Analysis of Building Maintenance Factors for IBS Precast Concrete System

Ng Ban Kiong[1], ZainalAbidin Akasah[2]

[1,2] Department of Construction and Building Engineering,UniversityTun Hussein Onn Malaysia

ABSTRACT

Industrialized Building System (IBS) is one of the construction method that utilized where the components are manufactured in factory or in-situ. Each component are produced in a controlled and monitored environment, transported and installed with minimum workforce. This system are widely used in Malaysia and commonly there are five types of IBS system which known as precast concrete system, formwork system, steel frame system, prefabricated timber system and block work systems. Unfortunately, they are still lots of issues occur for the building using IBS method to construct especially for the precast concrete system. The most common issues for precast concrete system are jointing and cracking. The building maintenance issues for precast concrete system can cause by many factors either in design, manufacturing or even installation stage. Thus, this study will investigate the building maintenance factors for precast concrete system in design, manufacturing and installation stage. This survey study had successfully identified 23 building maintenance factors and 5 major defects from the study of the literature and interviews. The result of the analysis from the software package SPSS version 19.0 had showing that building maintenance factors and the defects had strong positive linear correlation with each others through correlation and multiple regression analysis.

Keywords: Industrialized building system, precast concrete system, building maintenance factors, defects

1. INTRODUCTION

In Malaysia, construction sector plays an important role in generating's economy, with 3 to 5 % of the national Gross Domestic Product (GDP) contributed by the sector for the past 20 years. Apparently this statistic obviously shows that construction is one of the important major sectors that stimulate our country's economy. Booming construction activities is an indication that the country's economy is in a brisk condition while sluggish construction activities shows a depressed condition. Thus, the construction sector can serve as an important point of reference to indicate our country's economy condition [10]. Industrialized Building System (IBS) generally includes all building components which are mass produced either in factory or at site. All the components of the building will be designed according to specifications with standardized shapes and dimensions. Eventually, when all the building components have been successfully produced, they will be transported to the construction site to be assembled with certain standard to form a building [4]. Construction industry in Malaysia generally comprises many processes and these include many parties and different stages of work. Involvement of various parties from different sectors can effectively ensure high efficiency of the construction that will be carried out. Only high quality managerial and organizational performance with effective co-ordination through good teamwork from different parties will result in efficient and successful construction development and activities. Thus, every team member plays an effective role in ensuring that the development of the construction is proficient [10].The concept of using IBS in Malaysia started after the Minister of Housing and Local Government of Malaysia visited several European country. This is the significant starting point where the IBS becomes more popular in Malaysia. Construction field in Malaysia has achieved another new milestone when the pioneering project of Pekeliling Flat in Kuala Lumpur has been successfully built within 27 months which utilized the panel pre-cast concrete wall and plank slabs in the project [3].Nowadays, there are many local IBS manufacturers and the number is rapidly escalating. Most of the IBS systems used in Malaysia are large panel systems, steel frame, precast frame and formwork system. All these systems have been largely used for private residential projects in Malaysia which include projects in Shah Alam, WangsaMaju and Pandan, Dua Residency, KL, Taman Mount Austin and TongkangPecah, Johor [3].In the 21st century, IBS is not new to the construction industry. This method can effectively save costs and improve the construction quality by reducing labor intensity and construction standardization. Besides, it minimizes waste, reduces site material, yields cleaner and neater environment, provides higher quality control, and cuts the total construction costs. Examples of successful implementation of IBS in the world include Sesikui Home (Japan), Living Solution (United Kingdom), Open House (Sweden) and Wenswonen (Netherlands) [4]. This study focuses on precast concrete system in IBS method. Basically the study emphasizes the building maintenance for precast concrete system. Precast concrete system should be approached focusing on the building maintenance concept. Precast concrete system with maintenance concept are related to the planning, organizing, monitoring, design, construction and manufacturing which can be concluded as building maintenance factors in design, manufacturing and construction stage for precast concrete system. Thus, a good precast concrete building with building maintenance concept could prevent health and safety problems and environmental damage, yield longer asset life with fewer breakdown and result in lower operating costs and a higher quality of life

2. PROBLEM STATEMENT

In the 1960s, precast concrete was often misinterpreted with negative impressions. Normally, precast concrete buildings are associated with pre-fabricated mass construction method, low quality buildings, leakages, abandoned projects, unpleasant architectural appearances and other drawbacks. The public have a bad impression about the precast concrete due to the poor architectural design for the old pre-fabricated buildings. Two early pre-fabricated flats are Pekeliling Flats in Kuala Lumpur and Taman TunSardon, Gelugor, Penang. The very basic design for the Taman TunSardon by British Research Estalishment, UK had created many problems. The lack of design features to accommodate wet toilets and bathrooms has led to leakage problems. Furthermore, many low cost housing are not maintained properly and this gives more negative impression and poor image to the precast buildings [7].However, lack of knowledge in structural analysis and design of pre-fabricated components also contribute to the problem in implementation of IBS in precast system. The most common problems are the connection between the beam to column and column to base. The lack of knowledge of design could cause poor connection at site. The poor connection may lead to the issues of comfort and safety. When the steelwork structures are designed as a conventional reinforced concrete structural system, steel beams and columns are exposed. Unfortunately, this can bring about many problems such as leakage. The rain water can easily seep into the building joint between the wall and steel beam. On the other hand, the dampness will lead to corrosion of the lighting system and the beam [7]. Most of local contractors lack knowledge in IBS especially in precast concrete system. They need to increase their skills especially for their workers in order to produce a high quality precast building. It is an advantage if the local contractors could upgrade their skills which will ultimately enhance the competitive advantage of the industry in facing the issue of using the precast method in local construction. The local contractors should also prepare themselves in terms of design, installation and project management skills which are important elements in precast concrete system. The lack of knowledge in design for precast building could lead to safety issues. Without a proper method of design, negative impact on the precast building would be generated. Most of the contractors in Malaysia have little to no experience in constructing precast building. Therefore, the poor technical knowledge may create a negative impact on the building quality upon construction [5]. In fact, there exist projects facing many difficulties after being awarded to be constructed using IBS including precast concrete system. The most common issue is inappropriate installation of the component on site. Due to the inaccuracy in setting out the alignment and leveling, difficulties in the installation of the precast components are encountered. Precast concrete system could have risks such as technical and quality problems which will cause aesthetic and functional mistakes. These include blemishes, cracks, moisture penetration and poor insulation in a completed precast building [8]. Indeed, precast concrete system had caused failure to fulfill the requirement of the operational and quality. Most of the time, this system relies on the operation of the factory, operator’s skills and component. Hence, in order to achieve efficiency, there is a need to improve the handling system, storing and transporting of the component [9].Design firms often misinterpret the maintenance concept for the building design. Mostly, the property manager and maintenance consultants are involved in the schematic and preliminary design stage only. It is not sufficient to just depend of the reliability of the designer to produce a good design with longer life cycle and without the factors that contribute to the higher level of ease of maintenance in the future. The aim to extend the building life span with low maintenance cost cannot be achieved if the proper rules and guidelines that need to be followed during the design stage were not taken into consideration. The corrective or remedial measures due to the design or constructional defects need a large amount of resources. The amount of the maintenance expenditure can only be reduced if the number of design defects can be lowered. Malaysia is very concerned about problems related with building maintenance. On 20th February 2006, an article in the New Straits Times had stated that YAB Datuk Sri Abdullah Ahmad Badawi had urged for better quality and systematic building maintenance in Malaysia to avoid losing RM4 billion every year. Government had spend a lot of money was amounting near RM1 billion to provide various basic facilities in rural and urban areas in order to increase the standard of living of Malaysian citizen. In order to acquire a better life cycle, all facilities need to be preserved with good maintenance to preserve its good condition. A good maintenance could provide good and safe environment, which is also a part of saving money. Maintenance should be given undivided attention in maintaining good building life cycle cost.Effectiveness of building maintenance management is very important in order to provide a satisfactory condition of public housing and facilities. Mat Deris (2007) had simplified that the issues occurring with regards to maintenance include the formation of the organizational structure, implementation of the works and the planning scheduling of the maintenance works [6]. Meanwhile, Basiran(2002) had identified that the maintenance management is the main issue that would cause maintenance works not being implemented effectively [2]. Design and maintenance are actually very important elements in building process. These two elements are vital to preserve the shape of the building forms and for the building to stand a long period of time. The building design’s effectiveness is measured by its aesthetic values in order to make it capable of serving its required functions with better performance and accessibility for good maintenance. The important links between these two elements are always neglected in actual practice.In the design aspect, maintenance is seldom considered and maintenance team is rarely invited into the design process. The building will be left to the maintenance staff to manage only once the designers have completed their jobs. Consequently, this leads to common building defects and the difficulties in carrying maintenance jobs continually exist [1].Most of the designers are concerned with the client's requirements and the actual building objectives. Inevitably in reality designers need to accommodate their idea to the requirement such as the surrounding environment that will comprise human settlements and ground condition. Other factors for example community facilities, accessibility, interrelationship among users or residents and surrounding land use also need to be considered in the design. Consideration of the role of other buildings and surrounding developments especially when the surroundings could provide better information and good tips on the local needs or building conditions should not be isolated by the designer in their design. The way people use buildings and the way process and procedures are carried out in buildings must be highlighted and this will enable appropriate allowance for the needs of spaces and equipment, and for other facilities and amenities to be figured out closely. Thus, the requirement for social activities, environment, cost needed and maintenance criteria could be determined in adequate precision. Designing a building is always based on the budget and this leads to failure of building design. Selection of the design, coupled with the correct choice of materials and systems has been proven to have long term effects on the performance of a building. Most of the design characteristics of buildings are a direct outcome of design decisions and the quality of the construction that results from design choices. Hence, a good designer must be able to consider various factors and categories in the process of designing to ensure the building to become a quality product that consumers can utilize to their maximum satisfaction.Efficient maintenance of existing buildings is becoming more and more important when the construction cost keeps increasing in the market. Building owners are increasingly aware of this current phenomenon but yet there is also a need to produce a better precast concrete system in order to prolong buildings' life cycle cost.

2.1 Examples of Defects in Precast Concrete Building

Without proper planning of design, manufacturing and construction of the precast building, defects would occur after the building has been completed. The following figures show some of the defects identified in precast concrete systems.

Figure 1 :Poor Connection
(Picture Sources:[7])

Figure 2 :Poor Connection
(Picture Sources:[7])

Figure 3:Poor design steel beam exposed
(Picture Sources:[7])

Figure 4:Lighting system corrode
(Picture Sources:[7])

International Journal of Application or Innovation in Engineering & Management (IJAIEM)
Web Site: www.ijaiem.org Email: editor@ijaiem.org, editorijaiem@gmail.com
Volume 2, Issue 1, January 2013 ISSN 2319 - 4847

3. RESULT AND DISCUSSION

3.1 Introduction

The useful information for this study was gathered through data analysis which known as a process of gathering, modeling and transforming into important information that can be used in this study. The results of the study obtained from the survey of the installers, manufacturers and designers based on the information provided by the website IBS center Malaysia. From the literature study and interviews with other professionals,23 building maintenance factors and 5 major defects had successfully identifiedand a set of questionnaire was prepared for the respondents. In this study, 187 sets of questionnaire were distributed to all designers, installers and manufacturers by post and email and 64 questionnaires were successfully collected in the end of the study. The normal expected useable response rate is ranging from 25% to 35% according to Fellows et al.1997. Thus, this number of feedback questionnaire had provided enough of data for this study.

Table 1: Combination of Independent Variables

Combination Variables	Building Maintenance Factors
Design stage	a. Specifying finishing
	b. Functional layout
	c. Shape and size of precast concrete
	d. Access to cleaning area
	e. Joint details at panel to panel connections
	f. Grade concrete
	g. Internal crack control
	h. Loading
	i. Ease of repair or replacement
	j. Pre-plan and predetermine M&E services
Manufacturing stage	a. Procedure for quality control
	b. Approval manufacturing machine by SIRIM
	c. Procedure test the quality of the precast component
	d. The use of raw material with specification
	e. Inspection from the responsible authority
	f. Workers experiences
	g. Management of the company
	h. Storage
Installation stage	a. Procedure to install the precast component
	b. Detailed information install stage for precast component
	c. Process of lifting and install
	d. Skilled labor
	e. Equipment

Table 2: Combination of Dependent Variables

Combination Variables	Building Maintenance Factors
Defects	a. Poor humidity control
	b. Poor finishing
	c. Cracking
	d. Water leakage
	e. Poor M&E services

3.2 Data Analysis

The data analysis was important to find out the critical factors which will lead to building maintenance issues for precast concrete system. The step of analysis including reliability analysis, mean rank analysis, correlation analysis and multiple regression analysis. Based on the value of the mean rank, the data is ranked out to identify the critical factors. The data will be ranked based on the highest mean score and continued with the second higher until the lowest. Further up, the data will analysis it's correlation and multiple regression to obtained the significance relation between the building maintenance factors and defects.

Table 3: Reliability Statistics

Cronbach's Alpha	N of Items
.878	28

From the result gathered show that the Cronbach Alpha value was 0.878 and this data was bigger than 0.7. Hence this can concluded that the data gathered was in high consistency and can be acceptable.

Table 4: Mean Rank Score for Building Maintenance Factors

Building Maintenance Factors	Mean Score	Ranking
Procedure to install the precast component	4.1719	1
The use of raw material with specification	4.0625	2
Joint details at panel to panel connections	4.0469	3
Procedure for quality control	3.9687	4
Detailed information install stage for precast Component	3.9531	5
Loading	3.6562	6
Workers experiences	3.6406	7
Internal crack control	3.5938	8
Grade concrete	3.5937	9
Specifying finishing	3.4219	10
Management of the company	3.3438	11
Skilled labor	3.2813	12
Approval manufacturing machine by SIRIM	3.2031	13
Process of lifting and install	3.1875	14
Storage	3.0938	15
Inspection from the responsible authority	3.0937	16
Shape and size of precast concrete	3.0469	17
Access to cleaning area	2.9531	18
Equipment	2.8594	19
Ease of repair or replacement	2.8750	20
Pre plan and predetermine M&E services	2.7344	21
Functional layout	2.7188	22
Procedure test the quality of the precast component	2.5781	23

The data above showing that the mean score of the building maintenance factors is the highest for procedure to install the precast component which was 4.1719 rated by the respondents. The top 5 building maintenance factors rated by the respondents were procedure install the precast component(4.1719), the use of raw material with specifications(4.0625), joints details at panel to panel connections(4.0469),procedure for quality control(3.9687) and detailed information install the precast component(3.9531).

1. Procedure install the precast component

Procedure to install the precast component was very important in order to keep the precast building in good quality. For example the setting out need to be done before the process of the installation. Before do the grouting for the joints, the width between the panels must be checked within the design allowance. While doing the grouting works, non shrink grout should be free flowing and self compacting in nature. This can avoid and minimize the risk of cracking.

2. The use of raw material with specification

The use of raw material according to specification are extremely important to ensure the precast component in good quality. A bad raw material could affect the quality of the precast component. Raw material such as size of the aggregates and also the quality of the cement could give the negative impact to the precast components if this raw material is in bad quality. This perhaps will leads to building maintenance issue like cracking .Hence, the raw material was very important to ensure the quality of the precast concrete was preserved.

3. Joints details

Joints details are the most common issues which lead to building maintenance issues. The inaccurate of design for jointing will leads to building maintenance issues like water leakage. Eventually, when the water seep into the building, the humidity of the building will in bad condition. Besides, the water which seep into the building may give the negative impact to the building services for example lighting system. Therefore, a good jointing can prevent any issues like water leakage and poor humidity control.

4. Procedure for quality control

Procedure for quality control for the precast component are vital to ensure the building component are in good condition. After the precast component had produced, the component must to be random selecting for tested the quality. This are very important to ensure that the precast component is in good quality and will not lead to building maintenance issues after the building had successfully constructed.

5. Detailed information of the precast component

Detailed information install the precast component if not comply will lead to building maintenance issues after the building constructed. The information should provide to the site labor the appropriate way to install the precast component. Therefore, this can easily give a good understanding for the labor to install the precast component This can avoid any defects to occur after building had constructed.

Table 5: Mean Rank Score for Defects

Defects	Mean Score	Rank
Water leakage	4.8438	1
Cracking	4.0625	2
Poor humidity control	3.4219	3
Poor finishing	3.1563	4
Poor M&E services	2.9375	5

The table above had shown the ranking of the defects for the precast building. The analysis had revealed that water leakage(4.8438) is the highest rated defects followed by the cracking(4.0625),poor humidity control(3.4219),poor finishing(3.1563) and poor M&E services.

1.Water leakage(4.8438)

Water leakage is ranked the highest by all the respondents. Actually the water leakage is the most crucial defects for the precast building. Most of the defects for precast building were occur by the water leakage. This happen because of the poor designation of the joints and others factors that lead to building maintenance issues in water leakage.

2.Cracking(4.0625)

Cracking is the second highest ranked by the respondents. Cracking are most related to the use of raw material with specification, procedure for quality control, procedure for test the precast component and etc from the analysis of correlation. Cracking may occur any part of the precast component either panel, beam or even slab. There are many factors that causing this situation to occur.

3. Poor humidity control (3.4219)

Poor humidity control is ranked third highest by the respondents. Most of the time poor humidity control was caused by the water leakage into the building where cause the humidity inside the building was in high degree. Un-avoided this can cause the M&E services inside the building get rust for example lighting system. Therefore, the M&E services could not function as well. Normally building with high humidity could cause by the water leaking from the piping system. Poor humidity control have the correlation with the procedure test the quality of the precast concrete, the use of raw material and etc from the analysis of the correlation.

4. Poor finishing(3.1563)

From the analysis shows that the respondents ranked fourth for poor finishing. Poor finishing could cause by the human factors like workers experiences or the material issues.

5. Poor M&E services(2.9375)

The respondents ranked the poor M&E services as the low relevant compare to others. The poor M&E services basically could cause by the designers or installers who didn't emphasized as well. The example like ease of replacement or repair should be focus by the designer when design the M&E services.

3.3 Correlation Analysis

Table 6: Correlation Analysis

	Design Stage	Manufacturing stage	Installation stage	Defects
Design Stage Pearson Correlation Sig. (2-tailed) N		.656** .000 64	.661** .000 64	.648** .000 64
Manufacturing Pearson Correlation stage Sig. (2-tailed) N	.		.787** .000 64	.727** .000 64
Installation Pearson Correlation stage Sig. (2-tailed) N				.649** .000 64
Defects Pearson Correlation Sig. (2-tailed) N				

****. Correlation is significant at the 0.05 level (2-tailed).**

The analysis had showing that design stage had a high correlation with the manufacturing stage(0.656), installation stage(0.661) and defects(0.648). All the combination variables had highly correlation with each others. The full summary of the correlation was shown as table below.

Table 7: Summary Correlation Analysis

Building Maintenance Factors	**High Degree Of Correlation**	**Moderate Degree Of Correlation**	**Low Degree Of Correlation**
1. Design stage	a.Manufacturing stage b. Installation stage c. Defects	Nil	Nil
2. Manufacturing stage	a. Design stage b. Installation stage c. Defects	Nil	Nil
3. Installation stage	a.Design stage b.Manufacturing stage c. Defects	Nil	Nil
4. Defects	a.Design stage b.Manufacturing stage c. Installation stage	Nil	Nil

3.4 Multiple Regression Analysis

Table 8: Summary R square for Dependent and Independent Variable

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.764[a]	.584	.563	1.75822

a. Predictors: (Constant), Installation stage, Design Stage, Manufacturing stage

The table above showing that the R^2=0.584 which means that 58.4% of changes of the dependent variable(defects) was due to the change of the independent variables(installation stage, design stage and manufacturing stage)

Table 9: Summary of Anova For Dependent and Independent Variable

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	260.130	3	86.710	28.049	.000[a]
Residual	185.480	60	3.091		
Total	445.609	63			

a. Predictors: (Constant), Installation stage, Design Stage, Manufacturing stage
b. Dependent Variable: defects

The table above shows that the analysis result of the anova. From the analysis showing that the F value was 28.049 and the result was significant.

Table 10: Summary of Parameters Estimates For Dependent and Independent Variable

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	7.632	1.228		6.215	.000
Design Stage	.114	.048	.276	2.379	.021
Manufacturing stage	.217	.065	.470	3.332	.001
Installation stage	.070	.102	.097	.682	.498

a. Dependent Variable: defects

From the analysis showing that the B value for the design stage was 0.114. Every unit increase in design stage will increase 0.114 unit for overall defects is predicted holding others variables as constant. Besides, B value for the manufacturing stage was 0.217 indicated that every unit increase in manufacturing stage will expect to increase 0.217 in defects which hold all the variables constant. While, the B value for the installation stage was 0.070 and this indicated that every unit increase in installation stage will increase0.070 in defects. The result was significant for the design stage and manufacturing stage but unfortunately the result obtained didn't show acceptable for the installation stage.

4. SUMMARY

The result showing that procedure to install the precast component, the use of raw material with specification, joint details at panel to panel connections, procedure for quality control and detailed information install stage for precast component was among the top five building maintenance factors for precast concrete system. While for the correlation analysis, defects had significant correlation with the building maintenance factors(design, manufacturing and installation stage). Lastly the multiple regression analysis indicated that the dependent variable (defects) and independent variables(design, installation and manufacturing stage) had significant result. This study showing that all the building maintenance factors and defects which had identified had strongly correlation with each others.

REFERENCES

[1] Aris,R,(2006),"Maintenance Factors In Building Design",Master Thesis UTM.
[2] Basiran,M.N,(2002),"KajianSistemPengurusanPenyenggaraanBangunan Hospital Dari AspekPerancangna Dan PelaksaaanKerja:KajianKes:HospitalPakarSouthenBatuPahat,Johor,ProjekKhasTesisSarjanaSains PengurusanHarta Tanah),FakultiKejuruteraan Dan SainsGeoinformasi,UTM.
[3] CREAM and CIDB(2010), INDUSTRIALIZED BUILDING SYSTEM (IBS) CONSTRUCTION RESEARCH AND INFORMATION, Retrieved from http://ibsresearch.blogspot.com/2010/04/history-of-ibs-adoption-in-malaysia.html.
[4] Chung, L.P., (2006), "Implementation Strategy For Industrialized Building System", Master Thesis UTM.
[5] Hassim, S.,Jaafar, M.S and Sazalli, S.A.A.H(2009), "The Contractor Perception Towers Industrialized Building System Risk In Construction Projects In Malaysia", American Journal Of Applied Sciences.
[6] Mat Deris,M.S.(2007),"TahapKeberkesananPengurusanPenyenggeraanFasilitiBangunan Di SektorAwam", Master Thesis UTM.
[7] Rahman, A.B.A, Omar, W. (2006) , "Issues and Challenges in the Implementation of IBS in Malaysia". Proceeding
of the 6th Asia-Pasific Structural Engineering and Construction Conference (ASPEC 2006).5-6 September 2006, Kuala Lumpur, Malaysia.
[8] Sazalli, S.A.B.A.H(2008), "Risk Analysis Of Housing Projects In Malaysia Using An Industrialized Building System". Master Thesis UPM.
[9] Sekak, S.N.A, Hassan, F.A.P and Ghani, A.A A(2008), " The Marketing And Promotion Of Industrialized Building System(IBS) In Malaysia Construction TID-AM-01 (2000), "Maintenance Management System", Technical Information Document, Retrieved from, http://dsp-sd.pwgsc.gc.ca/Collection/P25-5-2-2000E.pdf.
[10] Tay.E.M, (2006), "Industrialized Building System Formation Scheduling For Public School", Master Thesis UTM.

AUTHOR

ENGR. Ng Ban Kiong, is a civil and structural engineer in consultancy andcurrently pursuing his master degree inUniversity Tun Hussein Onn Malaysia.He received his bachelor degree in CivilEngineering from University TunHussein Onn Malaysia. Few yearsexperience in civil engineering design.He is also a member of Board ofEngineering Malaysia(BEM) andInstitution of Engineering Malaysia(IEM).He has published oversix conference papers and journals. His research work is mainlyabout precast concrete system and building maintenance

Assoc. Prof. Dr. ZainalAbidinAkasahisan experienced academician inengineering education with overtwenty five years of teachingexperience in higher education. Heis currently the Head of Departmentof the Building and ConstructionEngineering in the Faculty of Civiland Environmental Engineering. Heobtained his Doctorate fromUniversitiTeknologi Malaysia (UTM) with his thesis related tothe Maintenance Management Process Model for SchoolBuildings. Prior to that he obtained his MSc. in Building Technology from the UniversitiSains Malaysia, his Bachelor of Technology with Education in Civil Engineering fromUTM and his Diploma in Architecture from the same University. Assoc. Prof. DrZainalAbidinAkasah teaches several subjects in civil engineering namely, Intelligent buildings, Acoustics, Lighting and Vibrations in Building andEngineering Drawing and CAD. He is also actively involved in consultancy and the training of trainers. His recent consultancy projects are for the Landscape Design Project under the Ministry of Education and the training of trainers for the KolejKemahiranTinggi MARA (KKTM) project. His involvement in the KKTM project includes giving trainings on Computer Aided Design (CAD) for Piping Design and Building Automation. Assoc. Prof.Dr.ZainalAbidinAkasah is currently are recipient of several research grants. His research interests are in the applicationof IT in architectural engineering, 3-D Visualization applications in building engineering, Computer Aided Design, and facilities management and maintenance, processmodeling andengineering education.