of persuasive nature) as there was already on record the Court of Appeal's previous judgment of *Sami Mousawi-Utama Sdn. Bhd. v Kerajaan Negeri Sarawak*<sup>10</sup>. Perhaps this was because it was not brought to the said courts attention. Be that as it may, the instant pronouncement reinforces the Court of Appeal's earlier decision; thereby reflecting its consistency in its approach to the said matter.

Another significant principle that can be distilled from the instant judgment is that pertaining to the necessity for consultants to provide registered engineers during the contract implementation stage, especially if there is an express stipulation to this effect in the consultancy contract<sup>11</sup>. Breach of such a stipulation is regarded a fundamental breach of contract, as reflected in the said decision, since it will inevitably lead to an ensuing delay in the project involved with its attendant dire ramifications for the client. Consequently, the client may be entitled, as transpired in the instant case, to terminate the contract and claim the consequential damages. Consultants should take particular heed of this aspect of the judgment as there is a tendency to treat the said obligation lightly, since to date a majority of clients have not been enforcing similar obligations strictly. Notwithstanding this being a contractual requirement, consultants should realize that the need to provide such engineers is also a statutory obligation<sup>12</sup>; breach of which carries concurrent statutory sanctions.

It should also be noted that on the facts of the case, the respondent's claim against the appellant failed as it was merely for damages for breach of contract; not for works done under the contract. As is clearly elucidated by the learned judge in the detailed judgment, this claim could not be tenable in law on the said basis; hence its summary dismissal. This does not mean that based on the facts, the

respondent could not have claimed the costs for the work done. On the contrary, in the author's opinion this could have been sustained and successfully pursued, had the claim being premised on Section 71<sup>13</sup> of the Contracts Act 1950 (Act 136, Rev. 1974) i.e. for *quantum meruit*.

It is pertinent to note that Section 71 can be invoked by the aggrieved person even to a void contract as its purpose is to prevent unjust enrichment. Provided, the aggrieved party can meet the four conditions stipulated in Section 71 on a balance of probabilities, the claim could be sustained in law: *Siow Wong Fatt v Susur Rotan Mining Ltd. & Anor*<sup>14</sup>. In the final analysis, much depends on the way the claim is drafted especially on the legal basis being pursued. For this, careful thought has to be expended in arriving at the very legal premise of the claim as a wrong decision reached may compromise the claim and thereby render it ultimately nugatory.

## CONCLUSION

The Court of Appeal's instant decision is a very pertinent one for consulting engineers in particular and also their employers as it underlines in no uncertain terms the judicial approach that is currently favoured in addressing issues pertaining to consultancy contracts that are submitted to such a forum. The issues under consideration are not unfamiliar to the industry as they encompass matters that are encountered frequently in practice by most of the industry players. Much has to be learned from the said decision, which if read in conjunction with earlier pronouncements of the local courts, furnishes valuable guidelines for the practitioners to imbibe and observe. However, it is ultimately left to the industry itself to take heed of the said judicial pronouncements and to ensure that these are adhered to as strictly as possible; failing which the consequences are well apparent and for which no one else can be faulted. **BEM**

7. [1981] 2 MLJ 149 where the HC held that an 'architect' meant an Architect registered under the Architects Act 1968 (Act 117).
8. [1976] 1 MLJ 5.
9. [1979] 2 MLJ 2.
10. [2004] 2 MLJ 414, CA.
11. In particular the BEM's Standard Form of Agreement.
12. E.g. under the 'Street, Drainage & Building Act 1974', 'Uniform Building By-Laws', etc.
13. Entitled 'Obligation of person enjoying benefit of non-gratuitous act.
14. [1967] 2 MLJ 118; (1967) 2 PCC 413, PC. See also *Ted Bates (M) Sdn. Bhd. v Balbir Singh Jholl* [1979] 2 MLJ 257, FC.

# IBS Roadmap 2003-2010: The Progress and Challenges

By Ir. Shahrul Nizar Shaari, CIDB Malaysia

Prefabricated construction in Malaysia started almost 40 years ago with the completion of the Tunku Abdul Rahman Public Housing Estate; or commonly known as the Pekeliling Flats. For the last four decades, the construction industry has been experimenting with various prefabricated construction; being lead by various precast concrete solution providers. In most cases, it was for one-off and isolated projects. No proper plan was formulated by the Government for the industrialisation of construction until the inception of the IBS Roadmap 2003-2010. A masterplan to facilitate the transformation of the Malaysian construction sector was formulated with inputs from industry and endorsed by the Cabinet in October 2003. Known as the “Industrialised Building Systems (IBS) Roadmap 2003-2010”, the masterplan is based on the 5-M Strategy (Manpower, Materials-Components-Machines, Management-Processes-Methods, Monetary and Marketing) with the target of having an industrialised construction industry as well as achieving Open Building Concept by the year 2010<sup>1</sup>. The transformation of the construction sector is crucial in ensuring the successful achievement of Vision 2020.

Even though the Construction Industry Development Board (CIDB) Malaysia is not the first to promote



Installation of Precast Concrete Wall: Manpower – Critical Success Factor

**“ The lead secretariat for the development and monitoring of IBS Roadmap is CIDB, under the patronage of the Ministry of Works. Supporting the program are the various agencies involved in the 5-M activities of the Roadmap; with JKR as the most important partner. ”**

the usage of prefabrication in Malaysia, kudos must be given to the agency for being the first to champion a coordinated national-level programme for industrialisation of the Malaysian construction sector. It can also be rightly claimed that it is actually a re-branding exercise by the Government to reintroduce prefabricated construction amid negative perceptions by industry players. Nonetheless, it is also a fact that the term “IBS” goes far beyond being a modern method of prefabricated or offsite construction. IBS also includes the Open Building Concept that was first promoted during the rebuilding years of post-war Netherlands. The rules for dimensions, positions and interfaces of components are important elements of Open Building. As such, the principles

of Modular Coordination (MC) are also applied. In the Malaysian context, it is the rules set by the Malaysian Standard MS 1064 that were based on Nederlands Normalisatie Instituut (NNI)’s NEN 6000; the standards for MC in design of buildings. In fact, the amendment of the Uniform Building By-Law (UBBL) to incorporate MC has been outlined in the IBS Roadmap.

The ideal state of having one common IBS Open System, based on the fundamentals of Open Building, for the whole industry is very unlikely in the near future. This is because the industry already has 129 IBS systems providers that cover precast concrete frames, panels and blocks, steel frames, prefabricated timber frames as well as system formworks<sup>2</sup>. Each

<sup>1</sup> *Industrialised Building Systems (IBS) Roadmap 2003-2010*, CIDB Malaysia, 2003

<sup>2</sup> *IBS Manufacturers Directory 2005/2006*, CIDB Malaysia

system provider has invested heavily and not all systems or production facilities are easily adjustable or convertible. Nonetheless, as outlined in the IBS Roadmap, the strategy is to start with Government building projects as it has great volume and in most cases, controlled by a single agency. This is not new as the Public Works Department (JKR) has always been using its own standardised building plans. The only change is to convert the plans using IBS components. In fact, by the time the IBS Roadmap was launched, the department had already been issuing standard IBS drawings. In essence, it is planned that the development of the national Open System is based on Government standard plans.

The lead secretariat for the development and monitoring of IBS Roadmap is CIDB, under the patronage of the Ministry of Works. Supporting the programme are the various agencies involved in the 5-M activities of the Roadmap; with JKR as the most important partner. The commitment by the Government on IBS implementation is very high. After the Roadmap's endorsement by the Cabinet, the first strong indication by the Government was through the 2005 Budget announcement in September 2004. First, it was announced that all new Government building projects are required to have at least 50% IBS content; which is calculated through the IBS Score Manual that was developed by CIDB. The decision to make it compulsory for Government buildings was to create sufficient momentum for the demand of IBS components. In order to attract private clients, the second announcement was on the levy exemption for housing projects that have a minimum IBS Score of 50%<sup>3</sup>.

The IBS Agenda was further boosted with the 2006 Budget announcement. Tax incentive was offered through Accelerated Capital Allowance (ACA). IBS manufacturers would be given ACA for expenses incurred in the purchase of moulds used for production of precast concrete components. Also stated in the 2006 Budget was that the



*Precast-In-situ Hybrid Putra Mosque, Putrajaya:  
Upholding High Integrity – No Compromise*

**“ IBS is far beyond prefabricated solutions and project implementation. IBS is also about the changing of conventional mindset, championing human capital development, developing better cooperation and trust, promoting transparency; and, most importantly, high integrity. ”**

Government would ensure that all IBS components used in public projects are MS 1064-compliant<sup>4</sup>. This would facilitate standardisation of components and increase productivity of construction. The commitment of the Government is further strengthened with the announcement of the Ninth Malaysia Plan. Again emphasis was given to IBS in public and affordable housing projects. In addition, it was also declared that the Government would be offering more

incentives for users of standardised drawings based on the usage of IBS and MC.

It seems that with all these commitments by the Government, the IBS Agenda would be smooth sailing. Unfortunately, the IBS Roadmap was launched at the end of the Eighth Malaysia Plan; and by then, most of the Government allocations for development had been utilised. As the kick-start initiative depends almost solely on Government projects, not much could be seen in terms of IBS application. It was limited to one or two “IBS pilot projects” and thus it could be argued that nothing much has changed in the industry since the introduction of the IBS Roadmap. As such, even though JKR offers a new set of Government quarters' drawings

using IBS and MC, it is not being utilized fully due to the low overall demand of public construction activities. Until the public projects under the Ninth Malaysia Plan are rolled-out physically by the various Government agencies, the actual impact of the IBS Roadmap's initiatives will not be felt by the industry. The support from these Government clients is very crucial. They must equip their staff with relevant IBS knowledge in order to ensure proper execution of the projects. Besides that, the appointed contractors must not be allowed to counter propose conventional construction. Nonetheless, with the strong commitment from the Government, it is expected that by the end of the Roadmap period; which coincides with the end of the Ninth Malaysia Plan, positive changes will materialise.

Besides the support from Government projects, it is also important for private developers to participate in ensuring the successful implementation of the programme. Some may argue that the incentive in the form of exemption of levy for projects with minimum IBS Score of

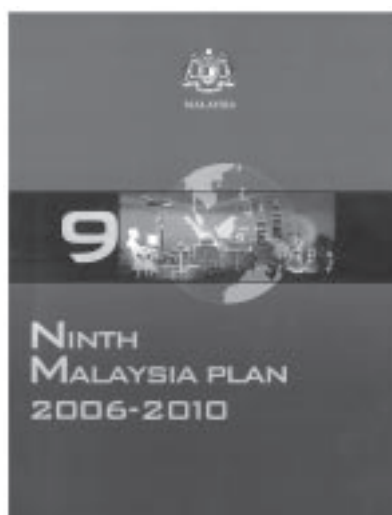
<sup>3</sup> 2005 Budget Speech, [www.pmo.gov.my](http://www.pmo.gov.my)

<sup>4</sup> 2006 Budget Speech, [www.pmo.gov.my](http://www.pmo.gov.my)

50% is too little. The effectiveness of the offer is very unlikely due to the fact that the current levy imposed on building projects is already low. Initially the levy charged for construction projects was at 0.25%. However, after the enforcement of the Economic Stimulus Package in 2003, it was reduced to 0.125% and as for low, low medium and medium cost housing projects<sup>5</sup>, no levy is imposed. Based on the 0.125% rates, say for a RM20 million project, the levy to be paid to the Government is only RM250,000. The offer will only be attractive if the increase of cost due to the usage of IBS components is less than that value. With the current low demand and low standardisation of IBS components, undoubtedly the initial usage of IBS will increase the total material costs of the project; even though ultimately it lowers the total construction costs in the longer term. Because of this, the industry is not too keen to take up this offer by the Government. As such, an increase in take-up rates will only materialise when overall prices of IBS components are reduced. Alternatively, positive response is expected to pour in if the Government decides to increase the levy back to pre-2003 rates.

Nevertheless, it is crucial to highlight that the incentives discussed above are designed to prepare private developers for a major change. It is stated in the IBS Roadmap that by the year 2008, all private development are required to achieve a minimal buildability or IBS Score before any development approval is given. This is similar to what has been practiced in neighbouring Singapore. In ensuring the success of its construction industrialisation programme, the Buildable Design Appraisal System (BDAS) was introduced. BDAS was made as a mandatory requirement for all building plans approval. It was implemented on January 1, 2001 for

all new buildings and new extensions that are more than 5,000m<sup>2</sup> in gross floor area (GFA). And with effect from January 1, 2004, the minimum GFA is reduced to 2,000m<sup>2</sup><sup>6</sup>. The year 2008 is not too far away and in consequence, it is also important for both the government as well as developers to start to make relevant preparation on this matter. Proper mechanism must be developed and promotions and education programmes must be in place within one or two years before the date of implementation.



Another main challenge for successful implementation of the IBS Agenda is regarding the construction workforce. In fact, it can be stressed that the most critical success factor is reducing or eliminating the illegal foreign workforce that is flooding the country. In fact, the total number of illegal workers in Malaysia is estimated at four times the number of legal workers; with the latter estimated at 1.85 million<sup>7</sup>. As long as it is easy for the industry to find illegal workers, labour rates will remain low and builders will find it unattractive to change into simplified solutions such as IBS. Irresponsible employers are still bold enough to hire the illegals; and in the process, bring

down the market rates. The Government through CIDB's *Akademi Binaan Malaysia* (ABM) spends millions of Ringgit each year to train construction workers but it is of no use if the graduates are not interested to find jobs in the construction industry due to the extremely low wages. In the end, the industry will always prefer the labour intensive methods, at the expense of IBS; quality and productivity.

It is important is for the Government to have a proper assessment and verification scheme for IBS products, manufacturers, contractors (installers) and workers in place. This is needed to avoid inferior products and service providers from flooding the market. While the IBS Agenda also includes the development of IBS techno-preneurs, it is very important that stringent quality control is imposed. An "IBS-Status" programme is suggested to be developed and modelled based on the Multimedia Development Cooperation (MDEC) approach. This can also be used to develop incentives programmes and not limited to verification activities. In addition, promotion and Continual Professional Development (CPD) programmes for designers must be enhanced to include IBS knowledge. A survey of the industry shows that 66% of architects admit to have "Poor" knowledge in IBS<sup>8</sup>. In fact, on the suggestion section of the survey, most of the respondents (34%) have requested for more awareness and education programmes on IBS.

In summarizing the issues, CIDB as the lead secretariat requires solid support from the relevant Government agencies that are involved in its implementation. Also important is for the Government and industry to work hand-in-hand in ensuring successful implementation of the IBS Roadmap and achieving the target of construction industrialisation. IBS is far beyond prefabricated solutions and project implementation. IBS is also about the changing of conventional mindset, championing human capital development, developing better cooperation and trust, promoting transparency; and, most importantly, high integrity. **BEM**

<sup>5</sup> *Economic Stimulus Package Speech, 2003, www.mten.gov.my*

<sup>6</sup> *Code of Practice on Buildable Design, Building and Construction Authority (BCA), Singapore, September 2005,*

<sup>7</sup> *1.85 juta warga asing bekerja di Malaysia, Berita Harian, 19 July 2006.*

<sup>8</sup> *IBS Survey 2005: Survey on Malaysian Architects' Experience in IBS Construction, CIDB Malaysia, 2006*

# Some Design And Practical Perspectives In Concrete Cracks

Part 1

By Ir Tee Horng Hean

The presence of visible cracks in concrete is inevitable when subjected to excessive tension-inducing forces such as pulling, bending, twisting, etc. Even if steel reinforcement bars (rebars) are placed into concrete, it still does not prevent the concrete from cracking but on the other hand, rebars merely control the crack width (NPIRD, 2004). Cracks, classified as structural or non-structural can deteriorate from non-structural to structural cracks due to serious corrosion of rebars (Perkins, 1997, p.81).

## PROPERTIES OF CONCRETE AND STEEL

Un-reinforced concrete, being capable of resisting relatively high compressive forces, behaves rather poorly with the imposition of tensile forces. Concrete, having a resistance in tension of approximately seven to 15% that of its compressive strength (MacGinley & Choo, 2001, p.13; Price, February 1951, pp.417 - 432; Wang & Salmon, 1992, p.13) is "strengthen" through the provision of steel bars in zones where tensile stresses exists. Steel, be it mild or high tensile, is a complementary material to be added to concrete and some differing properties of concrete and steel are shown in Table 1.

When there is a rise in temperature, an object would expand and when the temperature is reduced, the object experiences contraction. Steel and concrete have the same linear expansivities thus expanding and contracting by the same amount with varying temperatures.

## CONCRETE CRACKS

### ● Axially Loaded Forces (Tensile/ Pulling & Compressive Forces)

When a Reinforced Concrete (RC) structural element is subjected to a pulling force (Fig. 1), separation cracks penetrating through the entire cross section (Shina, 1988, p.290) would develop when its tensile strength resisting the applied force is exceeded. It should be noted that the use of concrete having a Young's Modulus of 30000N/mm<sup>2</sup> with minimum high tensile rebars (based on BS8110:1985), the tensile force experienced by the concrete would be approximately 30 times that experienced by the rebars when a tensile force is applied onto this element. Reduction of the stress onto the concrete is either through the provision of more reinforcements or the reduction of the concrete stress which the latter is seldom adopted in practice.

If the axially applied forces (Fig. 1) were reversed, the RC member would experience compression and would very seldom crack and fail unless of course if the concrete's compressive endurance limit has been exceeded. One such example can be witnessed in most material testing laboratories where progressive compressive force is applied on concrete samples and prior to complete failure, cracks can be observed on the test samples.

When a load is imposed on a structural element, checks should be taken to ensure that concentrated loadings do not exceed the compressive/tensile endurance limit of concrete as this would constitute a failure in the region of the applied loading and depending on the structural design, cracks would develop prior to failure. To avert cracks due to concentrated loadings, additional reinforcements should be provided and where this is not possible, an increase of the area of

**Table 1: Complementary Properties of Concrete and Steel**

Source: Adapted From: Mosley, W. H., Bungey, J. H. & Hulse, R., 1999, *Reinforced Concrete Design*, Fifth Edition, Palgrave, London, p.1.

Properties	Concrete	Steel
Tensile strength	Poor	Good
Compressive strength	Good	Slender bars would buckle
Shear strength	Fair	Good
Durability	Good	Corrodes when exposed and unprotected
Resistance to fire	Good	Loses strength at high temperatures

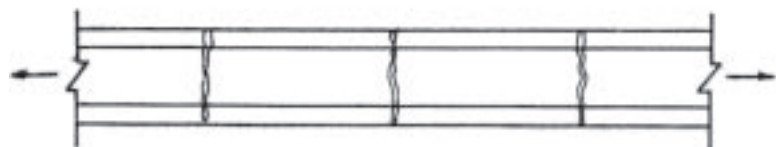


Figure 1

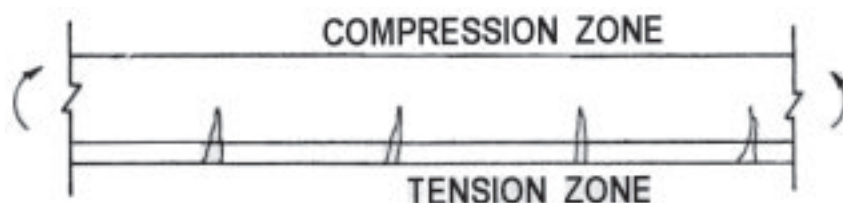


Figure 2

concrete in contact with such loadings should be looked into.

### ● Flexural Forces In Concrete

Flexural cracks will develop in RC when subjected to pure flexural forces (Fig. 2) when the concrete in the tension zone cannot resist the tensile stresses induced by the flexural forces. The top portion of a beam is in compression while the bottom portion is in tension when the element experiences pure bending (Fig. 2). Provision of adequate longitudinal reinforcements would suffice in resisting a predetermined flexural force and preventing serious cracks as shown in Fig. 2. The methods of determining the amount of reinforcements, usually covered in texts on *Mechanics of Materials*, *RC*

*Design and Code of Practices* are not discussed here.

If a RC beam is cast from the tension zone to its neutral axis with a particular grade of concrete and perhaps due to unforeseen circumstances, the remaining portion of the beam is cast with another grade of concrete, transverse shear would be present which under normal circumstances are negligible. Transverse shear forces that exceed the concrete stress are bound to produce cracks between the interfaces of the different grades of concretes. Besides, differential shrinkage will take place between the old and new concrete at the interfaces (Taft, Speck & Morris, 1999). Thus it is vital that during concreting certain form of control is adopted so that such a situation does not arise.

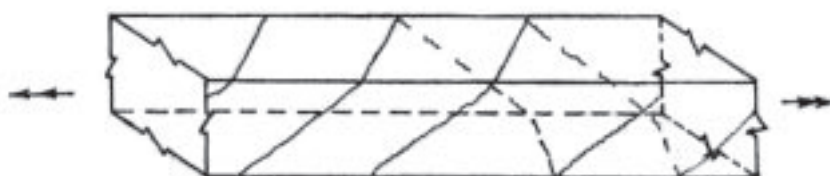


Figure 3

### ● Torsional Forces In Concrete

Due to the layout of the structural elements, there may be times where torsional forces might be present. The use of closer shear links spacing and the provision of additional longitudinal rebars to counteract torsional forces are usually recommended in most Code of Practices when torsional stresses are significant. The crack patterns that form due to torsional forces are of spiral form as shown in Fig. 3.

### ● Spacing of Reinforcements

In the BS8110 Code of Practice, though not explicitly mentioned, the reason for minimum spacing of rebars, in Clause 3.12.11.1, "minimum distance between bars" is to ensure that proper compaction during concreting can be achieved. Recommendations for the maximum distance between bars are also given. In the Indian Code of Practice, IS 456: 1978, the maximum slab reinforcement distance is the lesser of three times the slab's effective depth or 450mm (Pillai & Menon, 1998, p.162; Shina, 1998, p.292).

The British Code of Practice, BS8110:1985 on the other hand, permits larger reinforcement spacing that is the lesser of three times the slab's effective depth or 750 mm (Mosley, 1999, p.186; Kong & Evans, 1994, p.326).

The Institution of Structural Engineer's Manual (*I. Struct. E ICE Joint Committee, 1985*) however restricts the slab reinforcement spacing of main bars to the smaller value of three times the slab's effective depth or 300 mm while the distribution bars, the lesser of three times the slab's effective depth or 400 mm.

When rebars are placed too widely apart and if a situation arises where highly concentrated forces are imposed between the provided rebars, cracks would propagate from the applied loading to the rebars. Also, with rebars (of larger cross-sectional sizes) placed too widely apart, the control of crack is less effective as compared to rebars (of smaller cross-sectional sizes) that are placed closer. **BEM**

# Safety In Building Construction & Construction Site

By Ke Geok Chuan, Director, Policy and Research Division, DOSH Malaysia

There are two Acts that govern building construction activities namely, The Factories and Machinery Act 1967 (Act 139) and The Occupational Safety and Health Act 1994 (Act 514). The Department of Occupational Safety and Health (DOSH) under the Ministry of Human Resources is the lead authority in the enforcement of these laws.

These Acts are supported by relevant regulations, enabling any person or duty holder to be clear on how to discharge his legal obligations and responsibilities. One of the regulations is the Factories and Machinery (Building Operations and Works of Engineering Construction) (Safety) Regulations 1986.

## The Statutory Requirements

The laws that DOSH enforces cover building operations and works of engineering construction. Some of the salient requirements that have to be complied with by any person who undertakes any building operation and works of engineering construction are as follows:

- **Notification of Commencement of Construction Work**

Notice in the prescribed form (JKJ 103) shall be served on the Inspector not later than seven days from the commencement of those operations and which the person undertaking them has grounds for believing that

they will be completed in a period of more than six weeks. Such forms can be obtained from DOSH's regional offices.

- **Application for the installation of certificated machinery**

Application through the submission of the form JKJ 105 shall be made to the DOSH's regional office if tower crane, material hoist, passenger/material hoist, power scaffold and any other hoisting machinery, pressure vessel or steam boiler are installed and used in the construction site. No person shall operate or cause or permit to be operated any such machinery in respect of which a certificate of fitness

Source: IJM



Safety netting

is prescribed, unless there is a valid certificate of fitness issued under the Factories and Machinery Act 1967.

The applicant also has to ensure that tower crane, passenger/materials hoist and power scaffold are installed, erected, maintained, and dismantled by competent persons or company.

In addition, registered crane operator with DOSH has to be employed during the operation of tower crane, mobile or derrick crane at the construction site.

### ● Installation and Operation of Concrete Batching Plant

At some construction sites, concrete-batching plants can be found - they are erected and used for the production of mass concrete aggregates. In such cases, form JKJ 105 has to be submitted. Written permission for the commencement of the operation has to be obtained from the Inspector before any such plant can be used for the mass production of concrete at the work site.

This statutory requirement is in addition to the written approvals that need to be obtained from the Local Government Authority and the Department of Environment.

### ● Design and installation of temporary structures

Temporary structures such as scaffolds, catch platforms, ramps, wastes disposal chutes, loading platforms, reshores, formworks are commonly erected, installed and used in construction work. Design drawings with detailed calculations for such structures have to be prepared and endorsed by a Professional Engineer. These requirements are provided for in the regulations to ensure the integrity and safety of temporary structures at the work site for the whole duration of the project.

The main contractor or his representative must ensure that such documents can be made available for the examination and inspection by the Inspector during his site visit.

Many fatal accidents involving usage of such temporary structures in the past have been traced to poor and inadequate design - failure to incorporate suitable safety features,



*Scaffolding*

safe usage, operation, installation and handling even though duty of care had been made on the loadings that the structures are subjected to.

### ● Formation of Safety and Health Committee

A safety and health committee has to be established if there are 40 or more workers employed at the construction site. The safety and health committee has to be chaired by the project manager and the registered safety and health officer as the secretary. The Occupational Safety and Health (Safety and Health Committee) Regulations 1996 provides for the equal number of appointees from the management and workers. This is one of the safety arrangements that has to be put in place by the employer to comply with the law.



*Welding work with proper personnel equipment*

### ● Appointment of Safety and Health Officers

Under the Occupational Safety and Health (Safety and Health Officer) Order 1997 a registered safety and health officer shall be employed for any building operation or any work of engineering construction where the total contract price of the project is more than RM 20 million. The officer shall be employed full-time in the construction site to ensure that he is able to discharge his duties and responsibilities as provided for under the law.

### ● Formulation of Safety and Health Policy

In any work where more than five workers are employed, a written safety and health policy with respect to the safety and health at work of employees shall be prepared, approved and endorsed by the top management. A statement and any revision of it must be brought to the notice of all employees. This requirement applies to all employers whether they are main contractor, trade contractor, or sub-contractor.

### ● Appointment of Site Safety Supervisor and Contractor Safety Supervisor

The Factories and Machinery (Building Operations and Work Of Engineering Construction) Safety Regulations 1986 provide for the appointment of such personnel. The

Source: IJM

Source: IJM

main contractor shall appoint a part time safety site supervisor who shall spend at least 15 hours per week exclusively on safety supervision and on promoting the safe conduct of work generally within the site.

Also every contractor other than the main contractor in charge of worksite who employs more than 20 persons to carry out work on a worksite shall appoint a part-time contractor's safety supervisor, who shall spend at least five hours per week exclusively on safety supervision and on promoting safe conduct of work generally by the contractor's employees. These personnel in addition to the safety and health officer play an important role in ensuring that the work site is safe at all times and in assisting the contractors or employers on due observance of the laws.

- **Notification of Accidents, Dangerous Occurrence, Industrial Poisonings and Occupational Diseases**

The main contractor or his representative has to notify the nearest DOSH's regional office in the event of any accident that prevent workers from performing their normal duties by more than four days. Form JKPP 6 can be used to make such notification.

All cases of industrial poisonings or occupational diseases have to be brought to the attention of the employer and DOSH by making use of the form JKPP 7.

## Recent Legislative Developments

(i) The *Dewan Rakyat* and *Dewan Negara* have passed the amendments to the Factories and Machinery Act 1967(Act 139). Existing provisions have been reviewed, enhanced and strengthened. New technological development such as special scheme inspection has been incorporated. Penalties have been enhanced to ensure that all duty holders comply with the law. The amended Act is awaiting the Royal assent before it can be legally enforced.

(ii) A proposed Occupational Safety and Health (Occupational Safety and Health Management System) has been formulated and submitted to Ministry of Human Resources' Legal Adviser for comments. Construction industry stakeholders have been consulted for their comments and feedback.

One of the objectives of these regulations is to ensure that any person who undertakes any building operations and works of engineering construction shall have a functioning and effective safety and health management system at the work site.

(iii) Relevant steps have been taken to review and update the Factories and Machinery (Building Operations and Works Of Engineering Construction) Safety Regulations 1986. One of the new requirements is for the developer to provide for a suitable and adequate budget allocation to meet the cost incurred by the main contractor in formulating and implementing a safety plan at the work site.

## Other Non-Statutory Requirements

(i) Relevant steps have been taken to review the current guidelines on public safety in construction work to take into consideration current developments in the construction industry.

(ii) The requirement to carry out risk assessment by contractors involving construction activities in congested urban center will be provided for under the Code of Practice on Hazards Identification, Risk Assessment and

Risk Control (HIRARC). The draft document has been prepared and awaiting consultation with industry stakeholders before it is introduced for the guidance of the construction industry.

(iii) Steps have been taken by DOSH to come out with more new guidelines under the framework on occupational safety and health legislation. Such initiatives will be consistent with the self-regulation principle as enshrined under the Occupational Safety and Health Act 1994.

## CONCLUSION

It is the fervent hope of DOSH that every party or duty holder in the construction industry can demonstrate good corporate governance by exercising safe performance and adherence to the prevailing laws. Construction work like any other business operation can be managed well and profitably if top management in close collaboration with their employees ensures that all work activities are undertaken safely at all times without cutting corners or compromising on good engineering standard. **BEM**



Passenger hoist

Source: IJM

# World Toilet Organisation's Perspective On Toilets

By Colin See, Director, World Toilet Organisation



Sanitation is all about the process whereby people demand, effect, and sustain a hygienic and healthy environment by erecting barriers to prevent transmission of disease agents. It is also a crucial element for sustainable growth, be it rural or urban environments. The most important source of water contamination in developing countries is human faeces, due to the lack of adequate sanitation facilities

The United Nations, in collaboration with individual nations, regularly monitors access to water and sanitation. United Nations' World Health Organisation is one of the leading agencies in estimating the deaths caused by water-borne diseases. The most recently completed assessment, published in 2000 by the World Health Organisation (WHO 2000), is the most comprehensive to date, providing information for 89% of the world's population.

International statistics (WHO and UNICEF 2000) indicates that 2.6

## Estimates Of Water-Related Mortality

- World Health Organisation 2000 - 2.2 million (diarrhoea diseases only)
- World Health Organisation 1999 - 2.3 million
- WaterDome 2002 - more than three million
- World Health Organisation 1992 - four million
- World Health Organisation 1996 - more than five million
- *Hunter et. al. 2000* - more than five million
- UNDP 2002 - more than five million
- Johannesburg Summit 2002 - more than five million
- *Hinrichsen et.al. 1997* - 12 million

billion people in the world today are without any form of "improved sanitation" (defined by WHO as a pit

toilet, a pour-flush toilet or a WC connected to a public sewer or a septic tank). The real situation is even worse: the statistics include toilets that are so bad, or shared by so many people that it cannot be regarded as "improved sanitation".

About one billion of the six billion people in the world are served by sewerage systems but much of this sewerage is discharged into rivers, lakes and the sea with little or no treatment: Only about 300 million people have their sewage treated in an environmentally acceptable way (*Matsui 2002*). The excreta from the remaining 5.7 billion people are discharged directly into the environment.

The World Health Organisation's data showed high morbidity and death rates worldwide due to consumption of unsafe drinking water. Currently, about 20% of the world's population lacks access to safe drinking water, and more than five million people die annually from illnesses associated with unsafe drinking water or inadequate sanitation. If everyone had safe drinking water and adequate sanitation services, there would be 200 million fewer cases of diarrhoea and 2.1 million fewer deaths caused by diarrhoea illness each year<sup>1</sup>.

According to the U.S. Bureau of the Census international data group and UN population estimates, global population between 2000 and 2020 will grow from just over 6 billion to as much as 7.5 billion, with most of the increase in developing countries of Africa and Asia. Projections of future water-related deaths will depend on these future population estimates as well as a wide range of

<sup>1</sup> While each of these assessments offers a picture of the populations without access to water and sanitation services, different rates of response to surveys, inconsistent definitions of "access" and "adequate," and poor data availability make it difficult, and ill-advised, to draw conclusive trends over time. At the same time, despite problems with the data, it is evident that while progress has been made in providing water services to specific regions and areas, limited resources and rapidly growing populations have made it difficult to provide comprehensive and complete water and sanitation coverage for all. The most serious consequence of this failure is widespread water-related disease and death.

While data are incomplete, the World Health Organisation estimated in the 2000 assessment that there are four billion cases of diarrhea each year in addition to millions of other cases of illness associated with the lack of access to clean water. Since many illnesses are undiagnosed and unreported, the true extent of these diseases is unknown.

other factors. Excluding deaths from malaria and other diseases carried by water-related insect vectors, the current international estimates of total water-related disease mortality range between 2.2 and five million annually.

No “best estimate” is provided. The wide range of this estimate is, by itself, a strong indicator of the need for better monitoring and data collection on this public health problem.

### Sanitation According To Geographical Regions

The majority of these people live in Asia and Africa, where less than one-half of all Asians have access to improved sanitation and two out of five Africans lack improved water supply. Moreover, rural services still lag far behind urban services. Sanitation coverage in rural areas, for example, is less than half of that in urban settings, even though 80% of those lacking adequate sanitation (two billion people) live in rural areas – some 1.3 billion in China and India alone.

And the urban populations of Africa, Asia, and Latin America and the Caribbean are expected to increase dramatically. The African urban population is expected to more than double over the next 25 years, while that of Asia will almost double. The urban population of Latin America and the Caribbean is expected to increase by almost 50% over the same period.

Although the greatest increase in population will be in urban areas, the worst levels of coverage at present are in rural areas.

There are specific problems faced by each region.

#### Africa

Africa is facing an on-going, endemic water and sanitation crisis



that debilitates and kills in large numbers, limiting economic growth, educational access, and life opportunities. Most at risk are the poor, especially women and children in rural and informal settlements. Only 62% of Africans have access to safe water (85% urban and 47% rural), the lowest regional coverage in the world. Just 60% of the population has access to adequate sanitation.

#### East Asia and Pacific

The East Asia-Pacific region with its large population may hold the key to achieving the global Millennium Development Goals (MDGs). It features some of the world's most rapidly growing and robust economies, but development progress varies widely among the countries in the region. There are 480 million poor people in East Asia who need to gain sustained access to safe water supplies and sanitation services.

#### Latin America and Caribbean

About 220 million people live in poverty in Latin America and there is

still a long way to reach the MDGs in a sustainable way: To meet the target in water and sanitation, approximately 123 million additional people in urban areas and 23 million additional people in rural areas will require access to water supply. For sanitation, 131 million additional urban dwellers and 32 million rural inhabitants will need access to services.

#### South Asia

The region is experiencing a paradigm shift in rural sanitation that is on track to enable achievement of the MDGs ahead of schedule in Bangladesh and India. During fiscal 2005 significant strides were made in promoting the approach of rewarding villages and districts for achievement of “open defecation-free” (ODF) status and movement up the sanitation ladder. Bangladesh and India both adopted national programmes to promote Total Sanitation by rewarding villages achieving ODF status.

#### Millennium Development Goals <sup>2</sup>

*Everyone has a part to play to achieve UN's MDG*

Increasing recognition on how sanitation directly impacts on health, living conditions, education and poverty reduction has intensified the

<sup>2</sup> The eight Millennium Development Goals (MDGs) – which range from halving extreme poverty to halting the spread of HIV/AIDS and providing universal primary education, all by the target date of 2015 – form a blueprint agreed to by all the world's countries and the entire world's leading development institutions. They have galvanized unprecedented efforts to meet the needs of the world's poorest. More information at <http://www.un.org/millenniumgoals/>

advocacy for markedly improved sanitation access. The inclusion of sanitation targets in Millennium Development Goals (MDGs) and an understanding that improved sanitation is essential to achieving targets for good health, holistic education and environmental sustainability has given further impetus to address the challenge of sustainable sanitation. Sanitation in this context refers to the immediate household and community needs for human excreta management required for privacy, a healthy living condition and a clean environment.

The Millennium Development Goals (MDGs) are eight goals to be achieved by 2015 that respond to the world's main development challenges. The MDGs are drawn from the actions and targets contained in the Millennium Declaration that was adopted by 189 nations, and signed by 147 heads of state and Governments during the UN Millennium Summit in September 2000.

Goal Seven, for example, is to ensure environmental sustainability, to reduce by half the proportion of people without sustainable access to safe drinking water and basic sanitation. Just as important are the other goals like 'integrate the principles of sustainable development into country policies and programmes; reverse loss of environmental resources' and 'achieve significant improvement in lives of at least 100 million slum dwellers, by 2020'

To achieve the 2015 targets in Africa, Asia and Latin America and the Caribbean alone, an additional 2.2 billion people will need access to sanitation by that date. In effect, this means providing sanitation facilities to 384,000 people every day till 2015.

### **The Role Of WTO In Rural Environment Sanitation**

*WTO supports the MDG with Ecological Sanitation*

World Toilet Organisation (WTO) is committed to support advocacy and consensus building on the importance of sanitation and continues to spearhead the cause on effective and

## Start with and for the children

**School children of today will be the users and decision-makers of tomorrow. Therefore topics related to ecological sanitation should be included in school curricula.**

## Benefits of Ecological Sanitation Water

**Public-toilets in Bangalore, India**

Source: Johannes Heeb  
Source: www.virtualmuseum.ca

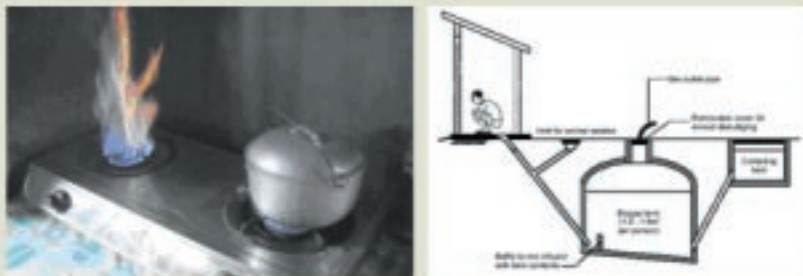
locally adapted sanitation approaches and technologies.

WTO advocates environmentally safe and sustainable sanitation systems. Safe sanitation systems are proven to solve many water related issues. Thus, adopting environmentally safe systems will, in the long run, help greatly in minimizing water borne health issues. Further, since sanitation systems are used by the people everyday, safe systems will educate people in terms of their hygiene and cleanliness. WTO also believes in continuous training and education. People need to be told, and told again and again.

The objectives of WTO in rural sanitation include developing and introducing sustainable, innovative approaches to help improve sanitation services in needy communities in the developing countries by working with the authorities, organisations and businesses responsible for sanitation in rural areas.

Social marketing strategy is broadly recognized as the use of marketing strategies and techniques to achieve a social goal, and WTO has adopted this strategy to meet the MDG on sanitation. Social marketing covers both demand and supply. It aims at stimulating a desire for toilets and

## Benefits of Ecological Sanitation Energy



Cooking using biogas from human excreta

meet the user's needs by tailoring the design and number of toilets and consider the user's ability to afford. A two-step mechanism is adopted, which includes – capacity building<sup>3</sup> of the local workers and decision makers with respect to toilet construction, and constructing toilets which stand out as examples for adoption by the local people.

WTO's philosophy of environmentally safe and sustainable sanitation solutions incorporates the resource recovery options – in the form of green energy (biogas) and nutrient reclamation (compost). Further, these sanitation solutions advocate minimal use of water in the process. Dry sanitation systems are also available and are ideally suited for many locations. In a few locations, like Indonesia, where water is used for personal cleansing and is a cultural practice, it is not possible to change, unless there is an acute shortage of water. There are examples of such interventions in many countries. WTO also incorporates the use of grey water (washwater, kitchen water) for toilet flushing so that in effective the wastewater generated is minimized. Rainwater harvesting is another intervention, whose usage minimizes the quantity of water going down the drain.

In collaboration with Habitat for Humanity, funded by World Vision Lanka and Lien Foundation, a project was undertaken by WTO to capacity build the local construction workers in construction of ecologically safe sanitation systems in the *tsunami* affected areas in Sri Lanka. This training led to the construction of more than 50 Ecosan toilets in a span of three months. WTO also prepared a document on designing of toilets, emphasizing the fact that "Sanitation is Dignity" for the NGOs working in Sri Lanka.

This experience in implementation of ecological sanitation within the cultural context of Sri Lanka led to a project on a larger scale, involving community participation and empowering their capacities. Banda Aceh and Meulaboh in Indonesia are among the badly affected cities by *tsunami*. The water table level in the cities has risen to an alarming height, making sanitation issues more critical. With funding from Singapore Red Cross Tidal Waves Asia Fund and supported by Kimberly Clark Professional, WTO has taken up a project in training local engineers, designers, decision makers, and contractors in designing and constructing of ecologically safe sanitation systems. It is also

constructing Ecosan community toilets in 13 locations in Banda Aceh and Meulaboh. This project is on-going.

### The Role Of WTO In Urban Development

*Water & Basic Sanitation – A Matter of Life and Death<sup>4</sup> in urban areas too*

The availability of clean, fresh water is one of the most important issues facing humanity today – and will be increasingly critical for the future, as growing demands outstrip supplies and pollution continues to contaminate rivers, lakes and streams.

To raise awareness and galvanize action to better manage and protect this crucial resource, the United Nations General Assembly has proclaimed the year 2003 as the International Year of Freshwater (Water Year 2003).

"Lack of access to water – for drinking, hygiene and food security – inflicts enormous hardship on more than a billion members of the human family," said United Nations Secretary-General Kofi Annan. "Water is likely to become a growing source of tension and fierce competition between nations, if present trends continue, but it can also be a catalyst for cooperation. The International Year of Freshwater can play a vital role in generating the action needed – not only by Governments but also by civil society, communities, the business sector and individuals all over the world."

To meet the MDG targets requires coordinated action, not just from Governments but also from people who use water and those who invest in it. Substantial resources are also needed. Currently, it is estimated that approximately US\$30 billion per year is being spent on meeting drinking water supply and sanitation requirements worldwide. It is estimated that an additional US\$14 to US\$30 billion per year would be needed to meet the targets on water and sanitation.

Virtually all societies in the last 20 years are wrestling with an acceleration and intensification of people movement, and this has a great impact on environmental sanitation.

<sup>3</sup> Capacity building is facilitated by World Toilet College (more details provided below)

<sup>4</sup> The UN Works for Freshwater

Many nations have also been working to industrialize, with an eye towards export markets. The cost of their respective successes is compounding the rate of environmental degradation, and in some cases, of massive proportion. Only about 300 million people have their sewage treated in an environmentally acceptable way (Matsui 2002), as mentioned above.

At the expense of this are sanitation facilities, ranging from solid waste treatment to adequate public toilet facilities. United Nations Centre for Human Settlements (UNCHS) estimates that over 20 mega-cities with 10 million people or more will be found in developing countries. This will contribute to the fact that globally, less than 70% of solid waste is being collected, only 50% of households have sanitation, and thus toilet facilities.

Furthermore, low or non-existent capacity in wastewater treatment is another major factor causing water pollution in most parts of the developing world. In Latin America, only about 14% of urban wastewater received proper treatment before discharge. Although the level of sewage treatment is reported to be higher among Asian cities (on average about 35%), it is still unacceptable that most of the wastewater is directly drained to various water bodies. Standard wastewater treatment is almost non-existent in many African cities. Toilets, and lack of them, have a major impact on environmental sanitation. Like toilets, there are also many other types of environmental concerns.

In the past, toilet 'hardware' components have seized the lion's share of any city's budget. In turn, there was neglect or outright drop in mass education about toilet hygiene. Research has shown that it is the correct use of water and sanitation facilities that yield the greatest health impact. Access alone may bring little or no health impact. For efforts to be sustained there is a need to address behaviour change and conditioning.

## Benefits of Ecological Sanitation Nutrition



Restored soil fertility through nutrient reuse



Improved soil quality through reuse of organics

### WTO's Annual Activities

*Utilizing the media to reach out to everyone*

Where it matter most for many of us is sanitation in public places<sup>5</sup> - where a large number of people are using one area, such as a bus station or school, especially when they are eating food from the same source, there is a greater risk of the spread of diseases such as cholera, hepatitis A, typhoid and other diarrhoea diseases.

These places vary in the number of people using them, the amount of time that people spend there and the type of activity that occurs in the area, but all public places need to have adequate sanitation and hygiene facilities.

Responsibility for the provision of sanitation facilities in public places is not always obvious, especially where these are informal gathering places. It is vital, however, that an agency monitors the sanitation facilities in public places on behalf of the users. Ideally, this should be part of the role of the Ministry of Health, or its equivalent. Special attention should be paid to the adequacy of facilities, their availability to the public, and the conditions of their operation.

However, in reality, provision of good public toilet facilities are neglected worldwide. Until recently, the fear of embarrassment prevents discussion on the subject. Solutions cannot be found if discussions are discouraged. Campaigns for social change faced an uphill task.

Dirty toilets are not unique to Singapore. In fact, Toilets NGOs are sprouting out worldwide on their own initiatives and there has not been a global platform for advocacy of better sanitation, and taking responsibility for the environment.

Important components of any effective strategy will include the introduction of new technologies, communication, training, policy changes, and community involvement. The sanitation issues include:

- Sanitation needs to addressed as a whole, including the improvement of facilities, environmental conditions and behavioral or social change;
- Programmes are demand-based and the community should be fully involved in the process; the mass media should be utilised to publicize them.
- Sanitation should be a component of other health-promoting or disease control programmes;

<sup>5</sup> World Health Organisation

priority should be at the national level to be sustainable.

- To sustain the change over a long period of time until such change becomes internalized and part of our social culture.
- To accelerate our own 'learning-curve' by learning from the world-wide toilet fraternity especially from experts in Japan, Taiwan, UK, Australia, Finland, USA.
- To mobilize and coordinate both volunteers and interested organisations to assist in this national effort as a civil society and through our work, bring pride and dignity to our people on their daily visits to the toilet.
- To provide capacity training to raise the standards of all who are involved

This strategy is reflected in the activities that WTO holds annually.

#### **World Toilet Summit & World Toilet Expo / Forum**

*There is no need to reinvent the wheel every time*

The opportunity of networking with the professionals to propagate the need for better toilet standards globally, and to gather resources, promote creative development and sustainability effort for sanitation issues, perpetuates annually with each World Toilet Summit.

The world was first introduced to WTO at the 1<sup>st</sup> World Toilet Summit held in Singapore from November 19 to 21, 2001 at the Singapore Expo with support and acknowledgment from both the Singapore Ministry of the Environment, and the United Nation Environment Programme amongst others.

WTO has also started a series of World Toilet Expo & Forum events. While World Toilet Summit remains a global platform and conference-led, the new series is expo-led, and focus more on regional and local solutions on public toilets of the host country.

From 2001, the World Toilet Summit was launched in Singapore. Thereafter, it became a travelling road-show:



- Year 2002, November, Suwon City, Korea
- Year 2003, October, Taipei, Taiwan
- Year 2004, November, Beijing, China
- From 2005, there were two conferences per year:
- Year 2005, May, Shanghai, China – World Toilet Expo & Forum
- Year 2005, November, Belfast, United Kingdom – World Toilet Summit
- Year 2006, May, Indonesia – World Toilet Expo & Forum
- Year 2006, September, Moscow, Russia – World Toilet Summit
- Year 2006, November, Bangkok, Thailand – World Toilet Expo & Forum

One direct benefit is tourism. Today, there are still many tourist sites without international grade toilet acceptable to tourists. No matter how attractive or historic a tourist site is, it cannot attract and serve tourist unless it has equally attractive toilets.

Public toilets were originally build to serve locals and designed based on their culture and habits. With air travel cost dropping and the proliferation of budget airlines, more people are travelling. Spending power is also growing.

Tourists with food and drinks needs to plan visits to the toilet on

an average 2½ to 3hrs. If such toilets visits are facilitated well, the goodwill will bring tourists back. Tourism is hospitality. Related topics are brought up during The World Toilet Summits e.g. Korea Suwon, Super toilets; Beijing Tourism Bureau's renovation of all tourism toilets in Beijing; Shanghai World Toilet Forum.

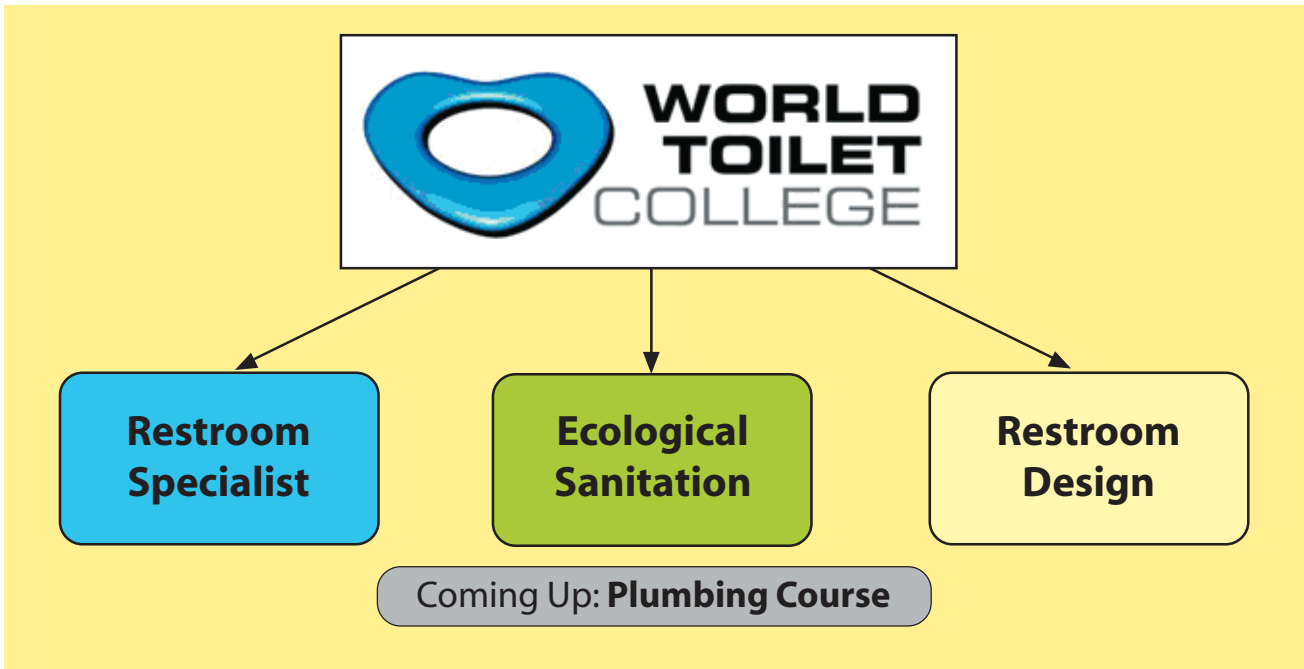
#### **World Toilet Day, November 19**

*It's everybody's business*

The purpose of this Day is to have people in all countries to take action, to increase awareness of toilet users' right to a better toilet environment, and to demand for it from the toilet owners. As such, it is also the toilet user's duty to contribute towards its maintenance, cleanliness and hygiene.

Press releases are sent to the media, and notices send to all Toilet Associations to be united in our message. On this day we at the Secretariat of WTO would like all toilet users to get involved. As the saying goes, "If you don't discuss it, you can't improve it." Rather, *'It's everybody's business'*

For World Toilet Day 2006, we would like the country's supermarkets to extend a discount for all toilet products. This will offer households a financial



incentive to break the toilet taboo. The more people like toilets, they more they'll talk about it and take care of it.

**World Toilet College**

*Training with a Social Mission*

WTO has started World Toilet College (WTC) in 2005 because there was a need for an independent world body to ensure that the best standards in Toilet Design, Cleanliness, Maintenance, Quality of Work and Sanitation Technologies are kept.

There are presently no comprehensive toilet educational institutions that address both urban and rural toilets' needs in a continuous manner. Locally and worldwide, through WTO, WTC has support from Government ministries and agencies, private companies, sanitation experts, and industry stalwarts. In addition, WTO has a network of resources such as the World Toilet Summits and the Singapore Polytechnic to leverage.

The training programmes have a societal mission besides imparting technical skills:

- Toilet cleaners are lowly paid workers that are not always appreciated. By re-creating the job, and bringing it to a new professional level, they become multi-skilled to become better paid and more productive Restroom Specialists.
- The Ecological Sanitation Course is the first of many that will train much needed sanitation human resource – estimated to only number 400 presently - to help alleviate the 2.4 billion people worldwide that do not have a toilet.
- Badly designed public restrooms are dirty and shunned by users, which may lead to personal health problems. Moreover, the Restroom Design course will also help reinforce designs and provisions that promote potty parity.

**Restroom Specialist Training Course**

**Train the Trainers' course, June 2006**



**CONCLUSION**

The world's sanitation problems seem insurmountable, but with everyone playing a part, we can help achieve the MDG for water and basic sanitation. We can empower local communities to not only help the underprivileged but also conduct activities that instill pride and ownership in having clean toilets and adequate sanitation. **BEM**

# Managing Mega Projects - The Experiences Of KLIA

By Tan Sri Dato' Prof. Ir. Jamilus Hussein and Prof. Dr. Shafie Karimin



No one, especially in the aviation fraternity, would have thought and believed that a small group of Malaysian professionals would have been able to deliver successfully The KL International Airport (KLIA) project to the Government of Malaysia seven years from the word 'go'.

Touted as one of the most architecturally beautiful and sophisticated airport in the world, the profoundness of this achievement would be more overwhelming if the following considerations are taken into account;

- A green field 25 million passenger per annum 1<sup>st</sup> Phase airport development on a generally peat soil, palm oil plantation and secondary forest site,
- Seven-year completion from initiation to site study and selection, Masterplan and Architectural design concept, engineering design, procurement, physical construction, testing and commissioning, and the crucial airport operational readiness and transfer exercise,
- Two years into the project, a sudden fundamental shift in the project's organisational and procurement approach was made – from a contractor-driven design and build turnkey to a client-driven total project management approach,
- 205 different contract packages running concurrently on a 7850 acres 1<sup>st</sup> Phase development site, with 130 million metres of earth moved; two 1.1 km tunnel BHS connecting tunnel; 200,000 square metres of granite flooring; 18,500 km fibre optic cables laid; 30,000 workers at peak from 50 different countries; to name a few,
- 52 months total construction including testing and commissioning and operational readiness and transfer from the old airport in Subang,
- First ever airport to successfully develop, design and implement a fully integrated IT airport management system,
- No major operational breakdown on opening day except a minor glitch on the baggage handling system (BHS),
- From a submitted estimate of RM20 billion design and build turnkey contract without time completion guarantee, the project estimate was reduced to RM11 billion on the same scope with full commitment on time completion by KLIA Berhad – a newly setup Malaysian run Minister of Finance Inc company given the task to implement the project in late 1993.

June 28, 1998, was the KLIA inaugurated date declaring the airport officially opened to commercial operation. It was also a date where Malaysians realized that through proper and effective usage of project management knowledge and skills large, scale and complex projects can be completed in time and within cost without sacrificing architectural beauty, functionality and quality. It was also a date that showcased to the world, Malaysian professionals' strength and capability in the field of project management and construction management.

Since then, this small group of Malaysian professionals, through its present flagship company KLIA Consultancy Services Sdn Bhd (KLIA Consult), has continued to utilize the great benefits of project management in handling large-scale Government projects. Amongst them are;

- airport,
- dam, water treatment plant, and solid waste treatment plant,
- railway and monorail,
- highrise office building complex,
- integrated transport terminal,
- integrated transport information system,
- university campus, and
- hospital.

From these experiences, several important aspects that need to be given serious effort to ensure that large-scale projects achieve the desired performance and success are:

- The need for effective project management on both Client/ Owner and Contractors organisation – knowledge, experience and competency
- Managing large-scale projects is about managing complexities – work content and work processes
- Strategic project planning is key to control
- Good leadership is vital for success

### Projects And Project Management

Projects are projects whether they are small or mega in scale. The



difference between the two lies in the breadth and depth in term of complexity of scope and scale. In as far as the life cycle is concerned, every project goes through almost the same stages, phases and related work processes. Furthermore, the characteristic of a project will not change whether a formal project management processes is used or not.

What changes is how events and issues are dealt with effectively and efficiently while the project is in progress so as not to jeopardize the targeted project objectives in time, cost, and quality. All projects will certainly face issues, potential risks, conflicts, and uncertainties caused by lack of or indifferent flow of project information, which if not dealt with properly, systematically, and timely will increase the risk of project failure. It is a question of doing the wrong thing right as against doing the right thing wrong. Even doing half right of what is wrong from the outset may save the project from total failure.

Modern Project Management has evolved to specifically deal with these kinds of situation. It is essentially about ensuring that a project will succeed in meeting the client's set objective/s. It is an organisational management approach and methodology that provide the framework and system with guidelines, processes, procedures, tools and techniques to manage the workload, the people, and organisation/s involved in the project. Its approach is also much about intuitive, managerial, and humanistic skills to mobilize the energies of diverse and multi-disciplinary team

members to work in a goal-orientated, disciplined, and team-working environment to achieve project performance.

Project management is a science in that it relies on proven and repeatable processes and techniques to achieve project success. It is an art because it also involves managing and relating to people, and requires the project manager to apply intuitive skills in situations that are totally unique for each project. A good project management methodology provides the framework, processes, guidelines, and techniques to manage the people and the workload. A good methodology increases the odds of being successful and therefore provides value to the organisation, the project, and the project manager.

The biggest value proposition for project management, particularly in managing large-scale complex time bound projects, relates to the way project organisation and the team members execute the following set of project implementation methodology:

- **Communicating and managing expectations with clients, team members, and stakeholders more effectively.**

Many problems on a project can be avoided with proactive and multi-faceted communication. In addition, much of the conflict that arises on a project is not the result of a specific problem, but because of surprises. Standard methodologies always focus on formal and informal communication, which results in fewer surprises.

- **More focus on metrics and fact-based decision-making.**

One of the more sophisticated aspects of project management methodologies is that they provide guidance to make it easier to collect metrics (measures). Metrics give you information that helps you to determine how effective and efficient your team is performing and the level of the quality of your deliverables.

- **Improved work environment.**

If the project is well planned and performs accordingly the work environment improves tremendously. Clients will be more willing to provide additional support, project team members will take more ownership of the project, morale will be better, and the project team will behave with a greater sense of professionalism and self-confidence.

- **Resolving problems more quickly.**

On many occasions, some team members spend too much time and energy dealing with problems because they do not know how to resolve the problems to begin with. Having a proactive issue management process helps ensure that problems are resolved as quickly as possible.

- **Better solution “fit” the first time through better planning.**

Many projects experience problems because there is a gap between what the client expects and what the project team delivers. Using project management methodology results in better project planning, which gives the team and the sponsor an opportunity to make sure they are in agreement on the major deliverables produced by the project.

- **Resolving future risk before problems occur.**

All project management methodologies have processes in place to identify and manage risks. Risk management will result in potential problems being identified and managed before the problems actually occur.

Nevertheless, it is important to be aware that by putting up a project management system and methodology will not necessarily lead to project performance if the project management culture within the project organisation and team member level of project management knowledge and practice is low and inadequate. Project success also has to do with the level of competency of individual team members in the ‘know-what’ (project management body of knowledge, disciplinary knowledge) and the ‘have what’ (experience-know how, humanistic/soft skills). The level of competency is very much dependent on the level of exposure and capability of the project manager and members in his project organisation (these are the know who) in utilizing the ‘know-what’ and ‘have what’ specific to the project external and internal environment requirements to match

the project success metrics. In addition, both of these aspects of competency must at the same time be matched with the required level of competency in the various technical disciplinary fields to enable the right planning, problem-solving and decision-making.

In the final analysis, the sum of the level of competencies of the individual team members and project management organisation in the ‘know what’ and the ‘have what’, and ‘know how’ of the technical disciplinary knowledge will ensure project issues are being address in a proactive, systematic and timely manner. When an organisation develops this project management working culture, one that is characterized with team-working, process and goal-orientated, discipline, problem-solving, and decision-making traits, the odds for a project to perform and achieve success will be very much increased.

Figure 1 and Figure 2 depict the concept and role of project management in the construction industry and how the project management organisation on the client/owner work side by side with the contractor’s construction management organisation to realize and make sure project objectives and goal are achieved.

## The Concept & Role of Project Management in Construction Industry

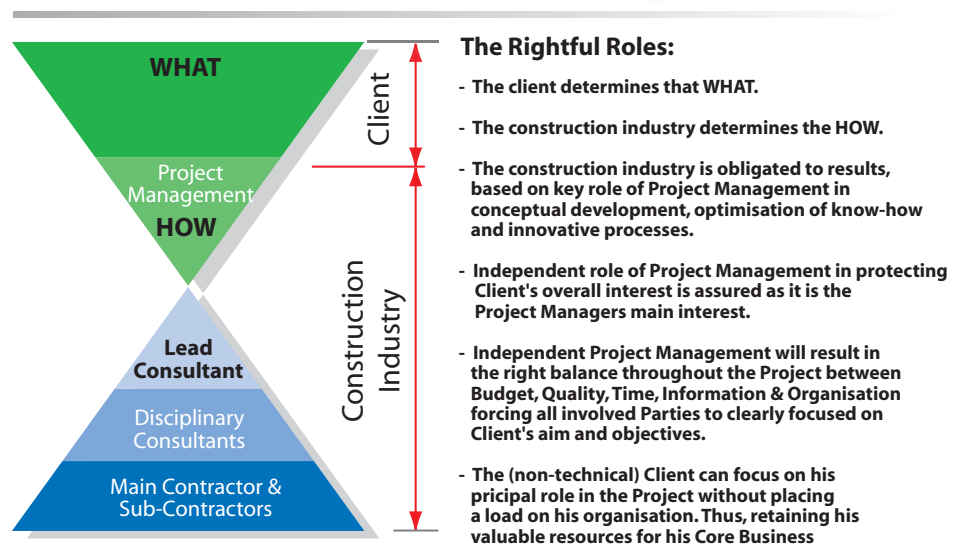


Figure 1: Role of Project Management

## Project Management & Contractor Construction Management Organisation

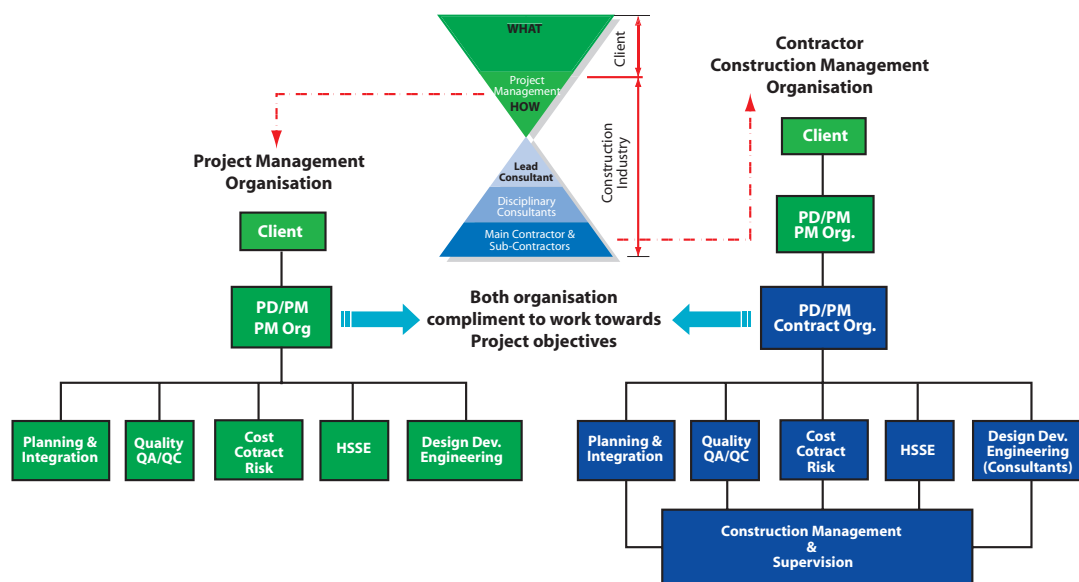


Figure 2: Role of Project Management within Client and Contractors organisation

### Managing Mega Project Is About Managing Complexities

The term “mega” denotes something that is huge – size, scale, scope, requirements, money, functionality, form, technical, etc., which in turn conjures the various contention of difficulties one will face to get the project completed and achieve the desired “value” outcome in time, cost, and quality.

In the managerial sense, it concerns the issue of acuteness of the span-of-control to affect effectiveness in controlling the various types and level of on-going planned project events and activities so that they perform to the desired technical, quality, sequence and time requirements.

In construction, the issue of span-of-control of the multitude of project activities is relative to the aspect of “time”, which in turn influence the level of risks the project faces. When time is not a factor to do the things you want to do, no matter what the scale and size, the issue of difficulty and complexity are rendered less acute. Things can be done in a relatively smooth step-by-step manner following each event and work activity process with far less

conflicts. The same goes for availability and management of resources, funding and cashflow. As long as there is a proper and effective monitoring and control mechanism put in place, a proper and disciplined organisation, competent and knowledgeable personnel to keep things in hold, good leadership, and good contractors and consultants, one can expect the project to perform considerably well.

In managing mega projects, time is a luxury one could not afford. With time as one of the core objectives of a project, even a simple project may become more complex to deliver. For a mega project, the bigger the scale and size of the project the more complex the work processes gets and a slight delay in one component of the project will have an exponential knock-on effect to the other project components. An oversight on one component on any aspect of the work requirement can result in the other components to be reviewed and reworked. In projects, there are always potential issues and conflicts along the way that if not captured and addressed adequately from the outset may well be the crucial blow to project progress and performance.

In mega projects, every effort must be given to the task of identifying and addressing the occurrences of issues and conflicts at the outset and during the implementation phase with the aim to reduce them to the minimum. In particular, difficulties are prone to arise out of the issue of procurement and contractual obligation vis-à-vis work execution; work packages integration and interfacing; communication and information flow *vis-à-vis* decision-making; organisational issues vis-à-vis resource adequacy, teamwork, and commitment level. All of these have a high potential to adversely affect time, cost, and quality output.

It is the task of the project planner/s together with the project team members to pierce through the maze and come out with the necessary strategies, plans, and system of control.

The planners need to analyze the whole macro and micro project delivery processes in detail (see *Figure 3* and *Figure 4*) to seek potential conflicts that constrain the delivery process. Interest of the project’s stakeholders need to be cross-checked and streamlined with the competing demands coming from the external and internal project

# Project Management Managerial Context

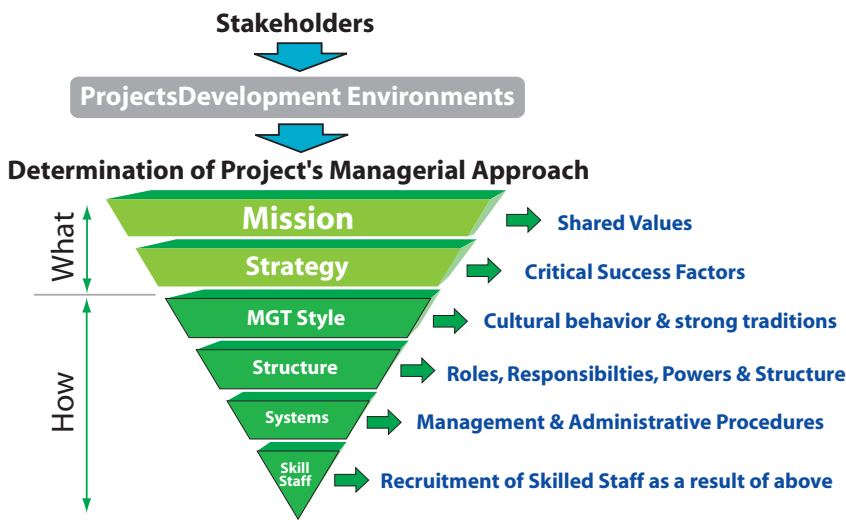


Figure 3: Framework to control project complexity

environment to determine and establish 'what' needs to be done in what manner and 'how' will it be done in order to meet the predetermined project objectives in time, quality, and cost. Appropriate project strategy *vis-à-vis* the project's critical success factors needs to be established for an appropriate project structure and management control system to be developed.

### Strategic Project Planning Is Key To Control

The essence of managing complexities is about control and the ability of the implementing organisation to increase effectiveness in its managerial span-of-control. When the risks are high, the key to risk management and control of the project performance is effective planning. This is to ensure plans that are put in place effectively streamline and offer quick responses to any conflicts and issues arising out of the competing demands from external and internal parties.

The performance of managerial control over the project to meet project objectives and goals will be largely dependent on strategies formulated to control not just planned work activities duration, cost, and quality but also, manage

complexities, the aspects on project organisation and information control (see Figure 4). Due to the different nature of work activities as the project undergoes different project phases, set of requirements for the five control elements also changes. The control processes of these five control elements need to be planned and structured to correspond to the requirements and complexity of work content and activities in each and sometimes overlapping phases.

The planning process, as depicted in Figure 5, starts not just with the project scoping and the project

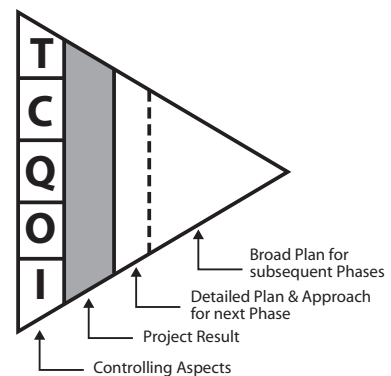
technicalities but more importantly looks at the strategic element of the project. Failure to look at this aspect, particularly in managing complex job, will render inadequacy and ineffectiveness to the project organisation to respond and make timely decision on issues, complications, and conflicts that arises throughout project phases.

Once the planning exercise is completed, project implementation plans which also includes the monitoring and control systems, must be effectively transmitted and communicated to the various organisations in the project team. These plans should adequately address the critical implementation considerations, as follows:

- Project implementation strategies in architectural and engineering design concept and work approach; the most effective procurement and contractual approach; funding and cost management, quality assurance and quality control implementation; most suitable project organisation structure; effective monitoring and control system; *vis-à-vis* the established project critical success factors.
- Master work implementation programme, schedules and work activities methodologies.

## "The Project Controlling Principle"

**Each Development Phase must be Controlled to ensure the Project Development is in accordance with the set Project END RESULT or GOAL**



**Each Phase will be subjected to Controlling Processes In Time, Cost, Quality, Organisation & Information**

Figure 4: Elements in Project Control

## Where The Strategic Development Starts



Figure 5: The planning approach

- Authority level and decision-making structure and protocols.
- Communication and information flow structure and protocols for the whole project organisation – includes document management.
- Organisational, managerial and administrative procedures.
- Risk management plan

All these plans must be developed, documented, and communicated during the initiation stage and further refined from feedback as the project progresses. The strategic role of the planners continues throughout the project in particular working with the various contractors' planners in making sure their work activities WBS, sequence of work activities, and duration are coordinated with the master implementation programme. The planners are the custodian of the monitoring and control of all development and site activities where 'trouble-shooting', re-strategizing, and re-planning are a continuous, constant and iterative process until the project is completed.

### Leadership And The Human Dimension In A Project

One of the aspects in project management managerial framework as shown in *Figure 3* is management style. The importance of managerial

style in formulating project organisational strategies alludes to the fact that different types of project require different types of interpersonal traits of the leader to lead the different levels of the project organisation. In addition, the different nature of task and activities throughout the life cycle phases of the project requires different type of organisational structure that necessitates different style of management. It also alludes to the different personality traits of the different category of personnel and workers involved in the project to execute the different nature of tasks and activities required in the life cycle of the project. For these reasons, good project leadership is at every stage of the project.

In mega projects, the diversity of the project types, organisational levels, and personnel and workers involved is as diverse as the project scope. With the numerous tasks to be accomplished by the various team members and other related parties, project leaders must foster a working environment of active participation and minimize dysfunctional conflicts. They must have the ability and capacity to attract willingness from the project team and related parties to participate, be motivated, and committed to achieving the project's vision, objectives and goals with the

resources at their disposal within a realistic timeframe. They must demonstrate that they are also good managers and good leaders, with strong will and focus that takes responsibility for decision-making as well team builders and integrators providing all the opportunity for team members to perform. A good communicator and listener is sensitive enough to the project organisational behaviour and the changes throughout the project life cycle to nurture trust and respect that will inspire the development and creation of self directed work teams.

It is through good strong leadership and 'managership' that team members and related parties would be willing to go the 'extra mile' to meet the project objectives and goals. With good, efficient, and effective 'stewardship' of the whole project organisation, it will be highly unlikely projects do not perform to meet objectives and goals to the satisfaction of the client.

### CONCLUSION

Projects will be projects whether mega or otherwise. The difference between them is their level of complexity. The higher the level of complexity the higher the focus, attention, and effort needed during the planning as well as the implementation stage. With time as a major deliverable and determining factor, to have control over the entire work processes throughout the project life cycle is the order of the day. To increase the level of span-of-control over the project, highly effective approaches and methodologies are needed. For this, the modern project management approach has shown to be most versatile and effective to ensure project performance and success.

Nevertheless, organisational aspect is also a major determinant to project performance. Good and effective leadership and 'managership' will inspire a highly efficient and effective working environment and teamwork with a single focus and the extra mile to make the project a success. **BEM**

# Jalan Petaling/Jalan Bandar, KL

Photos contributed by Miss Ling Pei San



In between

Before



Today