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Construction Challenges in the New Decade

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Foreword

Today's construction industry operates in an environment of widespread economic fluctuations on a global level. The regions and economies of the world are increasingly interdependent as a result of which the challenges that we face are more global in nature than just region-specific. The economic downturn that we have seen over the recent years has had a major impact on the industry. In the light of the above, the mission of the CITC-VI conference is to bring together all the stakeholders to take a fresh look into how construction education, research and practice should be conducted to meet the challenges and opportunities of the new decade.

The construction industry is poised to make great advancements in the way we build and manage our projects in the twenty first century. Technological advances have created an unprecedented window of opportunity for different professionals to pool their expertise for the common good of all. Public and private sector involved in construction should forge new and innovative alliances to take a hard look into the ways construction projects are organized and managed. They should scrutinize the manners in which techniques are employed, and should reconsider the mindsets in which principles are based. It is imperative that we, as educators, researchers, and professionals involved in the construction industry carefully examine techniques and principles that are in use and develop a vision for bringing changes in the future.

CITC-I was held in Miami in April of 2002, CITC-II in Hong Kong in December of 2003, CITC-III was held in Athens, Greece in September of 2005, CITC-IV in Gold Coast, Australia in July of 2007, and CITC-V in Istanbul, Turkey in May of 2009. All of these conferences were extremely successful. Just like the previous five conferences, this effort has also been extremely well supported by our friends, colleagues and well wishers from across the world. We now present to you the *Sixth International Conference on Construction in the 21st Century: Construction Challenges in the New Decade (CITC- VI, Kuala Lumpur)*. This two and a half day conference is being held in Kuala Lumpur, Malaysia at the Renaissance Kuala Lumpur Hotel from July 5-7, 2011. This event has brought together construction professionals, educators and researchers representing educational institutions, government agencies, contracting organizations, engineering consulting companies, financial institutions and other organizations from around the world representing twenty three countries. We proudly present one hundred and fifty four peer-reviewed papers in the proceedings.

It is our intent to organize the *CITC* series of conferences worldwide at regular intervals. We sincerely hope that you will continue to support this effort.

Thanks and best regards,

Syed M. Ahmed
Hamimah Adnan
Kamalesh Panthi
Salman Azhar
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Kuala Lumpur, Malaysia, July 2011

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Keynote Speech 1

Experimentation – A New Direction for Construction Management Research

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Abstract

The construction industry is one of the largest sectors in most economies, accounting for a considerable percent of the gross domestic product (GDP) and employing a sizeable percent of total labor force. For the economy to perform, it is important that construction-related activities are delivered to a high standard, with state-of-the-art technology, materials and techniques. Report indicates that a 10% efficiency gain may yield at least 1% increase in GDP. Research and Development (R&D) is considered as an indispensable strategy in effecting this efficiency gain. Construction management research is frequently being challenged in terms of its research design and methodology. Effective construction research requires proper application of research design and methods. It is generally acknowledged that there is no best way of data collection. Each method has its strength and limitation. This paper, by way of an on-going research project, illustrates how experimentation can be designed and applied in construction management research. It is found that experimentation can enhance the validity and reliability of a construction-related study, although such research may be more expensive than the survey-based research in terms of time, cost, and efforts.

Keywords

Experimentation, construction management research, heat stress model.

1. Introduction

The efficient generation and dissemination of industry best practices provides a significant contribution to the overall economy (Wilson and Rakhra, 1986; Manley, Marceau, and Hampson, 2001). The construction industry, being one of the largest sectors in most countries and accounting for a great percent of GDP and employing a huge percent of total labor force (Construction Industry Council, 2006), is no exception. Independent research (Nana, 2003) was undertaken by Business and Economic Research Ltd (BERL) on the economic impact of efficiency improvements in delivery of the built environment in 2003. The key results indicate that:

- Efficiency gains in building and construction lead to reduced economy-wide production costs, allowing improved competitiveness.

- Such efficiency gains have a positive impact on every other economic sector in the economy.
- A 10% efficiency gain means at least 1% increase in GDP.

R&D is generally accepted as an indispensable strategy to result in efficiency gain (Construction Industry Review Committee Report, 2001). Research is considered as a ‘voyage of discovery’ (Fellow and Liu, 2008). What is discovered depends upon the method and techniques of searching (*how*), timing (*when*), and the subject content (*what*). Consequently attention has increasingly focused on ‘co-production’ research whereby practitioners and academics cooperate to develop new knowledge and technologies together (Green and Harty, 2008; Yeung and Chan, 2002). Unfortunately, construction management research, unlike other well defined and established disciplines, is very often being criticized of having an inappropriate research design and adopting an improper methodology. It is generally acknowledged that there is no best way of data collection (National Academy of Sciences, 2008). Each method has its strength and limitation. This paper, by way of an on-going research project, illustrates how experimentation can be designed and applied in construction management research. In the following sections, the meaning of experimental research will first be defined, an on-going research project which adopts experimentation as the primary data collection technique will then be presented. In particular, its research design in terms of identification of variables, selection of participants, experimental procedures, equipment and apparatus used in collecting research data will be discussed. Finally data analysis and initial findings of the experimental studies will be reported.

2. Definition of Experimental Research

Effective construction research requires proper application of research design and methods. Abowitz and Toole (2010) advocated the following principles in conducting construction research:

- Proper research planning and design enables successful data collection
- Theoretical concepts must be explicitly defined before they can be measured
- Theoretical concepts must be operationally defined to provide valid and reliable measures
- Hypothesized causal relationships must be stated explicitly but are difficult to ‘prove’
- Appropriate statistical analysis is critical to meaningful results

In construction research, a clear understanding of experimental design issues is important (Fellows and Liu, 2008). It is critical not only to the quality of experimental data collected but also for a deeper understanding of basic research processes and problems (Abowitz and Toole, 2010). Experimental research is a collection of research activities which use treatment and controlled testing to understand causal processes. In general, one or more variables are manipulated to determine their effect on a dependent variable (Experiment Resources, 2008). Typically, experiments are conducted in laboratories to determine relationships between identified variables by holding one, or a few variables constant and investigating the effect on the dependent variable of changing these independent variables. The main stages in

experimental research are shown in Table 1 (Fellow and Liu, 2008). Experiments are carried out to predict phenomenon. Usually, an experiment is conducted to explain some kind of causation (Experiment Resources, 2008).

Table 1: Main stages in experimental research (Adapted from Fellow and Liu, 2008)

Experimental Design	
Aim	To test a theory, hypothesis or claim
Objectives	Determine what is to be tested and what limits to the scope of the experiment apply
Identify variables	Decide what is to be measured and how those measurements will be made
Determine sample size	Consider confidence intervals for the results and practical aspects – time and costs of the tests
Conduct the experiments	Maintain constant and known conditions for validity and consistency of results. Collect data accurately
Data analysis	Use appropriate techniques to analyze the results
Conclude	Use the results to draw conclusions about the sample and population
Further research	Note further work which is advisable to test the hypothesis more fully

3. An Illustrative Example of Experimental Research

Hong Kong locates in a subtropical climate zone. The humid subtropical climate is distinguishingly noted for its warm summer months, and relatively mild winters. Summer temperatures average between 21° to 26° C. Many days the temperature can hit 32° C (The Physical Environment, 2009). The Hong Kong government has expressed concerns of working in hot weather and promulgated a series of fundamental practice notes and guidelines on site safety measures for working in hot weather (Construction Industry Council, 2008). To ensure the health and safety of site personnel working in hot weather, research on physiological responses of construction workers under heat stress is urgently needed. An experimental study is therefore designed to construct a heat stress model for bar benders and fixers to better protect their health and safety when working in open areas without shading.

3.1 Identification of variables

Heat incurred disorders accompanied with acute symptoms often appear at human physiological limits (Robertson et al, 1990). The Rating of Perceived Exertion (RPE) scale can be considered as a practical and cost-effective approach to quantify the physiological responses during exercise such as construction works. It has been reported that RPE is highly correlated with many physiological factors e.g. heart rate, ventilation, respiratory rate, oxygen uptake and fatigue in undertaking the work activity; work-related factors e.g. type of exercise and time; personal factors e.g. age, resting heart rate, percentage of body fat, and drinking/smoking habits; as well as environmental factors e.g. temperature, relative humidity, wind speed and air quality (Impellizzeri, 2004; López-Miñarroa and Muyor Rodríguez, 2010; Nakamura et al, 2009). Air pollution is another factor that directly induces the

metabolic disorders. Air pollution index (API) measured and updated hourly by the Hong Kong Environmental Protection Department is transformed by many complicated air quality data into a single number (Environmental Protection Department, 2006). Table 2 summarizes the factors and relevant indicators influencing RPE as identified from earlier research studies.

Table 2 Factors and indicators influencing the Rating of Perceived Exertion (RPE)

	Factor	Indicator
Physiological factors	Energy expenditure)
	Metabolic equivalents)
	Oxygen consumption) Energy consumption
	Minute ventilation)
	Heart rate)
	Respiratory exchange rate	Respiratory exchange ratio
Work-related factors	Work type	Job nature
	Time	Work duration
Environmental factors	Temperature) Heat Index
	Relative humidity	
	Air pollution	Air pollution index
Personal factors	Age	Age
	Physique) Percentage of body fat
) Resting heart rate
	Alcohol/tobacco intake) Smoking habit
) Drinking habit		

3.2 Selection of participants

Ten apparently healthy participants aged between 20 and 60 years participated in this study. Exclusion criteria were: flu in the week prior to participation, history of diagnosed major health problem including diabetes, hypertension, cardiovascular disease, neurological problem and regular medication intake. Participants were informed of the purpose and the procedure of the study. Written consent was obtained prior to the study. Their participation was on a voluntary basis and participants can withdraw at any time without penalty. The study was conducted according to the Declaration of Helsinki and the protocol was fully approved by the Human Subjects Ethics Application Review System (HSEARS) of the author’s employing institution before the commencement of the assessments (Bernold and Lee, 2010). Data collected in the study was password-protected and kept centrally in a stand-alone server and was used for this study only. Only authorized research personnel could have access to the data and the raw data would be destroyed after analysis.

3.3 Procedures

Prior to the experiment, participants were asked to rest at room temperature of approximately 22°C for 15 minutes to stabilize their body temperature and heart rates. During this period, the testing procedure was explained to each participant. Whilst taking the rest, participants were

requested to complete a pre-experiment data collection sheet (written in Chinese) which includes questions on age, height, smoking and drinking habits and other personal information. Smoking and drinking habits were recorded in three categories namely “none”, “occasionally”, and “usually” according to the amount of their weekly alcohol intake and daily cigarette consumption. Before the start of the test, participants were evaluated with measurement of heart rate (Heart rate monitor, Polar, Finland), blood pressure (HEM-712C, OMRON, Japan), and percentage of body fat (InBody 230, Biospace Co., Ltd., USA). Figure 1 shows various apparatus used for the respective measurements of demographic, physiological data, as well as environmental data on site.



Figure 1: Various apparatus used in the field study
(From left to right: InBody 230, COSMED K4b2, QUESTemp°36 heat stress monitor)

Participants were then asked to wear a face mask, back pack and portable unit (Figure 2). The face mask contained the turbine where the airflow was measured. The back pack simply comprised of the battery. The portable unit contained the oxygen and carbon dioxide sensors, sampling pump and electronics, where the analysis of the expired air was carried out. Participants were asked to rest at the beginning of the test for 15 minutes, recording heart rate at 5-s interval, and the minimum value recorded was considered as participants’ RHR.

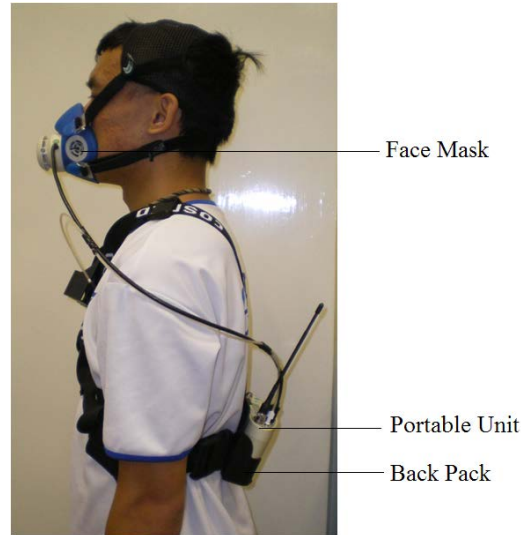


Figure 2: Overview of the metabolic cart

The weight of the metabolic cart is 1.5 kg including the battery and a specially designed harness. Wearing the portable gas analyzer during the work does not significantly alter the participants' energy demands (Flouris, AD, Metsios, and Koutedakis, 2005). Different stages of construction from foundation works to core structural works were studied to capture a wide spectrum of empirical data. Locations where the participants worked were recorded to ascertain the effects of heat stress under shade and under direct sunlight. The metabolic cart allows real-time collection of physiological data. Oxygen consumption (VO_2), minute ventilation (MV), respiratory exchange ratio (RER), metabolic equivalent (MET), energy expenditure (EE), heart rate and a train of physiological parameters would be continuously monitored and recorded during the test via a telemetry system (K4b2, COSMED, Rome, Italy) for every 5 seconds. Blood pressure was measured before the field study (after the 15min RHR measurement) and after the participant cooled down from work for 20 minutes. During the experiment, participants performed bending and fixing tasks as per their usual daily work routine. Without disturbing participants' normal operation, participants were asked to report a RPE value for every 5 minutes, to indicate the amount of strain or level of exhaustion. Perceived exertion was assessed with Borg CR10 Scale, a 10-point single-item scale ranging from 1 to 10 with anchors included 10 ranging from 'very very easy' to 'maximal exertion' (Borg, GA, 1990). RPE has been used in evaluating different physical tasks with proven validity and reliability (McDermott, Lopez, and Casa, 2008).

Alongside with the measurement of physiological data, a heat stress monitor (QUESTemp³⁶, Australian) was used to measure and record the prevailing environmental data. The heat stress monitor measures four environmental parameters simultaneously at 1 minute interval: ambient or dry bulb temperature, natural wet bulb temperature, globe temperature, relative humidity and computes the corresponding heat stress indices, i.e., Heat Index (HI). The recorded HI ranged from 27.5°C to 43.4°C with an average value of 34.6°C. A total of 281 data sets of environmental and physiological data were captured in four construction sites

over ten different working days. 271 sets of data were used to construct the heat stress model, and the remaining 10 sets were used for validation.

3.4 Data analysis

Multiple regression analysis is used to analyze the relationship between a single dependent variable (RPE) and several independent variables [e.g. Age (A), Duration (T), Heat Index (HI), Air Pollution Index (API), Drinking Habit (DH), Smoking Habit (SH), Percentage of Body Fat (PBF), Resting Heart Rate (RHR), Energy Consumption (EC), Respiratory Exchange Rate (RER), and Job Nature (JN)]. It describes the process of constructing a mathematical expression or equation used to represent the behavior of the phenomenon being studied (Belsley, Kuh, and Welsch, 1980). To compare across regression equations involving different numbers of independent variables or different sample sizes, the adjusted coefficient of determination (adjusted R^2) is calculated to reflect the goodness of fit of the model.

The sets of regression equations can be expressed as follows Eq. (1)

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \dots + \beta_k X_{ki} + \varepsilon_i; i = 1, 2, \dots, N \quad (1)$$

In the regression equation, β_0 represents the intercept while $\beta_1, \beta_2, \dots, \beta_k$ regression coefficients which denote the estimated change in the dependent variable Y for a unit change of the independent variables X_2, X_3, \dots, X_k . The prediction error, ε , or the residual, is the difference between the actual and predicted values of the dependent variable. While the assumptions of independence, linearity, and constant variance can be tested by plotting the standardized deleted residuals against the standardized predicted values, normality can be observed by the normal probability plot which displays cumulative normal distribution as a straight line (Campbell, 2001).

While dealing with large number of independent variables, it is of significant importance to determine best combination of these variables to predict the dependent variable. Stepwise regression serves as a robust tool for the selection of best subset models i.e. the best combination of independent variables that best fits the dependent variable with considerably less computing than is required for all possible regressions (Rawlings, 1998). The variable selection process terminates when all variables in the model meet the criterion to stay and no variables outside the model meet the criterion to enter (SPSS Inc., 2004). It is reasonable to expect stepwise selection to have a greater chance of choosing the best independent variables factors related to physiological, work-related, environmental and personal factors with the application of SPSS. In this study, we use stepwise selection procedure to construct the MLR prediction model. However, it is inevitable that physical apparatus for taking measurements may have suffered a transient malfunction, which may result in a large negative impact on the accuracy and reliability of the model; therefore outliers at group-level per condition (at standard deviation ≥ 2.2) were identified and removed by SPSS box-plot procedure (Schroeder, Sjoquist, and Stephan, 1986). Twenty two outliers were deleted after such analysis.

3.5 Results

Relationships between RPE and factors of physiological status were established by using the stepwise addition and deletion regression technique. SPSS v.13.0 statistical program was used to perform the MLR analysis. A multiple regression equation (RPE) with nine determining factors is finally constructed as Eq. (2) with an adjusted R^2 of 0.78 ($p < 0.05$).

$$\text{RPE} = -7.27 + 0.11\text{HI} + 1.26\text{T} + 0.09\text{API} + 0.08\text{A} - 0.05\text{PBF} + 2.23\text{DH} + 0.38\text{SH} + 0.17\text{EC} + 0.17\text{RER} \quad (2)$$

Where HI is heat index ($^{\circ}\text{C}$); T is work duration (hour); API is air pollution index; A is age; PBF is percentage of body fat (%), DH is drinking habit, SH is smoking habit; EC is energy consumption; and RER is respiratory exchange rate.

5. Discussion

This research was motivated by the need for refining the initial guidelines on working in hot weather. For this purpose, a heat stress model for working in hot weather with the application of SPSS software was constructed based on a series of experimental studies. It was found that *personal factors* including, age, smoking and drinking habits, and percentage of body fat; *work related factor* of work duration; *environmental factors* including heat index and air pollution index, and *physiological factors* including energy consumption, and respiratory exchange rate are good predictors in determining rebar workers' physiological responses. Multiple linear regression showed that nine determining factors were able to predict workers' subjective rating of perceived exertion ($\text{adjusted } R^2 = 0.78, p < 0.05$). It demonstrated that the model is adequately robust. Such information may benefit the industry to produce more scientific guidelines for working in hot weather. Workers in different trade activities may have different degrees of susceptibility to heat stress. A trade by trade study would better reflect the real situation. Although this study applies specifically to the rebar trade, the same methodology could be extended to other trades and to other countries to provide a holistic assessment in future research.

6. Conclusion

Construction is a key contributor to the overall economy in most countries. For the economy to perform, it is important that construction-related activities are delivered to a high standard, with state-of-the-art technology, materials and techniques. It has been suggested that a 10% efficiency gain may yield at least 1% increase in GDP. Research and Development (R&D) is crucial in bringing about this efficiency gain. Construction management research has long been challenged in terms of its research design and methodology. Effective construction research requires proper application of research design and methods. By way of an on-going research project to study the impact of heat stress on rebar workers in Hong Kong, this paper has vividly demonstrated that experimental research can help us understand the broader problems in construction management research (Bernold and Lee, 2010). It is found that

experimentation can enhance the validity and reliability of a construction-related study, although such research may be more expensive than the survey-based research in terms of time, cost, and efforts (Abowitz and Toole, 2010).

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Construction Industry: In Need of Radical Transformation?

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Abstract

The underlying theme of this research note is the notion that the construction industry is underperforming and perhaps not heading in the right direction. The case will be made that the industry is not at par with other high-performing industries and that the performance gap is getting wider with time. To advance our industry and close the existing performance gap, it appears that we need not only to “speed-up” our natural evolution but also to introduce more radical (breakthrough) changes. The most recent work on the industry’s performance will be summarized and the major issues, concerns, and proposed solutions will be addresses as well. Several potential obstacles in the industry’s quest to becoming a premier high-performing industry will be discussed in detail. These are: industry unattractiveness, need for “outsiders”, the adequacy of the education system, and the process inefficiency, as demonstrated by the practice of shifting the detail design and planning activities to the construction phase of a project.

Keywords

Performance, Evolutionary Changes, Breakthrough Changes

1. Introduction

The current construction industry delivery model produces too many projects that exceed cost and schedule targets, are of questionable quality and with high levels of waste. There are strong indications that something is “missing” in the way we conduct our business. Our industry is being described as “broken”, “absurd” (LePatner, 2007); “an industry that barely deserve the term” and “backward” (Woudhuysen and Ian, 2004). Doing more of what we (currently) do best seems to be an inadequate strategy for the 21st century. The purpose of this research note is to encourage discussion and exchange of ideas about what we need to do to advance the construction industry and improve its questionable performance. It is about who we are, as an industry, and, more importantly, what kind of industry we want to be. Although the majority of examples and insights offered are from the U.S. construction industry, it is believed that the issues and challenges that we are facing are “borderless” and applicable to any other nation’s construction industry environment.

This research note is also about the industry-level leadership, for which, interestingly, I was unable to find an appropriate term from the available leadership literature. Literature on leadership covers four broad levels of leadership experience: Personal Mastery (the ability to know oneself and learn from experience); Interpersonal Mastery (the ability to communicate and work well with others); Team Mastery (the ability to develop and lead groups of

individuals towards common goals); and Systems Mastery (the ability to lead an organization through a strategic change process). This paper is concerned with the next (fifth) level of leadership experience. It will be called Context Mastery (thanks to a suggestion from Clint Sidle from Cornell University) and is defined as the ability to lead the whole industry through a strategic change process.

2. Current State of the Construction Industry's Performance

A number of industry observers and recent reports and books are questioning the direction in which our industry is heading (Egan, 1998 and 2002; Woudhuysen and Ian, 2004; Kieran and Timberlake, 2004; LePatner, 2007; Miller et al., 2009; NRC, 2009; Brysson and Yetmen, 2010). There is well documented dissatisfaction with the project Owners (Clients) for being “routinely held hostage” by the construction industry (LePatner, 2007). There is also strong evidence that construction industry is not at par with other high-performing industry sectors, in terms of efficiency, quality, and value for money. Owners’ dissatisfaction alone should be sufficient reason to call for industry reform, but there is more disturbing evidence about the construction industry underperformance. Few examples follow: decline of productivity (Teichold, 1999); 25 to 50 percent waste in coordinating labor and in managing, moving, and installing materials (NRC, 2009); a broad range of values for “wasteful activities” (1.6 – 93.1%) with average of 49.6 percent (Horman and Kenley, 2005); the buildingSMART alliance at the National Institute for Building Sciences estimates that more than 50 percent of the cost of a building is waste; compared to other industrial sectors, the construction sector has experienced consistently rising costs over many years (Anheim, in Atkin et al., 2008). In addition to the above mentioned “process inefficiency” indicators, there are many “system inefficiency” indicators in support of the notion that the industry is underperforming: poor safety record; consistently being ranked as one of the most corrupt industries worldwide; low profit margins; extremely high bankruptcy rates; limited investment in research and development (R&D); very slow pace and resistance in embracing the latest client- and market focus business strategies; a small number of successful startups; a low number of patent applications; only about 27 percent of contractors currently have a functional Web site (LePatner, 2007), to mention but a few.

Based on the above it appears that the construction industry is not at par with other high-performing industries, like the automotive industry, for example. I would like to further extend that notion by arguing that the performance gap between the construction industry and any other benchmark high-performing industry is getting wider with time. Figure 1 depicts that position.

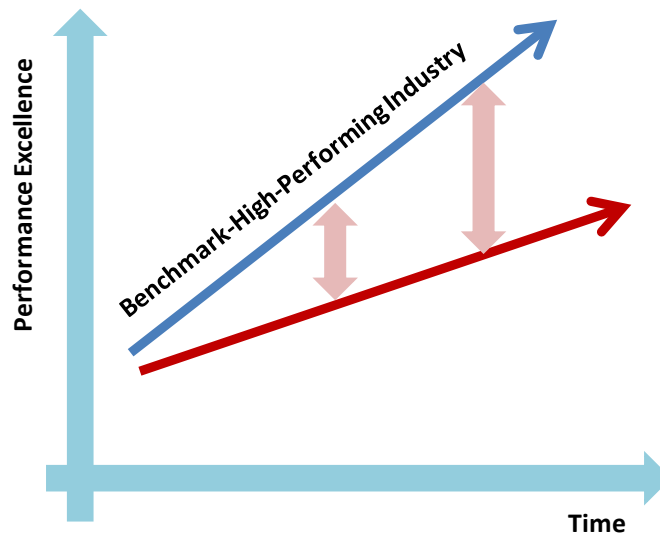


Figure 1. Performance Comparison: Construction Industry vs. a Benchmark-High-Performing Industry

To support that notion several additional indicators that have not been reported in the literature are added to the previous list: Our industry is rarely considered a resource for leaders in other industries; only 6 companies from the construction, engineering, and design sector appeared on the Ethisphere Institute’s 2011 list of 110 global firms saluted for their steadfast adherence to ethical practices (Civil Engineering, 2011); since its inception in 1988, there have been 91 recipients of the prestigious Baldrige Award for performance excellence—only one engineering and architectural firm is among the recipients (it was awarded in 2010); Fortune magazine’s 2011 “50 All-Stars” list that includes “the best of the best” companies as per 4,100 executives, directors, and analysts, doesn’t list a single construction company (Fortune, 2011b); the “100 Best Companies to Work For” list includes only 5 construction and engineering companies (Fortune, 2011a). Also, a few “atypical” performance indicators follow: the number of Harvard Business School case studies from the construction industry is negligible; we don’t have companies that have a position of Chief Creativity Officer, for example; to the best of my knowledge there is not a single construction company with the ITO (Innovation Time Out) policy, similar to Google’s ITO policy that encourages employees to spend 20 percent (or one day per week) on “innovation” activities that speak to their personal interests and passions.

In order to advance our industry and get closer to the efficiency levels that are demonstrated by the best performing industries, it appears that we need not only to “speed-up” our natural evolution but also to introduce more radical (breakthrough) changes. Figure 2 depicts that view.

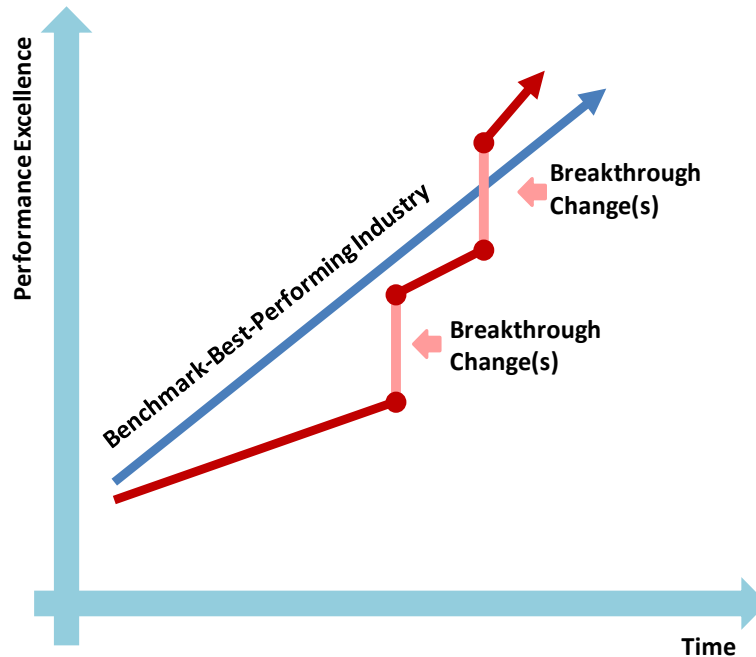


Figure 2. The Transformation into a Real 21st-Century Industry Will Require Both Speeding Up the Evolution and Introduction of Breakthrough (Transformational) Changes

3. Transforming the Construction Industry: Issues, Concerns, and Solutions

Winston Churchill once said that “there is nothing wrong with change, as long as it’s in the right direction.” Yet even though we agree that something needs to be done, the question underneath it all is – what is the right direction? There is no shortage of opinions/ initiatives/ suggestions, representing a different set of value propositions. A significant amount of research has been conducted on specific aspects of construction performance (for example, on productivity). However, a limited amount of literature is available about the performance of the industry as a whole. In this section I will summarize and comment some of the initiatives/ suggestions that have been proposed in the literature recently. The majority of proposed initiatives/ suggestions are ‘evolutionary’ in nature; a few have potential of being ‘breakthrough’ (transformational) changes; and some suggestions are, in my opinion, questionable and unrealistic.

In his book: *Broken Buildings, Busted Budgets: How to Fix America’s Trillion-Dollar Construction Industry* (2007), LePatner states that no one involved in the process has a clear understanding of why the construction industry is “broken” and works the way it does. Although he claims that problems are not the fault of anyone in particular, he is, never the less, very critical about one particular industry participant, namely the contractors, who in his words “use their market power to exploit owners”. It is important to note that LePatner is a lawyer, who has been prominent as an advisor to corporate and institutional clients, real estate owners, and design professionals. LePatner lists 5 symptoms of the “broken” industry: low productivity; the predominance of small firms fragmented across the industry; risk-averse and

short-sighted management; an uncompetitive market; and most problematic, mutable (variable)-cost contracts (industry's "core cancer"). These symptoms are caused by the twin root problem of (1) asymmetric information (the contractor has superior knowledge over the owner) and (2) the lack of "real" intermediaries (who will be able to stop contractors from "exaggerating, misrepresenting, or lying to owners to extract inflated and extra payments for both the base bid price and subsequent change orders"). In order to "jumpstart" construction "productivity" we need (1) a real intermediary "with some teeth" and (2) a true fixed-cost contract. In his view the solution is for construction companies to consolidate (increase in size) and vertically integrate. More "appropriately integrated" firms will have lower costs (and hence lower prices or higher profit margins) than firms that are too vertically integrated, not vertically integrated enough, too small, or too large.

Woudhuysen and Ian (2004), in their book: *Why is construction so backward?*, claim that the construction industry has not yet attained an overall speed of process, from design to completion, that can maintain a pace with the dot com speed of global business. By contrast with the construction industry, the automotive industry has developed enormously over the past decades. They claim that the physical and chemical laws upon which both industries are founded are the same, and in their view there are no intrinsic, technical reasons why the construction industry should not be as automated as the car industry. They cited an architect who said: "A totally new Japanese car requires 1.7 million hours of research and development time from blank sheet of paper to the first customer delivery. So each of the million cars benefit of 1.7 million hours (and split the cost) --- "by comparison a new office building, costing \$50 million with design consultancy fees running at 5 percent of cost, has the benefit of only 10,000 hours of design thought..... under these conditions it is ridiculous to talk about "smart buildings."

Kieran and Timberlake, in their book *Refabricating Architecture: How Manufacturing Methodologies Are Poised to Transform Building Construction* (2004) provide a fine argument for a shift from looking at a building (or any other end product of the construction process) as a constructed object to an assembly of a highly sophisticated system with multiple subsystems. They suggest that there are lessons that can be examined and transferred from our sister industries (automotive, shipbuilding, and aircraft industries) to construction. An important lesson to learn from these industries is that their design departments and production departments have ceased to exist as independent entities within large organizations. Designers and producers are members of a team that come together to solve specific problems. As the number of parts and the complexity increased to the point where the centralization of design and production began to compromise, design and production have been segmented and reassigned to a few integrated component assemblies that produce modules or chunks of the entire product. A new player has emerged, the process engineer, whose new responsibility is the development of integrated component assemblies (modules, chunks) that cut across all the separate categories of material and function. They presented a comparison of two Chrysler plants that are located next to each other, one of which uses the modular assembly method, and the other uses the old traditional method. A car cockpit that is built using traditional methods of assembly has 104 parts that weigh 138 pounds and take 22.4 minutes to install. Using modular assembly, the 104 parts are reduced to one and the installation time decreases to 3.3 minutes. Even the total mass decreases to 123 pounds. It is

important to note that the time saved (21.1 minutes) for cockpit installation didn't just miraculously disappear – it was just “displaced” to the pre-assembly phase where the 104 parts were put together into a single chunk.

In their book, *The Commercial Real Estate Revolution: Nine Transforming Keys to Lowering Costs, Cutting Waste, and Driving Change in a Broken Industry* (2009), Miller et al. claim that our current system of deciding, designing, and delivering buildings is “fundamentally broken”. The enormous amount of waste that characterize a typical construction process is coming from a very visible form of waste, from “inaccurate information that creeps into projects with multiple specialties gathering and regathering the same data during a project” and seven less visible sources of waste: lack of time; silos; boilerplate planning; sub-trade coordination; hierarchical dilution; phase-induced ignorance; problems that come with fielding a new team with every project. They offered the Owner's Roadmap, which consists of 9 Keys: 4 Principles (Trust-Based Team Formation; Early Collaboration; Built-In Sustainability; and Transformational Leadership); 4 Tools: (“Big” BIM; Integrated Project Delivery; Trust-Based Agreements and Client-Centered Incentives; and Offsite Manufacturing). The final key is a hidden revolution that lies beneath all the effort that goes into the design and construction of a building and its interior space: Workplace Productivity. In their view, the problem isn't really the contract, the schedule, or the process – it's the lack of trust. The industry is attempting to reform itself, but it is held back by a piecemeal approach based on years of fragmentation and adversarial instincts. The nature of the reform at this point is highly tribal, where each tribe has united around one of many trade silos: technology, sustainability, methodology, standards, legislation, contracting, liability, and conflict, to list a few. Project owners, however, have the potential to bring together the tribal leaders.

The National Research Council (NRC) Committee on Advancing the Competitiveness and Efficiency of the U.S. Construction Industry identified the 5 interrelated activities that could lead to breakthrough improvements in construction efficiency and productivity in 2 to 10 years (NRC, 2009): Widespread deployment and use of interoperable technology applications also called BIM; improved job-site efficiency equipment, and information; greater use of prefabrication, preassembly, modularization, and off-site fabrication techniques and processes; innovative, widespread use of demonstration installations; and effective performance measurement to drive efficiency and support innovation.

As for who is in the best position to lead an effort to drive change in the construction industry, there is an overwhelming agreement that it is the owners, large corporations and government agencies (NRC, 2009; Egan, 1998, 2002; Brysson and Yetmen, 2010; Miller et al., 2009).

3.1 Some promising examples

This section will conclude by a brief discussion of the 4 promising developments that might be transformational in nature.

David Fisher's Rotating Tower concept (www.dynamicarchitecture.net) brings three “revolutions”: the method of construction; the shape of the building changes continuously;

and making the tower a self-powered building. The entire building, aside from the concrete core, is made of prefabricated units which arrive to the construction site completely finished, including flooring, all mechanical and electrical systems, and all finishes. These units made of steel, aluminum, carbon fiber and other high quality modern materials will be assembled on site. The procurement and delivery model resembles a construction version of the OEM (Original Equipment Manufacturer) model that has been successfully used by the automobile and aircraft industries for decades. The final product bears the company's brand name, but it is the result of a joint effort of a number of companies that both design and manufacture highly integrated systems (chunks) that are assembled together on the site in the final product. The Rotating Tower is much more complex system than the traditionally designed towers; however, given the amount of detailed planning that takes place before the fabrication starts, the assembly phase (onsite construction) will be executed in a much more efficient and predictable manner.

A new technology called Contour Crafting (CC) (<http://www.contourcrafting.org>) is a mega-scale fabrication process aimed at automated construction of whole structures as well as subcomponents. It is a layered fabrication technology developed by Dr. Khoshnevis, which has great potential for building automatically a single house or a colony of houses, each with possibly a different design which can include curved features, in a single run, with all the conduits for electrical, plumbing and air-conditioning embedded.

A Harvard University engineering professor is creating mechanical insects that could be potentially used, among other things, to build bridges or dams in situations too dangerous for humans (Bloomberg, 2010).

Newcastle University team has invented the glue made from genetically-modified bacteria that can "knit" cracks in concrete back together. The genetically-modified microbe has been programmed to swim down fine cracks in the concrete; once at the bottom it 'knit' the building back together (MailOnline, 2010).

4. Potential Obstacles

In this section I will discuss four challenges, which in my view, are critically important, and if not appropriately addressed may become serious obstacles in our quest to becoming a premier high-performing 21st century industry. The first three challenges, namely, industry unattractiveness, need for "outsiders", and the adequacy of the education system, are concerned with our ability to attract, employ, and utilize an extraordinary work force (for both the "wage" and "salary" jobs). The last challenge is concerned with the process inefficiency, as demonstrated by the practice of shifting the detail design and planning activities to the construction phase of projects.

4.1 Industry unattractiveness

The construction industry will need the very best minds to become better, more efficient and innovative. And yet, our industry seems to be less and less attractive to the prospective

employees (the “quantity” concern) and particularly so to the “best-of-the best” the market can offer (the “quality” concern). Part of the perceived industry unattractiveness can be attributed to the unfavorable industry image. Construction is a public business; failures, difficulties and conflicts often play themselves out in the media (Gann and Ammon, 2000). But the media scrutiny and image issues can only partially explain the perceived unattractiveness. Wall Street companies are exposed to the same scrutiny; one of the premier Wall Street companies, Goldman Sachs, was recently described as “If they could eat your lunch and screw you over, they totally would”. Nevertheless, Goldman Sachs has extraordinary ability to recruit and indoctrinate not just “good” candidates but “the best and brightest” (Cohan, 2011). This is not to suggest that we should be ignorant about the industry image, quite the contrary. Rather, it is to suggest that there are other factors that contribute to this unattractiveness. One of them is a long-hours culture.

In 2008, about 18 percent of construction workers in the U.S worked 45 hours or more a week (BLS, 2011); similarly, in the UK the average working week has been 46.5 hours with over half the workforce in receipt of overtime payments (Egan, 2002). But these statistics cover only the wage jobs, and don’t include salary jobs, and these employees, also frequently work evenings, weekends, and holidays to finish a job or take care of an emergency. But the big change is about to happen. The Millennial generation (born after about 1980) is coming and it will compose the majority of the construction workforce by 2018 (ENR, 2011a). Some of the industry observers are questioning the work ethic of Millennials stating that the lower work ethic is their biggest deficiency. Interestingly, one of the interviewees was an architecture and construction management professor who expressed his pessimism by saying that few of his students have what it takes to be successful in construction. “In our industry, if you’re going to be successful, you’ve got to work really hard, a minimum of 50 to 60 hours a week” (ENR, 2011a). His view represents the industry definition of “work ethic” which is equated with the willingness to work long hours. That definition, in my view, is not adequate anymore and will only drive away a great talent that we need so badly if we want to transform the industry. These “rules” are already being challenged. In a recent interview one of the Millennial professionals was cited saying “our generation will change how management and employees interact in the A/E/C industry. We have a different approach to the work/ life balance (and) drive to change the industry” (ENR, 2011a). The industry is in serious need of new business model under which it will be possible to accomplish more in a 40-hour week than what is possible in a 50-or so hours a week under the existing conditions. Our industry is big on utilizing different kinds of “zero” polices, like Skanska’s The Five Zero Vision – zero loss-making projects; zero work-site accidents; zero environmental incidents; zero ethical breaches; and zero defects. My prediction is that the next “Zero” policy that will be utilized by the most successful construction companies will be the “Zero Overtime” policy.

One of the industry weaknesses, that can relatively easily be mitigated, is that we are not aggressive communicators about our success stories. Take for example, the ENR Top 25 Newsmakers List (ENR, 2011b); there is a beautiful story behind each of these individuals, but very few people, let alone prospective employees, are aware of these professionals and their accomplishments. These individuals and many more other successful industry participants deserve more public attention; they should be made more visible and their voices should be heard more often.

4.2 We are the industry where the outsiders are not welcomed

An “outsider” is defined as one who has non-traditional, non-construction-related educational and professional backgrounds. Drucker (1986) used a shoveling sand analogy to demonstrate that the proper design of work is not intuitively obvious and the people closest to the work are the least likely to properly redesign their own work. People have been shoveling sand for thousands of years using the biggest shovel with the longest handle, which is exactly the opposite of the design that is more efficient and less fatiguing. If design is intuitively obvious then those closest to the work would have redesigned their tools long ago to make the work more productive and less back breaking, but they didn't. The construction industry's ability to become more competitive largely depends on its ability to acquire ideas, resources, and individuals from an external environment. The construction industry is known for its legendary commitment to caution and routine – a “play-it-safe” attitude seems to be a part of the industry's DNA. Part of that culture is manifested by the resistance in embracing the ideas and initiatives coming from other industries, which is clearly putting the industry at risk of becoming ‘insular’ system that is out of touch with surrounding realities. The construction industry employs less scientists, engineers, engineering and science technicians and IT professionals than other competing industries, like manufacturing, transportation, trade, services, government (BLS, 2000). Miller et al., for example, are calling for adding new capabilities, including sociology, cultural anthropology, and architectural biology, for example (Miller et al., 2009).

In a study conducted in the Netherlands (Pries et al., 2004) it was found that the boardrooms of the leading construction firms are staffed by people growing through the ranks and those with technical backgrounds and education. The management paradigm is still technical and the management profile is still mainly engineer-manager; the ‘how to produce’-capability still receives far more emphasis than the knowledge capability of ‘what to produce’. Such inward looking orientation may only obscure the vision on the changes in the business environment (Pries et al., 2004). This is in sharp contrast to the approach used by other industries, as summarized by the *former Disney CEO* Michael Eisner: “I would much rather hire an executive who has taken courses in history and philosophy and language and art, and English and Russian literature rather than one who has studied a single element of one subject.” Other industries have much better record of utilizing industry outsiders for top executive positions. One of the recent extremely successful examples was hiring of Alan Mulally, a career Boeing executive, to lead Ford Motor Company. Or, hiring of Tom Thibodeau in 2010 to lead the Chicago Bulls, a legendary NBA basketball team (WSJ, 2011b). He became a 2011 NBA Coach of the Year in his first season for making a mediocre team one of the best league's teams in the span of just one year. He was by all means an unconventional hire as he wasn't a former NBA player and he didn't have a big college reputation. When he was hired, nobody rioted in celebration. Still, spectacular results were delivered. Similar examples are very rare in construction. A recent article in the Wall Street Journal (WSJ, 2011a) featured a former CEO of aluminum producer (an outsider) who had saved a billion-dollar home builder from bankruptcy. It is worth noting that he was not hired by the home-builder but appointed by a distressed-debt buyout firm that acquired the struggling company. When asked about the fact that he had never run a homebuilding company before if it helped or hurt, his answer was “It

definitely helped. Similar to other industries, people get into ruts. It gets harder to challenge yourself because you're surrounded by people who have been in the business for 25 years. Because I'm ignorant when I'm coming in, all the sacred cows lose their sacredness" (WSJ, 2011a).

4.3 Is the education system inadequate?

According to some industry observers the current construction education system is "unsurprisingly inadequate." The message coming from the industry side is that "An educational system that values abstract theoretical thinking over field experience is a key problem" (LePatner, 2007). Assuming that we should always have both of these components included in our curriculum; the question becomes what is the appropriate balance of the two opposing approaches? At the core of this dilemma is a question about what are we trying to accomplish: do we want to enhance our students 'how to produce' capabilities or 'what to produce' capabilities? Should it be more about learning "how to drive" or about "where to drive? For this million dollar question, I do not have an answer. Brysson and Yetmen (2010) argue that it is imperative that education focus more on learning how to think creatively about the business and processes of delivering projects. They believe that educational system must place greater emphasis on foundational business tools such as economics, finance, and organizational behavior; otherwise the industry professionals would find it difficult to think critically about existing delivery processes or to develop the analytical tools necessary for innovation (Brysson and Yetmen, 2010). They argue that students of engineering or construction management (no mentioning of architecture students?) are often captured in their own silos and rarely exposed to the other disciplines with which they will partner in the industry. At Rice University, for example, architecture and business students are placed in the same classroom to analyze the construction industry through multiple lenses.

4.4 Too many activities are "displaced" to the construction phase of project

The more one attempts to undertake at the point of final assembly, the more difficult it is to control quality and efficiency. Kieran and Timberlake (2004) mentioned the "1-3-8" rule of shipbuilding: any given task takes 1 hour in shop, 3 hours at site but off-hull, 8 hours inside hull. The delegation of detail design work is commonplace in construction; instead of fully designing a construction before it is put out to bid, the detail design work is done during the construction phase. Consequently, there is an enormous effort spent in coordination meetings (shop drawings preparation/ approval) during the construction (assembly) phase (Woudhuysen and Ian, 2004). Similarly, a great deal of planning effort has been purposely "displaced" from the pre-construction phases to the construction phase. Owners are not willing to invest sufficient resources for the planning effort prior to construction to "think out" the project from the beginning to the end. It seems that many owners see no value in pre-construction planning. A recent survey (ENR, 2011c) including in-depth interviews with 15 owners asked: why aren't owners using more prefabrication? One of the cited reasons was that prefabrication and modular methods require more planning! It appears that for some owners detail planning prior to construction is an unnecessary activity and that more efficient and less expensive it is to delegate it to the construction phase, which, as we know, rarely works. Under the existing system where the detail design and planning are pushed into the

construction phase, it is unreasonable to expect that the onsite construction operations will ever be able to resemble the efficiency of the assembly line operation, as seen in the manufacturing environment. There will always be too many opportunities to “screw something up”. This is a reason, for example, why materials are typically handled several times before being put into its final position. Because of that “system flaw” (lack of detail in both design and working plans), there is substantial amount of built-in “waste” time into the process which is very difficult, if not impossible, to completely eliminate. This context has been ignored in the previously cited studies suggesting that there is 25 to 50 percent waste in coordinating labor and in managing, moving, and installing materials (NRC, 2009) or that there is a broad range of values for wasteful activities (1.6 – 93.1%) with average of 49.6 percent (Horman and Kenley, 2005). This is why I am very skeptical about the prescriptive performance improvement targets, such as: “50 percent reduction in delivery time” (NSTC, 1995) or “reducing Capital Cost and Construction Time for 10 percent, and increasing Productivity for 10 percent (Egan, 1998). These targets are established with the assumption that the onsite construction can be as efficient as an assembly line, and it can’t, because we are running different races. A sport analogy may be helpful in explaining this point. The world men’s track record for 100 meters is 9.58 seconds (as of July 2011), and the men’s freestyle swimming record for 100 meters is 46.91 seconds. It would be absurd to claim that the swimming champion’s performance is characterized with 390 percent of “waste” (the “extra” 37.33 seconds). It would be equally absurd, based on the flawed assumption of 390 percent of waste, to set a target for 10 percent, let alone 50 percent, improvement. Swimming through water will always demand more time than running through the air. Similarly, unless we radically change the way we deliver projects, most of the suggested improvement targets will remain unrealistic, misleading (due to the tendency to direct the improvement efforts to the onsite labor mainly) and demoralizing (as we may not be able to reach the goals). One of the consequences of “displacing” too many activities to the construction phase is that this phase is characterized by hectic schedules and significant portion of time is invested in crisis management. That environment is not well suited for innovation, as it does not allow adequate time for “incubation” (a very important component in the innovation process). Many people feel they are most creative when faced with tight time constraints, but research does not support this view; in fact, the drop in creative thinking becomes most apparent when time pressure is the greatest (Amabile et al., 2002).

5. Conclusion

It is undeniable that the quality of the built environment affects everybody and all other aspects of economy. The case has been made that the construction industry is underperforming and falling behind other high-performing industries. To reverse that trend the industry is in need of radical transformation. The challenges are many and very serious. However, we don’t want to sink into a collective condition of ‘learned helplessness’, where the more we fail to do anything about the problem, the more we convince ourselves that there’s nothing we could do. Many great initiatives to change the industry are already underway, and there is much to be optimistic about. I am hopeful that “in a few years, it is highly likely that the industry will flip, turning processes, value chains, and the final products of design and construction head over heels” (Brysson and Yetmen, 2010). I hope that this

note has provoked your thinking and leaves you with the sense that we can not only change our industry but change it profoundly. The time to act is now.

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The paper number and page numbers refer to the complete paper present in the attached CD (back cover). The CD contains full version of the papers included in the proceedings

1. Cost Engineering and Financial Issues

1.1 Cost and Financial Management

Paper 1, Page: 19-27

Application of the Monte-Carlo Method to Determine the Costs for Building Projects–Influence of Ranges on Probability Distribution

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Abstract

This paper sets out to demonstrate the calculation of construction costs whilst considering key construction management parameters. Beyond a simple, deterministic method, other options for calculation are shown that rely on probability calculus. The approaches described to determine construction costs are illustrated by a building project example. The Monte-Carlo method will then be applied on the basis of the deterministic calculation mode used initially. The Monte-Carlo calculation sequence will be both described and displayed graphically. For each simulation exercise, distribution functions will be selected for the input parameters, and minimum and maximum values will be determined, as well as most likely values, as far as reasonably possible. The @RISK software will be used to carry out the simulations. The results will be shown as probability distributions for the output parameters defined in a preceding step. The results of several simulations with varying distribution functions will be compared to each other and analyzed. The comparison should show whether it is useful to apply weighted triangles as distribution functions. The influence of a reduction in the input parameter range on the probability distributions will also be determined. Such a range reduction is enabled by a more detailed knowledge of the prevailing site, management, structural and process conditions. The degree of uncertainty and fuzziness can be lowered as a result. The paper is to demonstrate and analyze the influence of the input parameter improvement on the results.

Paper 2, Page: 28-36

Efficiency Assessment of Bosnia Herzegovina Water Companies

Ivana Domljan & Vjekoslav Domljan

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Abstract

This paper is aimed at addressing the issue of municipal water companies in Bosnia-Herzegovina. It demonstrates that data envelopment analysis (DEA) could be a useful tool in assessing the relative efficiencies of water supply systems. The results obtained by applying DEA are additionally compared with the resultants achieved by employing corrected ordinary least squares (COLS).

The principal aim of this paper is to show that is worth assessing the efficiency improvements that could result from the better use of all inputs. Despite the severe scarcity of data for the BiH water sector, collected data allowed us to develop a DEA model with a set of inputs (number of connections, number of workers, and other costs) and outputs (water billed) as required in the water sector empirical literature.

As a first step in the efficiency analysis in BiH the research could serve as a benchmark against which future analysis of water utilities can be measured. Additionally, it could provide policy-makers with comparable quantitative evidence on the effectiveness of water utilities with the aim of focusing them in rebuilding the water sector infrastructure, beginning with the most inefficient municipalities to minimize huge water losses.

Paper 3, Page: 37-44

Road Construction Cost Prediction Models Based on Regression Analysis

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Abstract

The ability to predict the final cost of construction projects based on limited initial input data could be a very valuable tool for every project manager and/or construction enterprise. This paper focuses on the models of Trefor P. Williams and their application in Greek road construction projects. An overview and description of each model is provided and also their performance is assessed. These models can predict with satisfactory precision the cost at completion of road construction projects based on initial tender offers. The study applies these models in 28 selected highway construction project cases conducted in central and northern Greece and discusses their performance. The analysis of the models is taking place in various groups of sample projects, based on projects' budgets and geographical locations.

Paper 4, Page: 45-52

Prediction Models for Financial Ratios of Greek Construction Companies

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Abstract

This paper examines the relationship between the items of the balance sheets and income statements of Greek construction enterprises with various market and financial values. This is made possible by calculating selected financial indicators. These indicators provide an important tool for the analysis of sustainability and viability of construction enterprises.

More specifically the paper presents selected findings of the financial analysis concerning the ten largest Greek companies in the construction industry, for the five-year period 2004-2008. Initial reference to the definitions and concepts relating to the construction economy, the building market, efficiency and methods for measuring the performance are described and the legislative framework of the Greek enterprises is briefly presented.

The paper presents methods for assessing performance through financial statements, the concept of balance sheet and income statement of accounts in the light of international accounting standards. Moreover, the definitions and essential financial ratios are analyzed and the selected categories of ratios used in this paper are discussed. The study also presents the statistical analysis of the economic - market factors (parameters) which potentially affect the evolution of financial indicators - ratios of construction industry enterprises. Finally, prediction models for these financial ratios are produced based on regression analysis.

Paper 5, Page: 53-60

Network – Based Bill of Quantities (NetBOQ) vs Conventional Bill of Quantities: A Comparative Evaluation

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Abstract

Used in one form or the other in the cost management of construction projects all over the world, the issues of format, content, and practicability have remained major criticisms of the conventional bill of quantities, hence the objective of evaluating the suitability of different bill types in this work. The above criticisms become serious when viewed against contemporary clients' increasing demand for, among other things, better accuracy, predictability of project time and cost, process transparency, and better value for money expended for professional services. Using data sourced from experts in bill preparation and use, this paper shows that a network-based bill of quantities is better suited to perform the basic functions of a bill, and for meeting clients' needs since it makes time explicit, and its content follows real life construction sequence.

Paper 6, Page: 61-68

Financial Health of the Construction Industry of Pakistan - A Perspective of Major Stakeholders

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Abstract

Construction sector and construction activities are considered to be one of the major sources of economic growth, development, and economic activities. Especially the current decade is witnessing massive infrastructure growth in Pakistan. At the same time there are indications to suggest, that during times of adverse conditions, the occurrence of insolvent conditions seem to be on the increase. Construction companies must therefore undertake regular evaluation of their performance in order to ensure the adoption of timely and appropriate strategies to survive in business. Such considerations should automatically form part of the strategic planning process. There are various ideas for formulating financial analysis methods for corporate evaluation. Of these approaches, ratio analysis has received the most attention. The use of such models by construction companies can provide an early warning mechanism which should serve as an effective monitoring tool for avoiding continued poor corporate performance or eventual insolvency. It was very early when ratio models in the international construction industry were used as a decision tool but even at the present moment Pakistan Construction Industry can not adopt such practice owing to scarce technical support and lack of awareness. Keeping this in view the following objectives have been set for this research.

Paper 7, Page: 69-76

Cost and Time Overruns in Highway Projects of Pakistan

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Abstract

Meeting project objectives like timely completion within allocated cost reflects good project management in any field. Construction Industry of Pakistan with a contribution of only 2.405% to GDP, suffers badly due to lack of investment in infrastructure sector like roads, rail etc and poor management of projects experiencing delays and cost overruns. Transport sector is vital trade route in Pakistan as it carries 80% of the country's commercial traffic, clearly indicating that it constitutes major component of construction industry. This study aims to investigate key factors causing cost and time overruns in highway projects through literature review and questionnaire survey. Factors like delay in progress payments to contractors, land acquisition process, price escalation of major construction materials, improper planning, contractor's incapability to do the job, delay in delivering site to the contractor, additional work / scope changes and inappropriate government policies and priorities were identified by the study which severely affect the duration and cost of a highway project. Appropriate project management practices can help in minimizing the impacts of delays and cost overruns in highway projects.

Paper 8, Page: 77-85

Recycling of Demolition Debris as Sub-base and Base Course in Road Pavements in Palestine

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Abstract

The amount of the destroyed building debris resulting from the Israeli aggression war on the Gaza Strip in December 2008 weighs approximately more than one million tons. This rubble spreads in several regions of the Gaza Strip in the form of accumulated piles causing an environmental disaster. For this reason, the rubble must be cleared away. This does not mean to throw it into the sea; building debris can be considered as a good source of construction materials that can be used alternatively for natural aggregate crushed rocks. Accordingly, this research shows how to use the mounds of rubble in road construction. After conducting relevant tests on the crushed debris generated by UN-crusher, results showed that this crushed material can be used successfully in the road pavement as subbase and base course. This means that the use of building debris in road constructions meets the technical, economic and environmental conditions based on the international, regional and local specifications and standards.

Paper 9, Page: 86-93

A Cost Estimation Model in Pre-Design Phase

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Abstract

A cost estimation model that is developed for residential buildings to be used in pre-design phase and based on the factors that affect building cost in pre-design phase is introduced in this study. Factors affect cost in pre-design phase and affecting ratios of these factors are determined. As using affecting ratios of factors on cost, the conversion coefficients are determined and they are used for developing the cost estimation model. This is a conversion model. This model is explained with a formula and its usage is facilitated with using computer programs. It can be used in the future with using building cost index.

After cost estimation models in the pre-design phase are introduced, the developed model is compared with other cost estimation models in the pre-design phase. The values of per m² cost that are calculated with new model are compared to Ministry of Public Works Method values. As Ministry of Public Works Method is used after design phase, its values are close to the actual cost. The values of per m² cost that are calculated with new model are -4.6% and 5.4% different from the values of per m² cost that are calculated with Ministry of Public Works Method.

1.2 Decision Making and Risk Analysis

Paper 10, Page: 94-100

Project Governance in Malaysia Hillside Developments

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Abstract

Hillsides in urban areas around the world are being developed at an accelerating rate, to accommodate population growth and rapid urbanization. Developments at hillside are attractive places to live because of the views, fresh air, exclusivity and the sense of being close to nature. Despite its attractiveness, hillside developments are prone to natural hazards such as landslides that can have environmental, social and economic consequences. To minimise these risks, it is necessary to consider the concerns of all stakeholders during the project review stage. This paper proposes that project governance concept can be used for this purpose by defining the rights, responsibilities and interests of the key stakeholders. It can also provide a framework within which decisions are made in order to minimise risks associated with natural hazards.

Paper 11, Page: 101-110

Major Quantitative Techniques for Risk Analysis in the Construction Industry – A Comparative Analysis

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Abstract

Risk analysis is one of the critical functions of the risk management process. It relies on a detailed understanding of risks and their possible implications. Construction projects, because of their large and complex nature, are plagued by a variety of risks which must be considered and responded to in order to ensure project success. This study conducts an extensive comparative analysis of major quantitative risk analysis techniques in the construction industry. The techniques discussed and comparatively analyzed in this report include: Programme Evaluation and Review Technique (PERT), Judgmental Risk Analysis Process (JRAP), Estimating Using Risk Analysis (ERA), Monte Carlo Simulation technique, Computer Aided Simulation for Project Appraisal and Review (CASPAR), Failure Modes and Effects Analysis technique (FMEA) and Advanced Programmatic Risk Analysis and Management model (APRAM). The findings highlight the fact that each risk analysis technique addresses risks in any or all of the following areas – schedule risks, budget risks or technical risks. Through comparative analysis, it has been revealed that a majority of risk analysis techniques focus on schedule or budget risks. Very little has been documented in terms of technical risk analysis techniques. In an era where clients are demanding and expecting higher quality projects and finishes, project managers must endeavor to invest time and resources to ensure that the few existing technical risk analysis techniques are developed and further refined, and that new technical risk analysis techniques are developed to suit the current construction industries requirements.

Paper 12, Page: 111-118

Personalized Multidimensional Process Framework for Dynamic Risk Analysis in the Real Estate Industry

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Abstract

The risk analysis for real estate property investment is subject to high risk. It is qualitatively and quantitatively assessed by various techniques such as the analytical hierarchy process (AHP) and the analytic network process (ANP) which determine the risk factors based on expert survey, weight and rank the factors using algorithm and mathematical formula and decide the best investment based on performance index of the alternatives given. However, experts from the field have different opinions and judgments about the environment of the real estate industry and this scenario will affect the result of the risk factor weight and ranking. Moreover, different investors have different goals and objectives to be achieved. Thus, this paper will propose a new personalized multidimensional process (PMP) framework based on knowledge discovery. This framework comprises of two new methods namely the personalized association mapping (PAM) method and the personalized multidimensional – sensitivity analysis (PM-SA) method. The innovations of this research are the justification of risk factor weight and ranking. It will be based on deterministic approach using historical data driven to decision support using knowledge discovery in database and the heuristic approach which refers to investors' personalization of the risk factors which fulfil their requirements.

Paper 13, Page: 119-130

Bidding AHP Model for Iranian Construction Contractors to Select the Best Bidding Project

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Abstract

In today's competitive environment of construction industry, bidding decision is highly important. Selecting one or several projects among all possible options and winning them without considering systematic bidding decision process may seriously endanger the profit of construction contractors. For any project, contractor should intelligently and rationally decide on bid/no bid. To make a rational decision that maintains both long and short term profit of the company, all factors that may affect contractor's decision to bid/no bid for a project should be considered and evaluated. In this paper by reviewing available literature and also gathering opinions of experienced contractors, 38 factors are selected as the most important factors affecting bidding decision making of construction contractors in Iran. These factors are categorized under 11 categories and 4 groups. All factors are weighted by experienced contractors by distributing questionnaires. All participants are ranked as first-grade contractors by Iran President Deputy Strategic Planning and Control (IPDSPC) and undertake large size projects. Then, analytical hierarchy process method (AHP) employed to produce a model for prioritizing bidding opportunities. In this method, the weight of each factor is achieved by pair comparison logic. The proposed model helps contractors involved in construction projects in Iran to prioritize bidding opportunities and make the best decision to bid/no bid for a project considering resource limitations and companies' strategy.

Paper14, Page: 131-141

Identifying and examining affecting factors on the decision to bid/no bid at Iranian well-established contracting firms

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Abstract

Bidding is a strategic and vital stage for construction contractors. Regarding this contractors are always encounter with two important issues: first, they should decide to bid or no to bid for a project and second, they should decide the price they want to offer. Many factors are involved in such decision making. In this paper, by using a two-step questionnaire, which was initially evaluated and confirmed by experienced contractors, factors that may affect contractors' decision to bid/no bid for projects were identified and weighted by statistical indices. The research population includes first-grade contractors based on ranking developed by Iran President Deputy Strategic Planning and Control (IPDSPC) that undertake large size projects in construction, water and transportation fields. The study introduces 76 factors categorized under 11 categories and four groups. Finally, the results were adapted to Pareto's law and the most important factors were ranked and represented.

Paper15, Page: 142-150

Risk Assessment for Water Supply Projects using Public Private Partnership (PPP) / Private Finance Initiative (PFI)

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Abstract

Public Private Partnership / Private Financial Initiative (PPP/PFI) water supply project typically involves a plethora of risks. While forming PFI is a promising technique, many PFI water services contracts experienced either early termination or early re-negotiation due to mismanaging risk-related issues. So for successful PFI projects such risks need to be identified, assessed, allocated and mitigated properly which otherwise may result in the increase of costs, project delays and services which fail to deliver value-for-money to the community. Although the experts have used several ways to manage and tackle risks, a high volume of risks during the PFI water supply projects still arose. The idea of using a systematic framework for risk assessment in PFI water supply contracts is seemed to be a proactive approach to achieve the project's objectives. Therefore, this study intends to propose a systematic risk assessment technique in order to optimise the allocation of the risks to the responsible parties. The research methodology applied includes literature review and questionnaires which are distributed to the private and public agencies that are involved in PPP/PFI projects. The main finding of this research comprises identifying four categories of risk allocation at the base of the prospect of both the main participants. The research concludes by recommending the application of the framework for risk assessment in the current PFI projects especially in the water supply context.

Paper 16, Page: 151-160

Risk Assessment of Common Construction Hazards among Different Countries

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Abstract

The construction industry has the largest number of injuries compared to other industries. Thus, reducing accidents and determining construction risks are extremely important. One of the essential steps for construction safety management is hazard identification, since the most unmanageable risks are from unidentified hazards. This paper aims to rank the risk of construction hazards. To achieve this aim, the frequency and severity of accidents from the most common hazards at construction sites, were assessed. The data for this study were collected using a web survey. The questionnaire was sent to 300 safety professionals including safety managers, safety officers, and safety experts who were randomly selected from 20 countries. Of those, 76 completed responses were returned. The results reveal that there is no significant difference in severity and frequency of accidents between the studied countries. It was also found that a lack of safety-forward attitudes, a lack of awareness of safety regulations, poor safety awareness of project managers, and a lack of knowledge are the hazards with the most risk in construction projects. The outcome of this study can help organizations and managers prepare proper safety plans and also to increase the knowledge of partners in construction sites through training and awareness programs.

Paper17, Page: 161-168

Derivatives Trading Strategy for Managing Material Price Risks

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Abstract

As global sourcing of strategic materials for construction projects becomes more complex, new tools and/or strategies are needed. This paper investigates some existing tools that have helped other industries mitigate price risk. These tools, or financial instruments, have yet to be broadly adopted for use in the construction arena. A proactive strategy is proposed by employing derivatives trading, specifically for steel pricing control. Various steel markets are identified with pertinent details provided. Additionally, the basic types and functions of hedging are explained. This strategy has broad impact and meaningful application to construction firms working in an increasingly global competitive marketplace.

2. Construction Project Management

2.1 Project Planning and Control

Paper18, Page: 169-176

Cost and time overruns in commercial construction projects – An Australian study

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Abstract

Cost and schedule are two of most important performance indicators of construction projects. Cost escalation and time overruns are typically associated with poor management practices. Cost overruns and delays have huge impacts on construction projects in relation to the costs of a project, the reputation of the parties involved, and the satisfaction of the final product. Therefore, it is imperative to understand the causes of cost and time overruns so that mitigation measures can be set in place. A group of industry professionals in South Australia were surveyed on their perceptions of the factors contributing towards the cost and time overruns in commercial construction projects. The results showed that timeliness of decision making is ranked as the top factor contributing towards delays whereas problems with design is perceived as most influential to the cost overruns. In addition, the questionnaire survey found that different parties, i.e. clients, contractors and consultants have different perceptions on the impacts of these factors. Similarly, the structural frame stage was considered the most critical stage for controlling the time and cost performance during the construction process. Implications are discussed.

Paper19, Page: 177-184

Improvements in Network Modeling

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Abstract

Maximal type of precedence relationships are the part of network scheduling theory since the beginning of the development of these techniques. Despite this fact current planning practice and widely known project planning applications solely support the use of minimal-type relationships. This restriction of the model usually does not result in a proper schedule. This paper would like to call the attention of the scheduling experts to the fact that “reinvention” and the use of maximal-type relationships can lead to a more adequate schedule. It also discusses some problems that can arise from the application of this type of logical dependencies and shows possible solutions.

Paper20, Page: 185-192

Schedule Incentive / Penalty Provisions in Indian Construction Projects

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Abstract

Incentive/penalty provisions are used in construction projects for various reasons, which include improving the performance. The successful formulation and implementation of such provisions is dependent on a number of attributes which needs attention of client and contractor. A total of 25 attributes have been identified based on literature review and structured personal interview. The attributes have been evaluated based on the results of a questionnaire survey conducted among

professionals working in Indian construction Industry.

Five factors: contractor's management, client's role and responsibilities, manpower and equipment, sound planning, and advanced scheduling and monitoring have been extracted based on the results of factor analysis conducted on the responses of important attributes. The results would prove to be useful to clients as well as contractors in understanding and implementing the schedule incentive / penalty provisions in a better way to achieve timely completion of construction projects.

Paper 21, Page: 193-199

Approaches in management of Construction delays and cost overrun of Multiple D&B Projects in Sabah

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Abstract

The construction industry in Malaysia is of paramount importance for creating employment in the country, both directly and indirectly unlike other industries. It is the highest contributor to the country's economic growth as evident from the CIDB reports. Malaysian construction industry has shown continuous growth since independence. Over the years, many forms of private sector participation have been evolved for infrastructure projects of which the Design and Build (D&B) method is one of the most popular approaches for specialised works. Public infrastructure projects under D&B arrangement have a complex risk profile. To a considerable extent, the success of any D&B projects is influenced by the degree of which various project risks are managed. This study has identified the gaps in previous research studies which lack in providing a practical approach to identify these risks

and the appropriate responses. The paper discusses the recent related studies from literature; type of contract procurement practiced in Malaysia and a case study of multiple D&B projects in Sabah. The methods planned for the entire research are described in this article. The study of the entire research work is divided into two approaches. Firstly to conduct the questionnaire survey in the industry to acquire ranking of factors causing delays and cost overrun. Secondly to record the potential delay causing factors from the real time project. This paper has collected and analyzed the time and cost related data from the multiple bridge projects. This includes the completed and ongoing multiple projects of the D&B contractor. The final research findings are obtained by comparing the results of the studies from the analysis of the questionnaire survey responses and the case study. Outcome of this analysis has the benefit of providing reliable risk avoidance methods with applicable solutions for the construction practice.

Paper 22, Page: 200-207

Evaluation of Disaster Preparedness Plans, Information Management and Rescue Strategies of High Rise Buildings in Lagos Metropolis

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Abstract

Although disasters could happen anywhere and at any time, certain types of disasters are more likely to affect some building structures than others; especially those situated in highly populated urban areas. Buildings in Lagos metropolitan districts in Nigeria have had nasty experiences from both natural and artificial disasters in the recent past; claiming enormous lives and properties. This study aims at evaluating some aspects of disaster preparedness in the high rise buildings of the metropolis. To determine which disasters were likely to onset and how prepared the buildings were in events of the occurrences; a structured questionnaire was administered to the owners of the buildings, the estate managers and disaster managers

who managed those high rise buildings. To supplement the information, interview was also conducted with tenants, and relevant rescue organizations. The study identified typical potential disasters, their likelihood of occurrence and severity of impact if occurred. 66% of disaster response preparedness plan was in place to confront the disasters with only 41% available evacuation facilities and 60% disaster management plan. 63% of those buildings benefit from early warning systems for information and 67% of the rescue assistance expected from rescue organizations could be realized.

2.2 Procurement Management

Paper 23, Page: 208-216

Preliminary Critical Success Factors of Public Private Partnership (PPP) in the UAE Public Healthcare Projects

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Abstract

Public Private Partnership (PPP) is a procurement method that employs a long-term contractual arrangement between the public sector and the private sector for the intention of developing a public facility. It utilizes private sector finance and best practice to achieve value for money in the public services provided. The United Arab Emirates (UAE) is not new to the idea of PPP especially for infrastructure projects. The UAE, with its currently significant infrastructure development, is an environment which is well suited to the use of the PPP model, which is currently being utilized by the Abu Dhabi government in the power, water, healthcare, and education sectors.

The Critical Success Factors (CSF) are those that must be maintained in order to increase the project success rate and manage it in an efficient and effective way. This paper reports on the first stage of an ongoing research project aiming at developing a CSF framework for integrating the PPP procurement approach in the development of the UAE public

Healthcare projects. The main objective of this paper is to develop a preliminary list of possible critical success factors for projects procured under the PPP concept with an emphasis on the UAE environment. The study is guided by a comprehensive literature review. It is expected that the results of this research project will raise awareness of needed success factors at an early planning stage of the UAE Healthcare projects.

Paper 24, Page: 217-226

Infrastructure Procurement in Pakistan

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Abstract

In Pakistan, the need for infrastructure is immense while resources and capital are scarce commodities. This paper will explore the methods used in Pakistan to procure infrastructure projects. This paper is a part of doctoral study of procurement practices of developing countries. Through literature and archival analysis, it discusses the project approval and procurement process in Pakistan along with the problems and issues in the procurement practice of infrastructure projects in the country. The major constraints in procurement identified in this study are legal, regulatory, governance, management and project financing which needs to evolve to the growing needs of the time.

Paper 25, Page: 227-234

Procurement Practices in Developing Countries: the need for research

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Abstract

In the developing countries, the total value of construction work represents around half of the gross domestic capital formation. There is a lack of research on methods used in developing countries to procure construction projects and implement them. For developing countries to make that vital transition to developed countries, it is of paramount importance to have their construction industry research and development intensified. This paper is a part of doctoral study of procurement practices of developing countries. Through literature review it discusses the problems and issues in the procurement practices and a need for more research regarding the procurement of projects in developing countries.

Paper 26, Page: 235-240

Greening Procurement: A Research Agenda for Optimizing Mass-haul During Linear Infrastructure Construction

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Abstract

Infrastructure construction generates a significant amount of global economic activity. Much of infrastructure construction is government sponsored through a procurement process. Currently the ideals of sustainability are not embedded in these processes because methodologies to measure green house gas emissions produced *during* infrastructure construction are yet to be developed. Both government road and transport authorities and contractors require these tools. As a way forward, an agenda for preliminary research focusing on a special case is suggested. As mass-haul is known to produce high levels of greenhouse gas emissions it would make an excellent construction activity to explore. If it is possible to optimize the amount of handling and movement of soil, aggregates, and rock around projects, then it is possible that green house gas emissions could also be measured and optimized. Therefore a three-pronged research agenda is proposed, centered on mass-haul activity, in order to develop prototype methodologies and tools for green procurement processes that contribute to sustainability of the built environment.

Paper 27, Page: 241-248

Public Sector's Organizational Structure for Successful Public-Private Partnerships in Construction

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Abstract

Depending on the type of the project, the type of the partnership, and the particularities met in the host country, Public-Private-Partnerships (PPPs) present different characteristics, which despite, a certain level of procedural similarities lead to worth-noticing differences in the implementation of Public-Private-Partnerships and consequently to various levels of success. This paper investigates the parameter of the organizational structure of the public sector involved in PPPs in construction aiming at: a) identifying and collectively present the critical properties that public sector organizations should possess, and b) determining the minimum requirements that it must satisfy, in order to achieve successful PPPs. A thorough review of public sector

agencies involved in PPPs is conducted and presented including application examples and data that prove deficiencies and best practices, worldwide, in order to define the respective strengths and weaknesses in delivering construction projects through PPPs. One of the main conclusions is the essential role of a PPP Unit to the delivery of successful PPPs. Based on this finding, an organizational structure for the public sector is proposed that corresponds to the basic requirements that should be met, in order to succeed in developing PPPs.

Paper 28, Page: 249-256

Industrialized Building System (IBS) Construction Supply-Chain Strategies of Malaysian Contractors

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Abstract

Industrialized Building System (IBS) is the term coined by the industry and government in Malaysia to represent the adoption of construction industrialization and the use of prefabrication of components in building construction. Despite acknowledging its benefits, the construction industry is still not rapidly embracing IBS. Fragmented and disconnected construction supply chains are the leading causes of low construction performance and limited uptake to IBS construction. The purpose of the paper is to identify supply chain strategy of

contractors involves in IBS construction. The paper uses case study as research methodology and the analysis is based primarily on cross-case investigation and pattern matching. The main part of this paper is presentation and discussion of case studies with contractors in Malaysia. The case studies show that the IBS supply chain requires close control of materials and resource management to ensure continuity and timely delivery of construction components at site. The case companies involve heavily in the production of IBS components and practices closed supply chain. The supply chain is managed in a manner that allows the contractors full control of the process with the intention to improve efficiencies and competitiveness. As the way forward, this paper suggesting contractors to adopt partnering initiatives, and embrace open collaborative environment to be competitive. In addition, Information Technology (IT) tools such as Building Information Modeling (BIM) can be useful to support collaborative supply chain.

Paper 29, Page: 257-264

Assessing the Performance of Clients During the Briefing Process in Malaysia: Case Study Universiti Teknologi MARA

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Abstract

In the briefing process, the client's requirements for the proposed building are communicated. This process informs decision making, especially with regard to forming the objectives and definition of the project formulation. The objectives and definition of the project are important since they provide direction and are essential for successful outcomes of the project. The clients are responsible for determining and communicating their requirements to other project participants and leading them in

transforming those requirements into a completed building. Therefore, the performance of clients during the briefing process is crucial. This paper describes the ongoing research carried out at Universiti Teknologi MARA (UiTM), which is continuously involved in implementing construction projects for their 24 (twenty-four) campuses nationwide. It presents the conceptual framework of the research and the findings of the pilot study carried out on such construction projects. Semi-structured interviews and a questionnaire survey on 17 mixed-development projects for various faculties within the university were administered. The data was obtained from both the client's representatives and consultant Architects involved in the projects. Three categories of clients' performance were investigated namely, quality, brief management efforts and commitment of the clients' organization. The findings highlight the current performances of clients during the briefing process and their impact on project success in terms of time, cost and functionality.

Paper 30, Page: 265-271

Maintenance Management for Public Infrastructure for Malaysian Local Authorities

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Abstract

Local authorities have responsibilities to ensure its public infrastructure facilities are performing well up and up to a level of public satisfaction. This paper studies the current implementation of the maintenance of infrastructure facilities at four local municipal council authorities in Malaysia. It was found major efforts should be focused on improving the maintenance performance of local authorities. The findings prove to be vital to providing a better comprehension to authorities and related parties as to why the infrastructure maintenance work in Malaysia needs to be given an emphasis in order to achieve an acceptable condition and satisfy the public. Commitment from the broader range of

players within the Malaysian construction industry supply chain is vital.

Paper 31, Page: 272-280

Construction Logistics Management in Building Projects in Iran: the Warehousing Process

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Abstract

Logistics has been recognized as a major factor in industrial organizations for many years. However, it has not been applied appropriately in construction yet. The reason is that the nature of construction is different to other industries like manufacturing or food. Some characteristics of construction industry like matchless projects, fragmented supply chain, unique design, temporary organization, and working in different geographical locations, necessitates undertaking a new approach for managing logistics in construction projects. Construction logistics is a system with six agents (sub-systems): (1) site preparation, (2) purchasing, (3) delivery, (4) handling methods, (5) warehousing and (6) monitoring. This paper only covers issues regarding storage and the warehousing process. Owing to the space, staff and equipment that are required, warehousing is a costly element of a logistics system and therefore it should be managed efficiently. This paper aims to describe and evaluate the current practice of warehousing in construction sites to explicate existing problems and share best practice. To achieve reliable results, a qualitative research methodology is adopted which includes two parts. First, a comprehensive literature review was conducted to understand the current body of knowledge in the area. Second, twenty open-ended interviews were carried out with experienced practitioners to bring insight to the research. The study focused on the Iranian building industry as the main source of data collection. After gathering

enough data, a conventional template analysis is used to analyze textual data. Results are rich and exploratory and explain opinions, norms and attitudes.

Paper 32, Page: 281-287

The Current Bidding Environment of Commercial Construction Projects in Atlanta, Georgia

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Abstract

In a time of recession, general contractors tend to be very aggressive in bidding work in order to secure a backlog that will carry their operation and cover their fixed overhead. With the current economic slowdown, the meltdown of the residential market, and the fact that most of the work available in the market is the one funded by the American Recovery and Reinvestment Act, the number of contractors interested in bidding public commercial work increased significantly. Bidding experience varies with some of the contractors having commercial knowledge with no understanding of competitive bidding and others having only a residential background. Since the playing field was not leveled, the bid market became like a jungle with players of different background, overhead, and qualifications, especially when the targeted project is small in size.

The study consists of analyzing twenty public commercial construction projects that were bid in the Greater Atlanta area between 2010 and 2011. The study will examine the increased number of bidders and its impact on the overhead and profit and on the spread of bids from the lowest to the highest. The profitability and health of the market is another area that will be analyzed in this paper by reviewing the lowest bidders and reviewing the rates at which they are able to secure jobs in today's economy.

Paper 33, Page: 288-295

Best Value PIPS Research Reaches Malaysia

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Abstract

Brunsfeld, one of the largest developer/contractors in Malaysia, has entered into a three year arrangement with the Performance Based Studies Research Group (PBSRG) at Arizona State University to utilize the best value PIPS environment to raise their already efficient organization to the next level of performance. Brunsfeld has been a major contractor/developer for one of the largest land owners in Malaysia. Brunsfeld has been able to capture efficiency and supply chain thinking to deliver 33% faster than most contractors, minimize the cost of construction, increase the value of development 10 times the normal development, and deliver at a defect rate of .04 defects per unit (100 times less than the normal defect rate.) Brunsfeld is now planning to increase their production without minimizing any of their performance. To go to the next level, Brunsfeld is doing best value research with PBSRG to implement the best value environment in their supply chain to make their performance and value generation sustainable over a longer period of time through efficiency and alignment. This paper will analyze why Brunsfeld made such a commitment despite their own expertise and high performance, how PBSRG identified that this was a good research fit, and lessons learned in how to improve university construction management research programs, which can assist to improve the Malaysian construction industry.

Paper 34, Page: 296-302

State of the Art Research Model: Brunsfeld Research Center

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Abstract

A major problem in the construction management research area is the difficulty for traditional research programs to add value to the construction industry in a timely manner. Some of the issues include the methodology of doing research and getting research grants, the requirement of researchers to do administration work and teach undergraduates, the lack of research laboratories in the area of construction management and delivery, the

disconnect between the academic research community and the industry, and the inductive exploratory research approach of the academic research groups. Brunsfield is a highly progressive development/construction group, which not only optimizes its current operations, but every five years they plan significant changes to their operations to increase their value generation. Brunsfield will take a very progressive research model and simultaneously perform theoretical research, prototype testing, implementation, their supply chain, development, real estate operations and construction operations as laboratories for research. The paper describes their research model, their research staffing, publication and implementation of the research, and interface with university research institutions.

Paper 35, Page: 303-310

Solving the Malaysian Construction Industry Research Environment

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Abstract

Traditional practices has not lead to the expected results in the Malaysian construction industry research environment. The Malaysian construction industry has identified the weaknesses of the academic research groups as the cause of not meeting the expected results. As for academic research groups, they have complained that the industry is not looking for change, and research grants are difficult to obtain. Performance Based Studies Research Group (PBSRG), a forward thinking academic research group, has had tremendous success with industry research in multiple countries. Those countries are: Netherlands, Canada, Finland and Botswana. PBSRG is running a test in Malaysia using both the traditional model and the "out of the box" PBSRG research model to determine which methodology is more successful in solving the industry divide with academic research and thereby the problem with research results. The new model being tested differs from the traditional model. For example, the industry continues to fund the research effort and it is the only source of funding, aligns research expertise with academic classroom teaching, uses a deductive approach rather than the time consuming inductive approach,

and accomplishes simultaneous basic theoretical research, prototype testing, and implementation research. The authors developed a hypothesis and started the test in July 2010.

Paper 36, Page: 311-318

The "Seamless" Bureaucracy

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Abstract

The construction industry is suffering problems of low demand, low quality and performance, high overhead/delivery costs, dissatisfied clients, and high deviation rates. Research in best value delivery at Arizona State University has identified the problem as a "system/delivery" problem, and not a technical problem. The hypothesis being proposed is that industry "best practices" of management, direction, control, decision making, and inspection, to improve performance and minimize deviations, are inaccurate and inefficient practices. The elements of the traditional system are bureaucratic and in order for the industry to participate with the clients and buyers, the industry supply side has been forced to enter into a relational contract that mirrors all the characteristics of the buyer and the buyer's delivery system, thus maintaining a seamless bureaucracy. The research proposes the implementation of the alignment of expertise to replace the more traditional and bureaucratic characteristics of management, direction, and control. Accompanying the alignment of expertise are the concepts of self-measurement, measurement of deviation, minimized decision making, the use of dominant information and the management of risk that the vendor does not control. The concept is currently being tested at Brunsfield, one of the largest developers/contractors in Malaysia.

2.3 Project Management Issues

Paper 37, Page: 319-326

Innovation in the Context of a Developing Country: A Case of a Cable Car Project

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Abstract

This paper presents a case of a cable car project that was implemented in the underdeveloped economy of Nepal. The concept of the project as a whole has been taken as a contextual innovation because of its newness and uniqueness in the context of the country at the time of implementation. This study presents a detail account of the project implementation emphasizing the challenges that the parties in the project faced. It provides important insight into the project that was very successfully implemented in the harsh socio-political environment of an underdeveloped economy. Qualitative approach was used for the research in which the main instrument for collecting primary data was face-to-face semi-structured interviews with the key people involved in the project. The findings have been presented in terms of the categories of challenges as the initial perceived constraints, management level challenges, and project level challenges.

Paper 38, Page: 327-334

Labor Productivity Improvement in the Industrial Construction Projects Based on Effective Factors Utilization

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Abstract

Poor productivity among construction workers is one of the main causes of cost and time overruns, as well as poor quality and lack of safety in construction projects. Considering that a multitude

of factors simultaneously affect labor productivity, the aim of this study is to identify and rank the most influential factors. In this regard, based on the literature, review a practical classification method is presented using a Factor Breakdown Structure which sorts the initial list of 430 factors into 5 levels and 4 main groups: Management, External, Human, and Technical. In an effort to quantify the workers' perspective on labor productivity, a number of structured questionnaires (including 45 factors) were distributed among a group of craft workers, technicians, and engineers. Two different fields of industrial construction were analyzed through the following case studies: 1) Construction jobsite located in South Pars Gas Field development phase 12, Assaluyeh, Iran; and 2) South Khorasan cement factory, Khorasan, Iran.

The findings revealed that weather, management, motivation and incentives, tools, planning and materials have the greatest impact on labor productivity in South Pars Gas Field. Additional factors were pulled from the second case study. Finally, some guides are presented for improving labor productivity.

Paper 39, Page:335-344

Critical Success Factors for the Construction Organization in the Malaysian Construction Industry: A case study in Penang

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Abstract

The construction organisation plays an important role in the construction industry. It establishes buildings and infrastructure works required for social economic development which contributes to

the overall economic growth. The success of the economic development will further lead to an increase in disposal income, generating the demand for additional construction activity. The study of project success and the critical success factors (CSFs) is considered to be a means to improve the effectiveness of a project. However, the concept of project success has remained ambiguously defined in the minds of the construction professionals. Consequently, this study is conducted in order to make an attempt to identify the factors that influence the success of a construction organisation, to establish critical success factors for the construction organisation, and to identify the strategies that are undertaken by the construction organisation in order to be more successful. The quantitative approach was used on 100 construction players in Penang. The results were analysed by using descriptive analysis, frequency analysis and the relative importance index (RII) technique. As a result, it was found that sufficient cash flow was the most influential factor that contributed to the success of a construction organisation, while the critical success factor for the construction organisation was the human factor. Yet, tight controls of labour and materials have become the most contributed strategies for success. Lastly, it could be concluded that there were many factors that influenced the success of a construction organisation with several strategies that could be adopted in order to be more successful.

Paper 40, Page: 345-350

Project Management Performance in ICT and Construction Project: The Influence of Project Management Staff

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Abstract

One of the factors that can influence the project management performance of construction project is the project management staff. Recognition of the role of project management related processes can positively increase capability of Project Management Staff. Therefore, this study attempted to examine the relationship of project management staff on project management performance of the ICT

and construction companies. The respondent for this study was 156 project managers from ICT companies and 346 project managers from construction companies in Klang Valley, Malaysia. One dimension namely project management staff from PMPA model developed by Qureshi et al. (2009) served as the conceptual framework. The findings indicated that project management staff has moderate correlation on project management performance. It was found that project management staff received the correlation value of 0.475 with project management performance.

Paper 41, Page: 351-358

Preliminary Research into Responsible Business Practices in Engineering Firms through an Analysis of Project Stakeholders

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Abstract

In recent years, responsible business has become an increasingly important management topic in the international business community. In 2010, the International Organization for Standardization, (ISO) has launched guidelines for social responsibility (ISO 26000) which are applicable to

organizations in the public and private sectors, in developed and developing countries. Recent reports and references have considered the business case for CSR in the construction and engineering sectors. Key reasons include demand from key stakeholders; clients, investors and the media, that engineering and construction firms comply to social and environmental performance. Firms that develop social/environmental policies can provide a competitive and market advantage. Constructing Excellence assert that CSR policies and practices can secure strategic advantage through improved community goodwill, improved reputation, reducing costs by avoiding conflicts with community groups, and minimizing risks (related to project performance and corporate image/branding).

Firms from a range of industrial sectors, including engineering businesses, have been developing their own policies, strategies and CSR initiatives. This paper explores the approaches and application of responsible business practices in engineering firms through assessment of the key business and project stakeholders and uncovers some of the prime CSR issues, challenges and opportunities for CSR to become embedded in the culture of this important Industry.

Paper 42, Page: 359-366

Transparency Initiatives (TI) Strategies for Public Construction Projects

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Abstract

The construction industry is consistently ranked as one of the most corrupt industries worldwide. Corruption in the construction/engineering sector

across the world has taken a high toll including lost lives, financial losses, diverted resources and destruction of the environment. Transparency contributes to a favourable investment climate as a result of less corruption and better country risk ratings. Any method that helps to ensure quality, timely delivery at reasonable cost is a transparency (anti-corruption) strategy.

Numerous transparency initiatives (TI) were formulated, created and implemented by various organizations and countries, using diverse methodologies, to increase transparency and reduce corruption in construction projects. Therefore, the objectives of this paper is to review TI strategies across the world to capture the critical components needed for successful TI strategies within organization. Based on the consideration of these strategies, this paper proposes TI strategies for the construction industry in Malaysia. These strategies consist of three vital components: adequate anti-corruption measures, the commitment of political leaders or top management, and people-related issues. The benefits of these strategies are perceived from the target outcome of the Malaysia National Key Result Area (NKRA), which include regaining public confidence, reducing leakage in government procurement, and tackling grand corruption.

Paper 43, Page: 367-374

Approach of Japanese Project Management: A Comparison Between PMBOK and P2M/KPM in the Construction Industry

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Abstract

Project management is important in running an organization and project managers in different countries practice different ways to deliver their best to their global clients. The most common and well-established US method, Project Management Body of Knowledge (PMBOK®) has been adopted by many organizations, including some Japanese organizations. However, the Japanese have come up with new project management methods, i.e., Project & Program Management (P2M) and *Kaikaku* Project Management (KPM). This research aims to identify the behavior and practice of Japanese project management methods; and to compare PMBOK®

and P2M/KPM in the construction industry. The features and essence are highlighted, discussed, and reviewed to identify if they are applicable in construction field. The results show that PMBOK® is target orientated, and concentrates on time, cost and quality to obtain excellent results. P2M/KPM on the other hand, is mission orientated, responding and adapting well to environmental changes in order to overcome crises with a concentration on loyalty, safety, trust and relationships. Identifying the suitable criteria will provoke interest in organizations to implement the best suitable method in their project management in construction industry. Ultimately, the findings would determine the feasible use or incorporation of Japanese Project Management principles with the existing management principles.

Paper 44, Page:375-380

Prediction of Construction Labor Production Rates for Malaysian Construction Industry Using ANN

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Abstract

Construction labor productivity in Malaysian industry has been declining over a decade due to lack of standard productivity measurement system. Beside this the influences of various qualitative factors on labor productivity have not been incorporated accurately during the scheduling and estimation of the project durations. Therefore, the

aim of this research is to predict the production rates by using Artificial Neural Network (ANN) which incorporates the factors. Qualitative factors influencing the rates such as weather, project location, site conditions, etc. have been identified on project sites during the measurement of production rates values for concreting of a slab. Data obtained from seven building project sites have been used in the ANN for predicting labor production rates. The results obtained with the least error can be used as reliable and valid production rates for building projects estimation in the Malaysian construction industry.

Paper 45, Page: 381-386

Factors Influencing Construction Projects Delays: A Literature Review

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Abstract

Delays in a construction project, not only affect project performance in terms of time but they also impact project cost and quality, either directly or indirectly. Review of related previous research was conducted in order to identify the root causes that lead to the delay in construction project. It was found that every involved party in a construction project could contribute to delay in construction projects. Studies also revealed that, financial problems and management-related factors are among the highest ranked major causes of delays in construction projects. Every party involved in construction projects plays an important role in mitigating and minimizing delays in construction projects. Good coordination among parties and a strong management team is essential to better project management.

Paper46, Page: 387-394

Conceptual Framework of Resource Allocation Procedures and Practices in Construction Projects

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Abstract

Optimal resource allocation for successful project completion is critical in the field of construction. All construction projects are composed of several concurrent activities, which may comprise of numerous resource constraints. Resource allocation like other management tools strongly influence and act as one of the effective management tool. It is not unusual that some construction projects cost many times their fair value. This practice has a tremendous impact on the economy. The recent economic situation has had further notable effects on construction projects. The detail literature review was conducted to comprehend the fundamentals, related to resource allocation procedures. The key factors for a conceptual framework were identified and further analysed. Resource allocation procedures provide versatile managing tool to allocate resources in construction project. The conceptual framework of resource allocation is recommended for construction projects. The benefits include improved construction management process and resource management system.

Paper 47, Page: 395-406

The Dilemma of Communications and Management of Remote Construction Projects in the Kingdom of Saudi Arabia

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Abstract

Remote projects have their unique problems that are caused mainly by the remoteness of the project itself thus the loose control over communications and management. Little research was undertaken particularly in the gulf region regarding this issue and it has highlighted few unique problems associated with the communications and management of remote construction projects. This paper explores the potential use of Advanced Communications and Management Systems (ACMS) by the Saudi Electric Company (SEC) for managing its' remote construction projects in the Kingdom of Saudi Arabia (KSA). It discusses the opinions of contractors and the SEC's supervision teams regarding the weaknesses in the present communications and management systems and the potentiality of ACMS and their possible impact on project's performance and process. The study found that, although ACMS would improve some project management practices, there are barriers that limit their potential benefits in regards to other management practices. Thus, certain and planned changes to the management system and practices are necessary to ensure that the SEC is capable of achieving the full benefit from using these advanced systems.

Paper 48, Page: 407-419

Using Performance Metrics to Guide Management and Predict Client Satisfaction

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Abstract

Fluctuating macro-economic conditions require design and construction teams to effectively and efficiently respond to project risks through improvements in management practice. The lack of meaningful performance metrics, infrequent assessment of project deficiencies and inaccurate prediction of Client satisfaction result in misaligned project management strategies. This paper begins with an illustration of these three challenges faced by the project execution team using a four-month case study on a healthcare project in California.

The motivating challenges necessitate a need for Client-based, tactical-driven project management using real-time measurement of relevant metrics. The Dynamic Performance Monitoring and Management (DPMM) framework draws on literature in the areas of organizational effectiveness for key performance indicators; strategic management for continuous improvement and client satisfaction; and applied microeconomics for measuring management practices. Next, a breakdown of the framework will illustrate the convergence of literature to conceptualize the constructs embedded. Our empirically derived approach starts with a survey of project key stakeholders to establish a representative set of metrics to be tracked and assessed. The project execution team will interpret metrics results and shift attention to deficient performance areas. Improvements in management practice are directly correlated with large increases in productivity and decreases in project risk.

Paper49, Page: 420-424

Current Trends and Future Prospects of Online Bidding in Construction: A Survey of Owners and Contractors Organizations in USA

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Abstract

With the advancements in Information and Communication Technologies (ICT), the use of online bidding is steadily increasing in the construction industry. Online bidding allows contractors to prepare and submit project bids electronically in encrypted format via a secure network, thereby resulting in substantial time and cost savings. This paper will first discuss the concept of online bidding with its advantages over the traditional paper-based bidding. Then two types of online bidding systems, namely traditional online bidding and reserve auction bidding, will be discussed with their pros and cons. At the end, findings of a research project which investigated the current status and future prospects of online bidding in the U.S. construction industry will be presented.

Paper 50, Page: 425-438

Selection of Procurement Systems in the South African Construction Industry

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Abstract

A procurement system is vital in ensuring the successful implementation of a construction project, precisely executed for all phases of any particular project. Therefore, this paper aims to investigate in a systematic manner the factors that influence the selection of a procurement system in the South African construction industry. An extensive theory and literature review of procurement systems was conducted. The literature reviewed included a sample of 6 case studies of completed Building and Civil Engineering projects within South Africa. Questionnaire surveys were carried out using a 4 round Delphi method approach to conduct the empirical study in order to obtain participants' opinions about the factors that influence the selection of procurement systems as well as the utility value of various procurement systems on each factor as identified. Finally, data analysis of both qualitative and quantitative techniques was performed using the statistical package for Social Sciences (SPSS). After qualitative analysis the findings indicate that the factors that influence the selection of procurement systems are closely linked

to the problem areas or cut across all the phases of the project as identified in this paper. Therefore, these factors are categorically classified into internal and external factors. Factors from the internal environment were further classified into client characteristics and project characteristics, with client characteristics comprising of variables such as the client's level of knowledge and control, political and social consideration, familiarity of procurement systems, competition, funding arrangement, government public/private sector projects and risk allocation whereas project characteristics comprise of factors (variables) such as size and technical complexity of the project, influence of the project life cycle, expedited project delivery, time, quality and price certainty. Factors from the external environment include variables such as market competition, information technology, regulatory environment, natural causes and globalization.

After factor analysis had been performed on variables obtained from the literature review, five (5) newly established factors were identified and are considered to be the most significant factors that influence the selection of procurement systems for the South African construction industry. These 5 factors are: socio-economic consideration; client requirements; capital cost/cash flow; procurement policy; and project characteristics. This study investigates factors that influence the selection of procurement systems in South Africa for the purpose of assisting and guiding construction practitioners in selecting suitable procurement systems for their planned projects.

2.4 Project Delivery Systems

Paper 51, Page: 439-447

Public Sector Perceptions of Early Contractor Involvement for Delivering Social Infrastructure

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Abstract

There have been widespread calls for the public sector to use of non-traditional delivery methods so as to obtain better 'value for money'. Early contractor involvement (ECI) is one form of delivery approach that has begun to attract the attention of many Australian State Governments, as it allows a contractor to proactively participate in design development, risk management and the construction programming processes. Design and construction processes can also be integrated which therefore overcomes the impediments and barriers that have conventionally existed between designers and contractor. Within Western Australia (WA) the use of ECI has been limited in application. Using questionnaire surveys and semi-structured interviews, this research sought to determine the perceptions of public sector representatives about the benefits and barriers of implementing ECI. Findings revealed that a significant proportion of contractors did not have the capability and experience to be involved within an ECI approach. Their preference was the use of a traditional lump sum method. Where there was limited scope for using competitive tendering, particularly on large complex projects, then ECI could be a preferred option for future projects. The paper recommends that the public sector begin to educate designers and contractors about the benefits of using ECI.

Paper 52, Page: 448-456

GBI-NREB towards the Sustainable Value of Money and Sense for Existing Purpose-Built Building in Malaysia

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Abstract

The Copenhagen Climate Change Summit 2009 (COP15) has seen Malaysia aim for a voluntary reduction of its emissions intensity of GDP by the year 2020. Therefore, the building sectors are also motivated to play a part through the Green Building Index (GBI) scheme; the sustainable tool that has potential in resolving this global environmental issue. It is expected that GBI offers a promising outcome to stakeholders against the issues on the fees and construction cost to gain this certificate. This paper is part of a main research area focusing on the value of money and sense towards attaining the GBI-NREB certification which takes into account existing purpose-built buildings in Malaysia. This paper measures the quantifiable value of the GBI-NREB scheme that can be materialized through the computation of the upfront cost on the GBI scheme and government incentives against the promising operational cost saving. The research method is based upon a literature review and comparative studies on relevant cases in Malaysia. The anticipated outcomes from this paper are that, a profound effect on the investment in attaining GBI-NREB certification which eventually

aims for property sustainable value and operational cost saving.

Paper 53, Page:457-467

Exploring the Opportunities of Design and Build Contracts for the Construction Projects in Pakistan.

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Abstract

Design and Build is one of the latest procurement techniques and philosophies for the construction projects in the developing world. The main objective of this approach is to transfer the risk and achieve the Total Quality Management in the construction projects. There is very little application of this approach in the developing world including Pakistan due to lack of policy and institutional support. The traditional approach of Design Bid Build is thus leading to delays and cost over runs of the construction projects. In this paper, the application of Design and Build approach has been explored for the construction industry in Pakistan, and particularly the public sector. If suitable environment is developed, the Design and Build approach can be successfully applied to boost the construction industry of Pakistan.

Paper 54, Page:468-476

Comparison of Project Delivery Methods Used in Building Construction Projects

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Abstract

In Pakistan, the traditional project delivery method used for building construction projects is "design-bid-build", especially in public sectors. Most of the projects following traditional project delivery method do not meet the desired project performance in terms of cost, time and quality. The projects performance can be improved by adopting non-traditional project delivery methods. This paper compares the cost and schedule performance of design-bid-build and design-build delivery method, using project data collected from 92 building construction projects of Pakistan. The results of the statistical analysis are presented in two parts. First, the distribution of data set by project delivery method, project type, owner type and contract type used for the projects. Second, results of univariate analysis (descriptive statistics) are presented. Key findings of univariate analysis showed that unit cost of design-bid-build project was 22% more than that of design-build projects. Very less significant differences were found in cost growth between design-bid-build and design-build project delivery methods. Results show that the design-build projects had large construction speed and thus resulted in better schedule performance. It is concluded that the projects performance can be greatly improved by adoption of non-traditional project delivery methods.

The present study was restricted to univariate analysis only. It is recommended that future studies may be carried out which include multivariate analysis.

Paper 55, Page:477-484

A Case Study of a Strategic Facilities Management Planning and Implementation in a PFI Hospital Project

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Abstract

The rapid pace of changing in communication technology, demand for efficient use of energy and security performance and sustainability in workspace have an impact on the facilities management (FM) services. Such impact highlights the needs for better FM services linking to business strategies and early integration with organization core business.

The discussion in this paper focuses on a Private Finance Initiative (PFI) hospital project with the aim to explore FM services and its integration process during pre-construction, construction and the commencing of the FM services of a completed hospital project. The research is based on the data collection exercise during pre-construction stage, construction, FM operational period of a hospital project through semi-structured interviews with the Whole Life Cost manager and the FM personnel from the PFI project consortium.

The findings from the post-construction FM services annual review show that the strategic FM inputs during pre-construction stage have proved successful in the early stage of concession period. This including efficient use and effective energy management in the built-facilities; better and safer working environment for the hospital staff, patients and visitors; and better integration of clinical and non-clinical activities.

Paper 56, Page: 485-495

Public Private Partnership in U.S. Infrastructure Projects: Port of Miami Tunnel Case Study

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Abstract

Public-Private Partnership (PPP) in construction is becoming more popular in the USA. Highway transportation agencies across the United States are facing a fiscal challenge caused by the growing gap between the costs of providing and preserving the highway infrastructure and available highway program funding. The inability of motor fuel taxes to provide adequate funding has prompted transportation policymakers to consider alternative ways to finance and deliver needed transportation infrastructure. Public-Private Partnerships (PPPs) represent a wide variety of project financing and delivery approaches which offer the potential to expedite project delivery, operations, and maintenance in a more cost-effective manner, enabling transportation agencies to effectively “do more with less.” This paper focuses on the application of public private partnership used in the Port of Miami Tunnel. Also included, are the lessons learned and challenges faced before the start and during the first phase of construction of the project.

2.5 Safety and Quality Management

Paper 57, Page: 496-503

An Empirical Study of Applying ISO 9001 Elements in Large Size Indonesian Contractors

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Abstract

The effective implementation of such an ISO 9001 Quality Management System (QMS) in construction companies requires a proper and full implementation of the system to allow companies to improve the way they operate, by this means increasing profitability and market share, producing innovative and sustainable construction products, or improving employee and customer satisfaction. In light of this, this paper discusses the current status of QMS implementation, particularly related to the twenty elements of ISO 9001 within the grade 7 (G-7) category of Indonesian construction companies. A survey was conducted involving 403 respondents from 77 companies, to solicit an evaluation of the current implementation levels of the ISO 9001 elements. The survey findings indicated that for a large percentage of the sector surveyed they had ‘not so fully implemented’ the elements. Scrutiny of the data had also indicated elements that are ‘minimally implemented’, whilst none of the elements fell in the category of ‘fully implemented’. Based on these findings, it is suggested that the G-7 contractors may need to fully commit to practicing control of customer-supplied product and statistical techniques in order to enhance an effective implementation of ISO 9001 elements for ensuring better quality performance. These two elements are recognized as the least implemented of the quality elements.

Paper 58, Page: 504-512

Developing an Assessment Model for Factors Affecting the Quality in Egyptian Roads Construction

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Abstract

A new assessment model was developed in this work. The developed model introduced a new approach and reference for assessing the factors affecting the quality in Egyptian roads construction

using the fuzzy logic system. Fuzzy logic system was chosen to be used in this research because of its suitability for uncertain or approximate reasoning that involves human intuitive thinking. In addition, it requires a little data to achieve the aim of the proposed model. A field survey was used with construction practitioners in the field of roads projects across Egypt. The proposed model was then evaluated and applied using the data that was collected from the field survey. The results of the study proved that the proposed model can be successfully used in the assessment of factors affecting quality in Egyptian roads construction. The major factors that found to be significantly affecting the quality in construction of these projects were identified according to their importance as; 1) Poor quality of local materials; 2) Defective workmanship; 3) Poor quality, performance control, and supervision and 4) Changes in the materials prices. The proposed model is considered as a general model that can be easily adapted and applied to other types of projects.

Paper 59, Page: 513-522

A Comprehensive Approach towards Managing Quality in the Construction Industry

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Abstract

Heterogeneity is the hallmark of the construction industry. The life cycle of a construction project is fragmented in several distinct phases. The requirements of each phase in terms of human and non-human resources may differ significantly. Quality management systems appropriate for other industrial sectors may not be found appropriate for the construction industry. These factors pose a

difficult challenge to the construction industry to delivering quality in construction projects. However, a systematic and planned approach to quality can possibly meet the customers' needs and aspirations. The present study attempts to identify the quality related issues that need to be addressed by the industry in managing the quality of projects. This research is based on the premise that delivering quality in construction requires dealing with various issues at each phase of the project life cycle. A construction project can be typically split into seven phases viz. project initiation phase, design phase, procurement phase, construction phase, commissioning phase, contractual close-out phase, and the post-occupancy phase. The authors have undertaken the study of thirty four Indian construction organisations to identify the inadequacies in construction organisations in managing and delivering the quality in construction projects. The analyses of responses provide an insight into the existing deficiencies in the quality management approach. The paper deliberates on a comprehensive approach that could guide the industry in effective management of quality.

Paper 60, Page: 523-530

PAF Model for Quality Cost Estimation in Mass-Housing Projects

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Abstract

Cost and quality are considered vital competitive factors for construction firms, and studying their relationship plays an important role in the construction industry. The objective of achieving a good-quality product is not only to meet the customers' requirements, but also to do it with the lowest cost. Therefore, a realistic estimation of CoQ and improvement benefits (which is the trade-off between the level of conformance and non-conformance costs) should be considered a critical quality activity for contractors. This paper studies and estimates quality costs in a mass-housing project in Iran. First, background information is presented on quality costing, and the prevention-appraisal-

failure (PAF) model, which is the most widely used model for determining the quality cost and the optimum level of quality. Second, some previous studies are presented as benchmarks and their assumptions and conditions are discussed. Finally, a mass-housing project in Abeyek, Iran including 288 residential units is considered as a case study and its quality costs are estimated by using the selected benchmarks.

Paper 61, Page: 531-538

Quality Performance Evaluation of Embankment Dam Construction Projects

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Abstract

Quality management is one of the most important areas in project management, especially in the field of infrastructure construction industry. To better manage and control the quality of a construction project, the role of quality evaluation is critical. But it has been always a challenging task due to its complexity and the varying factors during construction phase. Quality evaluation or quantifying the quality performance of heavy construction projects such as embankment dams consists of the following main stages: 1) identifying quality indicators related to different project activities; 2) determining the factors affecting quality performance of indicators; 3) aggregating quality performance of quality indicators to gain the overall quality level of the project. This paper seeks to distinguish these quality indicators and factors, as well as evaluate each indicator. Furthermore, the weight and the relative importance of each indicator and each activity are established by eliciting the views of experts with experience in the field of dam design and construction using conference method. Consequently the overall quality at the project level is calculated by using a defined function which accumulates quality performances at activity levels. The results of this study can be used in quality-based contractor prequalification systems.

Paper 62, Page: 539-546

Exploring Fire Safety Awareness Among the Malaysian Public

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Abstract

As a global issue, fire incidents would cause severe implication(s) to victims. Fire incidents in Malaysia have increased rapidly over the years. Most cases of property loss involved residential buildings causing severe injuries, and in some cases death, to fire incident victims. This scenario is of concern in terms of national development because the prime purpose of owning a house is to provide shelter and security to the residents. In response to growing concerns, surveys were conducted over recent years, as shown in the media, that revealed that the main contribution towards the increase of fire cases in Malaysia is due to a low level of fire safety awareness among the public. Furthermore, there is still a lack of fire safety measures especially in regards to landed residential properties. The installation of smoke detectors and portable fire extinguishers in houses in Australia, the United Kingdom, and New Zealand, in comparison, significantly reduced the fire fatalities and losses. Over recent years, there have been campaigns, seminars and trainings on fire safety conducted by the National Fire and Rescue Department of Malaysia throughout the nation. However, these fire preventive measures failed to increase the level of fire safety awareness among the public. Perhaps we should kept in mind the significant importance of promoting fire safety awareness among the public. Does this responsibility solely rest with regulating authorities or with each individual?

Paper 63, Page: 547-555

Developing and Implementing an Occupational Health and Safety Program in a Construction Company: A Case Study in Pakistan

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Abstract

Occupational Health and Safety (OH&S) has been an intrinsic area of attention in the construction industries of developed economies. Considerable work to improve OH&S performance in construction has been done globally. However, the developing countries like Pakistan have yet to respond to recent technological as well as OH&S improvements. Research carried out in the subject area of OH&S in Pakistani construction industry show that the majority of the contracting firms in Pakistan have yet to establish a safety program. Accidents and fatalities are sadly common due to a lack of awareness amongst the workers and management. Unavailability of a regulatory framework depicts the unsafe performance on construction companies. On some projects owners and consultants do stress implementation of OH&S, but as the work progresses their concerns for deadlines become a priority rather than the OH&S of the contractor company. This research work attempts to foster concepts of OH&S amongst the management and workers in a construction company with the objective of developing and implementing a safety program and identifying areas of improvements. The key findings of the research advocates for an OH&S program to be implemented by companies working

in the construction industry of Pakistan. Insights and discussions are given in this paper.

Paper 64, Page:556-565

Effectiveness of Worker Motivational Techniques on Construction Project Safety, Productivity and Quality Performance

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Abstract

Construction labor can be motivated. This is important because dwindling productivity is a major problem confronting construction today. Productivity has decreased every year for the past decade, in part because of increasing design complexity, more rigorous federal and state regulations, and socio-economic changes affecting the work force. Construction is a relatively hazardous undertaking. If top level management expresses strong concern for project safety, this can be a motivator for workmen. Quality of construction projects, as well as project success, can be regarded as the fulfillment of expectations (i.e. the satisfaction) of the project participants. The client would require the main contractor to only select subcontractors who have demonstrated quality attitude and work performance on previous jobs, and so on. The research undertaken identified several motivational techniques that can be used to improve performance on construction project productivity, safety and quality performance through frequency analysis of the responses obtained. Motivational techniques such as “A letter of praise from a customer shared directly with the employee who delivered the service”, “Provide training to employees. Offer them opportunities to improve

themselves”, “Job Security”, “Provide better job descriptions so that employees will know exactly what is expected of them”, “Having good equipment to work with. Good working conditions” are found to be varyingly effective in improving performance on construction project safety, quality and productivity performance. The study is concluded with the quantification of the effectiveness of each motivational technique through a relative ranking analysis in a consolidated table which proposes techniques, that are firstly majority of times used in the industry in the present scenario and at the same time can be used to achieve improved performance on construction project, safety, and quality in relative order.

Paper 65, Page: 566-573

Investigation of the Multi-level Safety Climate of Working Groups for Perceptual Differences

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Abstract

Construction is among the hazardous industries with poor safety performance. Both safety culture and safety climate shared common grounds such as beliefs, values, attitudes etc about safety. Safety climate termed to be the leading indicator of safety performance which frames the positive safety culture. Organizational structure mainly comprised of working groups (manager, supervisor and workers) exhibit sub-cultures which create barriers to the common safety climate. This papers aims to investigate the multi-level safety climate for *Between Group Differences*. A questionnaire has been developed and is comprised of 40 safety climate statements (using Likert scale), and the survey was done with 21 major companies (contractors) on 36 construction sites. 150 valid responses (83.33%) were received through self interviews and post mail. Collected data was analyzed by SPSS 17.0, to assess multi level safety climates, differences among groups by one way

ANOVA (sig. value < 0.05). The results found that; Front line workers’ suggestions were not considered by Managers, Managers do not involve Front Line workers for development/review of safety procedures/instructions/rules, Front Line workers have opinions that people are just unlucky to suffer an accident, and Managers confirmed that every accident/near miss happened on site is reported but workers revealed that every accident/near miss is not reported. Front line worker’s played major role in pivotal conflicts upon safety climate perceptions in multi-level context. Construction companies can induct above findings to formalize the positive safety climate which helps to enhance safety culture in the right direction.

Paper 66, Page: 574-581

Conceptual Model of Noise Hazard Assessment System for Construction Workers

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Abstract

Noise hazard is one of the main concerns in construction health and safety. Many construction workers operate their activities without hearing protection even though the organization provides the equipment for them. It seems that the supervisors and workers lack an awareness about their health and safety. Currently, noise dosimeters are used for assessing dose of noise in which workers are absorbed during their workday. However, the price of these instruments as shown in year 2010, were expensive. This method may not be the practical solution for reminding workers about their risk. Therefore, current research aims to propose an alternative method for the assessment of noise as a hazard for building construction workers who daily operate around sources of noise. This research paper describes a conceptual model of system development. Under this conceptual model, sound recorders were clipped with those workers in order to record all the sound that occurred during their workdays. Then those sounds were transcribed into sound pressure level by using Matlab computing

languages. Also, gathering data was calculated for identifying the level of noise dose, the Time Weighted Average and the hearing protection. Finally, the calculation results were discussed for assessing noise hazard from workers' activities. The outcome of this research is to provide the concept of developing an economical method that could be a useful alternative for warning workers' about health hazards in the construction industry.

Paper 67, Page: 582-588

Effects of Wind in the Construction Activities at High-rise Buildings

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Abstract

Wind is one of the determinant factors of outdoor human comfort. In this respect, wind negatively affects the productivity of the workers working outdoors. Thus wind conditions can hamper the construction site activities and unless carefully planned for beforehand major delays can be faced. There are various studies made by the researchers regarding the effects of wind on productivity at construction sites. In high-rise construction, especially during the structural works, wind affects several functions on site. In cases of reinforced concrete buildings, these can be named as the workers' productivity, formwork manipulation, crane operations, concreting activities including curing of concrete and workers safety. The objective of this study is to demonstrate analytically the effects of wind on the construction schedules in the reinforced concrete high-rise constructions in Istanbul taking into the probabilistic wind conditions. The study is conducted using the commercial software code ANSYS-FLUENT. The necessary long term meteorological data is obtained from the Turkish State Meteorological Service. Through the study it is intended to form a guideline

for the contractors for selecting the best probable scheduling scheme in high rise construction.

Paper 68, Page: 589-602

Construction Quality Management – Case Study of the Shanghai Pudong International Airport Terminal II Expansion Construction Project

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Abstract

Shanghai Pudong International Airport, which first opened in October 1999, is a major aviation hub in Asia, particularly in the East Asian region, and is the primary international airport serving Shanghai in the People's Republic of China. To cater to the transportation needs of the Beijing 2008 Summer Olympic Games and Shanghai 2010 World Expo, approximately 5 years after it first opened in 1999, the second terminal building started construction. In approximately 36 months, the new terminal building, Terminal II, and ancillary facilities, including new runways and taxiways were completed to a high level of quality and opened in March 2008. This paper presents background information on the project, organizational structures, details of this special project under the influence of the Chinese cultural side and overall government managerial systems; and the quality management techniques used in this mega construction project and the positive consequences. In view of the growing global construction and construction management projects worldwide, the practices in this infrastructure in Pudong Airport provide insights for international companies and construction managers pursuing projects in China.

Paper 69, Page: 603-610

Safe Design Best Practices: A Summary of Singapore's Rooftop Greenery Guidelines

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Abstract

As research and practice within the built environment advances, safe design is being recognized as a best practice within a holistic approach to facilitating and influencing site safety. Isolating building elements to target site safety risk within the built environment and tracing them back to design decisions has been effectively utilized as a means to identify safe design suggestions that can then be implemented in future designs. As urban greenery increases globally, standards must be effectively developed to ensure the efficacy of the industry, and safety is no exception. Singapore's Guidelines on Design for Safety on Rooftop Greenery provides the only recommended guidelines specific to green roof safety with a focus on safe design of the built environment. This proceeding paper reports on 1) the background of green roof safety with a focus on the design of the built environment, 2) details of the aforementioned Singapore guidelines, and 3) the research design and potential outcomes of an upcoming fellowship by the first author to study the implementation of Singapore's safe design guidelines for rooftop greenery.

Paper 70, Page: 611-622

Use of Human Factor Analysis and Classification System (HFACS) Framework for Assessing Tower Crane Safety in Construction Sites

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Abstract

Crane related accidents in construction have been consistently high and have been a major cause of concern to the regulating agencies. High profile crane fatalities during the recent years have led Occupational Safety and Health Administration (OSHA) to promulgate stricter regulations regarding various aspects of crane safety, including crane operators' and other personnel's certification, and manufacturing of cranes. Although this promulgation may have addressed some of the safety issues directly related to tangible causal factors of crane accidents, very little has been done to understand the underlying causal factors contributing to trigger an accident. Behind the obvious cause of an accident event lie a multitude of latent causes whose culmination leads to accidents. Accidents invariably happen when these latent causes are overlooked, or their combined effects contributing to accidents are not well understood. There are no such frameworks present that analyze the sources of accident factors to their root and underlying causes. Human Factor Analysis and Classification System (HFACS) is a highly effective tool that has been successfully used in the aviation sector to identify the latent and contributory factors that lead to an aircraft accident. In this research study, an attempt has been made to apply this framework in the construction industry using a case of a crane accident in a construction site. It is found that the framework is applicable in analyzing construction accidents, and the contributory factors leading to the crane accident discussed in the paper can be traced back to the roots originating in the organization and the supervisory level.

Paper 71, Page: 623-630

Comparative Analysis of Construction Safety in Asian Developing Countries

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Abstract

There is no doubt about the fact that there is a huge performance gap in terms of construction safety management practices between developed and developing nations but this is also true that this situation persists even within the developing nations. It has been acknowledged that there are many socio-economic and political reasons behind this poor construction safety performance that need to be addressed with a proactive approach. Despite of the fact that construction safety has a vital role for the progress of construction Industry and for the nation's economy as well, currently a really weak framework of policies has been instituted for safety implementation in Asian developing countries. The aim of this paper is to conduct a comparative analysis of safety regulations, technology, training and techniques adopted in different Asian developing countries such as Pakistan, India, China, Bhutan, Malaysia, South Korea and Taiwan. This analysis had provided a more clear understanding related to the current issues that are hindering the proper implementation of safety techniques in developing countries. This analysis can be really helpful to develop a common regulatory framework for implementation of construction safety within the Asian developing countries that meets their needs in accordance with their developing economies.

Paper 72, Page: 631-638

Impact Significance of Construction Clients' Culture on Contractors' Health and Safety (H&S) Culture- An Exploratory Delphi Study

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Abstract

Contractors' top management has been identified in many studies to be of great importance to H&S performance and continual improvement. Therefore developing strategies that support and motivate contractor top management, implement H&S elements would ensure a gradual and sustained improvement of H&S in the construction industry. This way construction workers' H&S can be assured and in so doing achieve sustainability in the industry through skills preservation.

The paper reports on an analysis of impact significance of clients on contractors. It will underscore the point that has been made before using different methodologies that client H&S culture is critical to contractors' H&S culture because it is crucial to H&S performance

Paper 73, Page: 639-647

Indicators for Measuring Health and Safety Performance Improvement of Small and Medium Construction Enterprises in South Africa

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Abstract

This study identified and validated leading indicators for health and safety (H&S) performance improvement measurement in the construction industry in South Africa. The requirements of the study were that the process used to identify the

elements and indicators should be comprehensive, be reproducible, and reflect the perspective of stakeholders. A three round of consensus-building process i.e. Delphi technique was used to validate the indicators. The experts rated the indicators on a 10 point Likert scale of importance and impact, the importance scale 1=unimportant and 10=very important, and impact scale 1=no impact and 10= major impact. The data was analyzed to determine the importance and the impact of the indicators in improving H&S performance at project level of SMEs. The experts reached consensus on 62 indicators based on the median, mean and inter-quartile range for each indicator. The indicators were categorised into ten core elements which were identified from literature review. This approach proved to be feasible and cost effective. Despite the diversity in the background of the experts, the Delphi technique was effective in achieving consensus through successive rounds of participation. The resulting indicators reflected the views of all the experts.

2.6 Legal and Contractual Issues

Paper 74, Page: 648-655

Construction Claim Factors in the Nigerian Built Environment

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Abstract

Claims are contentious issues and any of the parties in the contract can file claim against another. However, claims are not bad *per se*, as it purportedly meant to address contentious among the parties to the contract. This paper aims to identify claim factors in the Nigerian built environment. To achieve this aim, this paper combined literature reviews and survey questionnaire. 58 claim factors were identified and addressed to professionals in the Nigerian built environment in order to indicate the extent at which each of the factors contribute to a claim. About 70% of the respondents agreed that the factors could lead to a claim. The results also found

that 37 of the factors are very critical to claim issues in Nigeria. Late payment, delayed approvals of schedule and change order and delay costs were the factors respondents ranked extremely influential while the least were offsite and onsite storage charges, loss of productivity and claim preparation costs. The major conclusion drawn from the survey was that; although there are many different variables that causes claim, they can be categorized. It is recommended that clients need to reduce the issuance of change order and to reduce their unnecessary interference at the construction phase.

Paper 75, Page: 656-668

Challenges to the Arbitration Award: Legal Perspectives from the UK Construction Dispute Cases

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Abstract

The Arbitration has always been the favourite choice for dissenting parties to resolve their conflicts in construction disputations. Policies legislated under the Arbitration Act 1996 often emphasised the concept of fair resolution to ensure that the arbitrator's award, which is a binding decision after the arbitration, would achieve the proper and fair settlement for the parties in dispute. Nevertheless, there are still many persisting cases reported to the courts that disagreeing parties have to challenge the arbitrator's award due to the inherent controversies arising from the arbitration proceedings. In this paper, it was discovered that the disputed cases can only be brought to the courts through three main provisions under the Arbitration Act 1996, the first provision is on the ground to challenge the arbitrator's jurisdiction (section 67 of the 1996 Act), the second is for challenges on the serious irregularities (section 68 of the 1996 Act) and the third provision allows appeal against the questions of law (section 69 of the 1996 Act). Based on the above findings it was decided to conduct a further analysis. A thorough research and compilation of relevant cases was carried out which identified 29 court cases specifically referring only to the UK construction disputations. The lengthy analyses on

these court cases, disclosed the legal principles applied by the courts to dispense the appropriate settlements. Further studies indicated that about 58 percents of the various categories of challenging the awards were rejected by the courts. The courts are greatly impacted by the strict rules regulating the 1996 Act, which require them accept challenges only under extreme circumstances. Perhaps unfortunately, such restrictions, have in a way, constrained the discretionary power of the courts to intervene in the arbitration awards.

Paper 76, Page: 669-676

Multi-Tier Dispute Resolution in International Construction Contracts: Conflict Escalation or Resolution?

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Abstract

This last decade has witnessed the proliferation of multi-tier dispute resolution clauses in construction contracts. Multi-tier dispute resolution clauses are now found or entrenched in many international construction contracts, including standard form construction contracts, notably the Fédération Internationale des Ingénieurs-Conseils (FIDIC) suite of contracts. This paper highlights the legal issues and practical problems that arise from multi-tier dispute resolution. The legal issues and practical problems are related to the enforceability of the early tier dispute resolution processes (including negotiation and mediation) and the enforceability of the results of dispute resolution processes. The paper further identifies the main reason for the issues and problems. The paper concludes by answering the question whether the issues and problems that arise from multi-tier dispute resolution outweigh its benefits? This paper is based on a theoretical research approach.

Paper 77, Page: 677-684

The Adequacy of Malaysian Security of Payment Legislation for Sub-contractors in Construction Industry

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Abstract

In Malaysia, the particularly small sized subcontractors are definitely benefited from payment provisions in the proposed *Construction Industry Payment and Adjudication Act* (CIPA Act). However, they need to enhance their knowledge of the so-called the 'Security of Payment' Regime to benefits from the Act. Due to this, this on-going research attempts to introduce payment framework to the sub-contractors, in giving the knowledge, to claim for payment. This paper, though, is to disclose the finding of the level of knowledge that the sub-contractors have to the proposed Act, by preliminary analyzing the quantitative questionnaire survey. It was found that the adequacy of security of payment framework to the particularly small sized sub-contractors needs to be produced, and the analysis on effectiveness of the various avenues incorporated in the construction contract or statutes in the other developed countries as well as the proposed Act needs to be done. However, as long as the regime remains in proposal, the sub-contractors have to bear with the current structure of payment mechanisms in the standard forms of contract, which are payment upon certification, direct payment from the employer, and contingent or conditional payment.

Paper 78, Page: 685-692

Malaysian Legal Framework and Risk Management: Design Professionals

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Abstract

Construction projects are associated with various aspect of risks, be it risks associated with the feasibility stage, design stage, construction stage and post construction stage. This paper is meant to illustrate the criticality of designer's understanding of risks and the law relevant in managing such risks, from the viewpoint of experts in construction and law. The expert evaluation of issue related to professional designers perception over design related risk and the law is a second stage to earlier

data collection process, namely in the form of questionnaire survey and in-depth interview. The expert evaluation is gathered from expert interview session, which completed the triangulation approach. Questionnaire survey was deployed to generate general perceptions of professional designer on the issue in question. The general perception of the respondent gathered from the questionnaire acted as a basis for further in-depth data collection. In-depth data collection involving experienced architects and engineers was conducted, in form of in-depth interview. This method will give clearer picture on the state of professional understanding of design risks and the relevant provisions of law corresponding to the management of such risks. Finally, the findings of the critical issue gathered from the questionnaire survey and in-depth interview were evaluated by experts in both fields, namely construction and law.

Paper 79, Page: 693-700

Use of Incentive Contracts in Turkish Construction Sector

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Abstract

Incentive contracts are widely used in the construction sector of the developed countries in an effort to decrease the costs or the project duration or to increase the quality and the performance of the final built facility. The ultimate aim is no doubt being a win – win result. This contract type is even widely used by the public sector in these countries. However, on the other hand this contract type is much less preferred in especially by the public authorities in the underdeveloped or developing countries. There are indeed numerous reasons about this fact. The objective of this study is to determine these reasons of non-preference through a survey conducted in Turkey. The findings of the study indicate that the public sector is somewhat conservative in using this type of contract while both the contracting and the consulting sector respondents believe that the use this type of contract will improve the business environment by reducing corruption and misconduct.

Paper 80, Page: 701-708

Work Zone User Costs and Incentive Values of Highway Construction Projects

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Abstract

During highway repair or rehabilitation period, highway work zones cause additional highway user costs and affect highway safety and environment. In order to minimize the negative effects of construction projects, the state highway agencies have been using incentive/disincentive clauses in contracts to encourage early completion of highway projects. Incentive clauses are used to reward the contractors for early completion of projects. On the other hand, disincentive clauses are used to recover the engineering and administrative costs incurred when contractors fail to complete highway projects on time. The excess user costs of traffic delays caused by the presence of work zones are essential for assessment of the impact of the work zones on public. User costs at highway work zones are increasingly used by highway agencies in determining the contract times of highway construction projects. This paper analyzes the user costs at freeway work zones based on traffic data recorded by weigh-in-motion devices in Indiana. With a high traffic volume, user costs caused by a work zone can be significant; it is therefore desirable to minimize the user costs by expediting construction process. User costs at work zones are often used as the basis of determination of the monetary values for incentive or disincentive clauses in highway contracts for early or late completions of highway construction projects.

Paper 81, Page: 709-721

Seventeen Years of Learning in the Upgrading of Informal Settlements in South Africa

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Abstract

Purpose: The aim of this paper is to give an insight into lessons learnt in the upgrading and eradication of informal settlements in South Africa. The paper looks into the experiences gained to date on the upgrading of informal settlements. The paper will investigate the challenges that have been encountered upgrading to informal settlements. The paper will further evaluate the reasons why the problem of informal settlement still persist in South Africa despite the numbers of housing delivered to date. The research was conducted with reference to existing theoretical literature, and published and unpublished South African research. The study is mainly a literature survey/review and looks at challenges that have been overcome to bring about the success made to date, thus achieving the goals and objectives of a city without slum. The paper ties up the identified gap with solutions to the problems to enhance the reality of having a city without slum in 2014.

Findings/Implications: One of the primary findings that emanated from the study revealed that all development where people have to be displaced or inconvenienced has all come with problems. Other findings attribute the success so far to a well-structured housing system. Though policy made is not well implemented for the betterment of all, progress has been made nonetheless. Also, it was discovered that since 2004 to date, the progress made is not laudable because in most cases rights to housing have been violated, but strengths needs to be drawn from the success to achieve the ultimate goal of a society without slum.

Originality/Value: The upgrading and eradication of informal settlements has long been a subject of global discussion and have taken a firmer root since

it was declared as one of the millennium development goals agenda. The paper will explore and reveal the progress made so far with the lesson learnt to date in informal settlement upgrading and eradication.

2.7 International Issues

Paper 82, Page: 722-729

Market Positions of Four Major International Construction Sectors

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Abstract

The market volume of international construction has grown every year and along with it, its importance is being emphasized more than ever. This trend has induced many studies to investigate the characteristics of international construction industry and these studies have contributed in understanding the nature of international construction industry. However, despite the fact that each project type has its own characteristics, many studies have broadly considered the international construction as a single industry unit. This study distinguishes international construction industry into four major sectors, i.e. general building, power plant, industrial process/petroleum plant, and transportation facility. The study analyzes market growth, market entry barrier, and profitability of each industry sector using ENR Top 225 International Contractors and International Contractors Association of Korea (ICAK) databases. Analysis results led to the following findings: 1) a trade-off relationship between market growth and profitability; 2) a positive correlation between entry barrier level and profitability; 3) a negative correlation between entry barrier level and market growth; and 4) different positions and trends of each sector in relation to the

three market attributes. Theories from economic and management science were reviewed to provide enhanced knowledge toward supporting these notions. The results of this study can serve as a starting step for seeking attractive markets. It can benefit the international contractors by assisting their decision making process for selecting promising construction sector.

Paper 83, Page: 730-737

Analyzing the Performance of International Contractors According to the Organizational Capability

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Abstract

Every international construction project is exposed to various uncertainties, but the actual effect of these exogenous risks differs considerably according to not only the severity of the risks but also the organizational capability of contractor. This study begins by investigating the performance of more than 820 international projects performed by Korean contractors during the last decade. Each project is partitioned into corresponding political, economic, sociological and resource risks. The relevant data were comprehensively compiled by the use of secondary data from the various authorized institutions. This study then estimates the organizational capability of each contractor based on the experience within a given host country, the experience of the corresponding project type, accrued experience of whole international projects, total revenue, total number of employees, and growth rate of revenue. Based on these capability backgrounds, each contractor was classified into four groups. A two-step cluster analysis was

performed to classify the international contractors according to the quality of organizational capability and the level of risks during the same period of data analysis. This study also investigates the relations between performance level and organizational capability of each group. The results showed that the highly internationalized and large contractor group is likely to enter the high risk market to gain more sound profitability, whereas the lowly internationalized and small contractor group has a tendency to enter low risk market to yield instead unstable profitability. This study is expected to aid international contractors in designing internationalization strategies by revealing the strategic preference of firms in association with the level of risk and degree of organizational capability.

Paper 84, Page: 738-746

Assessment of Malaysian Construction Companies' Capabilities to Venture into International Market Using SWOT Analysis

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Abstract

A tremendous demand of development worldwide has gained interest of Malaysian construction firms to venture into the international construction domain. Identifying and analyzing major determinants of both internal and external factors are crucial in order to ease the complexity of entering in global construction business. The main objective of this paper is to evaluate the relative importance in

identifying the strengths, weaknesses, opportunities and threats (SWOT's) related to the international construction market. Responses were received from thirty one (31) Class A and Grade 7 construction firms to establish the SWOT's framework that includes the elements influencing internationalization. The results indicate that specialist expertise, technology capability and good track record are the most influential strength factor for a company to effectively compete in a global market. However, shortage of financial, material and labor resources contributed into weaknesses in exploring international market. The findings also indicate that technological innovation and beneficiary international agreements provide huge opportunities in overseas market. Whilst, corruption is a threat due to unfamiliar and difficulty in dealing with the moral problem and environment within the host country. Overall, this study offers a valuable reference of practices that interested Malaysian construction companies can make use of this finding as strategies and preparation before moving internationally.

Paper 85, Page: 747-752

Effectiveness of IBS in Reducing Foreign Workers in the Malaysian Construction Workforce: A Review

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Abstract

Nowadays, our country have totally depends on foreign workers in construction development especially in site activities. In June 2007, there are 69% (552,000) out of total 800,000 of registered workers is foreign workers according to Construction Industry Development Board (CIDB) Malaysia (CIDB, 2008). Large scale dependency on foreign worker in construction industry was producing a leak in the economy due to the

repatriation of the large amount of funds outside Malaysia (CIDB, 2006). These foreign workers are from Indonesia and the Association of Southeast Asian Nations (ASEAN) is unskilled which impact on the productivity and the quality of the construction industry. Today, Industrialized Building System (IBS) is most preferred construction method which replaces the labor-intensive conventional methods. Syarul and Nor (2003) indicate that IBS promotes labor reduction, cleaner and neater sites, easy installation, fast completion, enhancement of quality finished products and flexibility. Although, the use of system formwork has very limited impact on the foreign workers reduction and not to replaced wet trades at site (IBS Survey, 2010). Therefore, foreign workers intensity problem still have to be solved. This paper is intended to review the effectiveness of IBS method on the foreign workers intensity in current Malaysian construction industry. The findings hopefully will give more clearly evidences that relates to the IBS effectiveness in reducing the dependency on foreign workers in construction industry. Therefore, this will help to provide directions in producing the effective measures that will ensure labor reduction and increase local involvement in IBS construction projects.

Paper 86, Page: 753-759

International Projects Management, Framework for Controlling Conflict and Cultural Diversity in Developing Countries

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Abstract

In today's globalized environment, international construction project management is an important trend. During recent years a lot of construction companies in developing countries have been faced

with project management challenges. The conflicts and issues concerning cultural differences and diversity of the workforce have been increasing in multinational projects. Hence, the project managers have to be aware about the culture (s) of any country that they are operating in, for the planning and projects progress. In addition, research findings around international project management show cultural awareness is very important before starting any international project. The key cultural factors that influence international project management may be summarized to include organization level differences such as owners, consultants, contractors, subcontractors and government agencies, and workforce level diversity and organizational differentiation. This paper concentrates on the cultural diversity impact on international project management in developing countries. It considers some effective cultural features such as religion, composition and power of the workforce. In the twenty first century, the big challenge in developing countries construction projects management is to acknowledge and understand the differences amongst the workforces, customers and also competitors. To achieve benefits in international projects, it requires reducing negative cultural impressions. International project managers have to manage and support multiplicity initiatives towards successful project implementation which includes management commitment, in order to create a more flexible working environment and to ensure effective communication between the project management team and workforce, and other important stakeholders, by eliminating conflicts, possibly caused by a lack of appreciation and understanding of cultural diversity.

2.7 Education and Training

Paper 87, Page: 760-767

Successful Construction Project Manager: Different Perceptions from Different Stakeholders

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Abstract

The construction industry requires well trained managers and that explains the demand for appropriate educational programmes. However, it is questionable, whether the educational programmes

offered are actually effective and respond to the industry's requirements. This paper investigates the perception of three different stakeholders in the education – industry system, namely the employers, the employees and the educators. Through a questionnaire survey prepared and conducted for this research, several interesting findings are inferred with the following being the most critical: a) industry's requirements for construction projects managers are hardly met, because of insufficient educational programmes, b) educators and professionals have a different evaluation of the required skills and competencies for qualified construction project managers, and c) soft skills are proven to be more critical than hard skills, which directly implies the need to develop behavioral and personality-based competencies compared to the strong technical and business training background. These findings are critical, because they contribute to the development of the philosophy and content for construction projects management educational programmes that can ensure a platform of knowledge to respond to a wide spectrum of required skills and competencies for construction projects managers

Paper 88, Page: 768-776

Gender Development of Women Construction Entrepreneurs: The Role of Family as an Agent of Socially Construct

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Abstract

Construction industry traditionally is a male dominated activity. As we move into the twenty-first century, women involvement in construction industry increased from time to time. Starting business in a male dominated industry is a very challenging task for women entrepreneurs. The subject of this study is focusing on the application of the perspectives of third group of Feminist Theory (FT) on women entrepreneur in construction industry. This study will highlight family as an agent of gender socially construct. The research framework is proposed to explore i) how family construct gender of women construction

entrepreneurs, and ii) what is the gender of women construction entrepreneurs.

Paper 89, Page: 777-784

The Conception of Balanced Scorecard Method in Measuring the Corporate Real Estate (CRE) Performance for Malaysian Universities

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Abstract

This paper aims to study the implementation of Corporate Real Estate (CRE) in universities to develop the Balanced Scorecard (BSC) dimension as a performance measurement of CRE practice for the universities in Malaysia. Using six universities as samples, the score rate for each university has been established and analyzed. The findings reveal that even property management practice in Malaysian universities at the moment is not in accordance with CRE practice, but the score shows a range between moderate to good real estate management practice implementation. This situation is expected to further improve if the universities are able to bring in CRE practice and follow the principles in it. The rationale of this paper is to promote the application of CRE into the management of the universities as part of their strategic plan.

Paper 90, Page: 785-789

Importance and Benefits of Engineering Economy in Construction Management Curriculum

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Abstract

Construction in the 21st century is characterized by a

new set of challenges, options, and expectations from owners and clients. As we move into a new era of globalization, awareness about sustainability and scarcity of resources has been instrumental in devising and experimenting with newer models of project delivery. Concepts such as Public-Private-Partnerships (PPP) and Build-Operate-Transfer (BOT) are being entertained at different levels and seem to gain popularity in certain parts of the world. Since construction projects are always capital intensive and take significant time from inception to delivery, project delays are a common cause of concern. This paper addresses the importance of emphasizing teaching engineering economy in the Construction Management (CM) curriculum and takes a position that the future CM professionals should have the exposure to sound economic principles and concepts. In addition, they must possess the ability to apply those concepts in the project planning and execution phase to minimize the delay and maximize the return on investments. The CM curriculum of various ASC member schools has been analyzed and discussed in the context of ACCE accreditation requirements. It is anticipated that a firm grounding in time-value of money and engineering economy would act as a critical competency in exercising control towards project delays.

Paper 91, Page: 790-795

State of the Art Integration of CII Research Products within Higher Education Curricula: A Case Study

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Abstract

The Construction Industry Institute (CII) has a long line of research products that have been successfully implemented by industry organizations. When properly implemented, such products have been found to lead to enhanced project delivery processes. However, there is a perception that colleges and universities have been rather slow in the utilization of those products for teaching purposes, but no data on the topic has yet been published. Thus, this study unveiled the state of the art integration of CII products within the higher education curricula of construction-related courses in North American colleges and universities. To this end, an interactive survey tool was distributed to the academic members that actively teach construction-related courses. Based on the survey responses, the integration of CII products into higher education curricula is detailed in this manuscript.

of structured questionnaire in an in-depth exploration of the constructs underlying the subject matter of the research. Purposive sampling was used where the researcher selected a sample in this case building students pursuing quantity surveying at a Comprehensive University. The sample consisted of 30, fourth year students undertaking Baccalaureus Technologiae Quantity Surveying and 61, third year National Diploma Building students. The results indicate the most important competencies required are; costing and estimating, knowledge and practice of construction contracts, leadership and management, and financial management as they had a mean score of between 4.20 and 5.00.

Paper 92, Page: 796-803

Evaluating the Required Quantity Surveying Competencies: A Perception of University of Johannesburg Quantity Surveying Students

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Abstract

The South African quantity surveying profession is faced with new challenges that the 21st century has brought along. Aspects such as technology, social development, merging of tertiary institutions have brought forward new aspects in qualification. New competencies are required as the industry is evolving with time. The curriculum, which has been in place and used for years by the former Technikons', which are now University of Technology or Comprehensive University suggest a review. This research survey focused on the students' perspective as major role players in the construction industry on the current quantity surveying competencies required. A descriptive survey method was adopted, which involved the use

3. Information Technology and Information Systems in Construction

3.1 Information Technology

Paper 93, Page: 804-811

Automated Risk Assessment in Construction: Combining Novel Concepts with Cutting Edge Technologies

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Abstract

Although, an issue that applies to all aspects of a construction project, risk has always been primarily related to workers safety. The risk of accidents requires appropriate identification, assessment and response in all phases of a construction project's life cycle. This, in turn, is achievable by applying a systematic approach that can effectively measure the right indicators of an emerging risk. In this paper, the novel concept of "risk component" is defined and shortly described through different examples that correspond to different risks. From another starting point Automated Data Collection (ADC) technologies are briefly reviewed, in order to investigate their appropriateness for measuring risks components. A comparative presentation of the main ADC technologies highlights their advantages and disadvantages and indicates the most effective among them in assessing risk through risks components measurements. Through this presentation, it is concluded that vision-based tracking methods are the most effective in quantifying risk components. This result is validated with a case study that simulates the operation of a proposed simple system for construction site monitoring by the use of vision-based tracking methods. The application example clearly demonstrates the effective combination of theoretical and technology innovation in construction risk assessment.

Paper 94, Page: 812-818

Applications of PRC (PDA, RFID, Camera) in Construction Monitoring

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Abstract

Currently, the prevalent data collection method in most construction firms focuses on document based approach which leads to excessive cost, time and manpower of projects. Activities such as Information sharing, production tracking, progress measurement, resource management and safety control can be performed more efficiently by using an automated data-based management system. This paper focuses on developing a method for data collection, called PRC in which a trilateral interaction among widespread technologies(PDA, RFID and camera), is used to obtain data from the job site and transfer it to a web based system where all the parties involved can access to this information subsequently. This system provides daily data, procurement data and visual data through the use of PDA, RFID and Camera installed on site, (PRC Data Collection System), which assists the project management team to fulfill their objectives, monitor and control the project more precisely and effectively.

Paper 95, Page: 819-833

The Need For IT Alignment Studies in Construction Companies in Malaysia : A Theoretical Framework

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Abstract

Researchers in the past have found that information technology has contributed to many organizations worldwide. However, organizational issues still inhibit the implementation and strategic use of information technologies in the construction industry. Construction companies are still slow in adapting to ever changing trends in IT applications. One significant problem is a lack of understanding on how to actually implement IT in construction companies so that the benefits of IT can be realized at a strategic level. The importance of implementing a formal and well documented IT Strategy has been realized in many organizations in other industries. However, the existence of an IT strategy in construction companies is still in question. A good IT strategy should be comprehensive, aligned with company business strategy, and forward looking. This paper tries to highlight the importance of IT alignment study in construction companies in Malaysia. It attempts to understand the concept of IT Strategy, Business Strategy and IT Alignment within the context of the construction industry environment focusing on construction companies. It also tries to identify the existing methods of alignment studies through various studies that can be applied to construction companies in Malaysia.

Paper 96, Page: 834-842

Critical Path Method (CPM) Software in Malaysian Construction

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Abstract

Critical Path Method (CPM) is a well known scheduling method and it is currently a necessary tool in middle and big construction projects in Malaysia. This study investigates the utilization of CPM software among Malaysian contractors and its relations toward their perception of project performance. 110 questionnaires were distributed among contractors as participants of Construction

Industry Development Board (CIDB) training programs within two weeks of time frame and the data analyzed. The result shows that Malaysian contractors have yet to fully adopt the CPM software in their work. Most of them (49.1%) use the CPM software for planning, scheduling and monitoring activities but they still did not highly use the software for their project. However, 77.3% of the contractors' perceived that the use of CPM software helps to increase their projects' performance.

Paper 97, Page: 843-852

Mobile Application Information Requirement in Construction Industry

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Abstract

The construction industry is information intensive. Although the amount of information has increased over the past years, the number of advanced information technology applications used to collect, access, and use this information has not grown accordingly. For instance, current commercial information technology applications are very specific and lack simplicity and functionality. This paper describes the information requirements of an on-site mobile application that can be used to improve information management in construction projects. To achieve the research objective, the information required to properly design the mobile application was collected by distributing an online questionnaire among construction professionals. It was found that Design Intent and Clarification, Daily Report, and Report Quality Control (QC) /Quality Assurance (QA) Problems required

information from perspective of the consultants. Similarly, contractors need Schedule Updates, Reporting Violations, and Report QC/QA Problems. The results of this study can be used to develop a mobile application that can be used in medium- and large-size construction projects where the management of on-site information has a significant influence on achieving project objectives.

Paper 98, Page: 853-863

Survey of Information Technology Utilization in the Construction Industry in Malaysia

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Abstract

This paper presents the findings of conducting a modified version of the IT barometer survey in the construction industry in Malaysia. The study collects data from 68 firms. The majority of the respondent firms are G3 record 39.70%. However, more than 75% of the respondent firms are in the private sector. Seventy-three percent of the participating firms are involved in construction engineering work with experience years ranging between 5 years and 20 years. The study shows the reasonably IT confidence firms (40 - 75% of applications computerized), there was > 80% use of general and technical software, this finding can be correlated with intention to use IT and services. This paper has concluded that the firms are using IT reasonably and the internet usage is one of the primary factors affecting the use of IT in the construction industry in Malaysia. Besides, that understands the level of leading importance of construction and practice to current movement for future directions, and conduct international comparisons.

Paper 99, Page: 864-871

Readiness of a Developing Nation in Implementing Automation and Robotics Technologies in Construction: A Case Study of Malaysia

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Abstract

The government's vision for Malaysia to be a developed nation by 2020 has pushed forward the use of innovative technologies in most sectors and industries, including the construction industry. Through the Economic Transformation Programme (ETP), major projects launched, such as the proposed high-capacity rail transit network, is expected to provide a great catalyst for the market and the economy. These projects may become the platform for increasing the use of automation and highly enhanced plants and machineries in the construction industry, thus bringing the use of innovative technologies to the fore. Innovations in most countries are mostly driven by the need to find revolutionary solutions to problems, such as a shortage of skilled labour, decreasing quality of product and processes, inferior working conditions, declining productivity and increasing costs of labour and materials. Automation and robotics technologies encompass a wide range of innovative technologies using technologically advanced machineries to improve the speed and efficiency of a given process. In construction it may apply to the prefabrication of materials off-site and assembly of components on-site using dedicated machines, or even the automated production of drawings or schedules using software during the design and planning stage. This paper discusses the readiness of a developing country in embracing innovative technologies such as construction automation and robotics, with specific reference to the Malaysian construction industry.

Paper 100, Page: 872-876

RFID for Concrete Maturity: Impact of RFID Frequency

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Abstract

The concrete maturity method, which uses the temperature of concrete, has been utilized to determine the strength development of cast-in-concrete. However, monitoring the concrete temperature using thermocouples brought up a wiring issue, which is not advisable in an equipment and human intensive area like a construction site. One of the ways to get around this wiring issue is to use Radio Frequency Identification (RFID) technology, which is capable of transmitting information wirelessly. Previous research implemented using ultra high frequency RFID tags integrated with a thermocouple found that water could be the impediment for transmitting the temperature data over the RFID signal from within concrete during early stages of curing. Would the frequency of RFID tags then have anything to do with the readability of RFID tags embedded in fresh concrete? This paper presents our experiment with low frequency, high frequency, and ultra high frequency RFID tags to figure out any difference between radio frequencies in terms of transmitting information. The test showed that the readability of the RFID signals was affected by the radio frequency. The paper also presents how the test was implemented and some lessons learned.

3.2 Information Systems

Paper 101, Page: 877-884

Electronic documentation management in construction projects – A qualitative study

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Abstract

Information and communication technology (ICT) has opened new avenues for businesses to communicate and exchange documents with advantages such as faster communication and reduced costs compared to traditional communication methods, not to mention the environmental benefits associated with paperless offices. Organizations within the construction industry have recently been integrating electronic documentation management (EDM) systems into construction projects, in an effort to increase efficiency. Semi-structured interviews were undertaken with industry practitioners in South Australia to understand the current practice of EDM systems and their perceptions of the benefits of adopting EDM systems in construction projects. The results showed that there has been a rapid transition from hard copy format design and documentation to electronic formats with the advancement of information and communication technologies. The adoption of EDM systems is perceived to correlate with the improved efficiency of communication within the project team and in turn better project outcomes. Implications are discussed.

Paper 102, Page: 885-892

Content and Applications of Artificial Intelligence for Cost Management in Civil Engineering Projects

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Abstract

During the last few decades many developments in computer science, software programming and application production have been adopted by various engineering disciplines. These developments are mostly focusing on Artificial Intelligence Techniques. Therefore, a number of definitions are presented, which focus on the concept of Artificial Intelligence from different viewpoints. This paper reviews existing applications of Artificial Intelligence (A.I.) that facilitate cost management in civil engineering projects. An analysis of the Artificial Intelligence in its specific partial branches is presented. These branches or approaches contributed to the creation of a significant group of models that concern analysis, interpretation and prediction of various parameters. A list of selected, up to date models is provided, that concern cost management for civil engineering projects. The models are analyzed according to the activity, field of operation, input and output data and the methods and techniques they implement. It becomes clear that Artificial Intelligence will be the future essential tool for every engineer and it will lead to significant improvements in the construction sector.

Paper 103, Page: 893-900

E-Readiness in IBS Components Management for Construction Projects

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Abstract

Construction materials usually constitute a major portion of the total cost in a building construction project, which makes the control of this resource important. Despite the potential benefit of Information and Communication Technology (ICT), convincing construction organisations to embrace its use and implementation has proved a difficult task. This paper aims to present a review of the existing literature on e-readiness (ICT uptake) in Industrialised Building System (IBS) components management in construction projects. Consequently,

the analysis is conducted by reviewing and then justifying the findings from the literature. Previous research found that ICT has brought about a competitive advantage to the IBS construction industry from the global perspective. However, the e-readiness in Malaysia is rather low. Thus, there is a great opportunity for the future development of more effective frameworks to encourage e-readiness in the IBS construction field.

Paper 104, Page: 901-908

Conceptual Framework for the Development of a Web-Based System for Managing Suppliers' Performance

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Abstract

In the construction industry, a project is very often procured by the client through appointing consultants to prepare the design and then subsequently awarding the contract to a contractor through tender to deliver the project based on the design. Collectively, therefore, the contractors, consultants, subcontractors and material suppliers can all be rightly regarded as "suppliers" as they all are engaged for supplying their skills and knowledge (i.e. service) or materials to their client. Review of existing literatures shows that most of the research are mainly focused on capturing the information on suppliers' performance to facilitate better supplier selection process. However, there is no evidence that mechanisms are available to feedback to the suppliers their performance as recorded in the system to allow them to clarify and to improve themselves. This paper presents the findings from

existing literature on the current practice on the supplier selection and proposes a framework comprising a Web-based system to address the aforementioned shortcomings. It also forms part of an ongoing research that aims to develop a more rounded Web-based supplier's performance management system which facilitates the leveraging of suppliers' knowledge for the benefit of the ongoing projects.

Paper 105, Page: 909-916

Implementation of Bridge Management Systems in State Highway Departments in the United States of America

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Abstract

The National Bridge Inventory of the United States includes a 25% of deficient bridges, either structurally deficient or functionally obsolete. Deficient bridges require major maintenance, repair, or replacement (MR&R) activities to satisfy the safety and serviceability requirements. The MR&R activities require a total budget of 15 billion USD, while the available funds by the Federal Highway Administration does not exceed 2 billion USD per year. Due to the budget deficit, bridge management systems (BMSs) are required to select the most cost-effective maintenance strategies.

This paper presents the use of bridge management systems, mainly Pontis, in the United States in different state departments of transportation (DOTs). Technical features of BMSs are reviewed, as well as user comments on the effectiveness of BMSs in daily applications. The results of this study show that major features of BMSs are not used in several DOTs. Hence, partial advantages are only exploited.

Paper 106, Page: 917-926

Internet-Based ICT usage in Construction Project Management: A Global Appraisal

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Abstract

The use of Internet as a means of communication can help information transfer occur faster and more effectively. The technology can enable new opportunities for development of shared and distributed information systems crossing organizational boundaries and providing a unique opportunity for effective teamwork and workflow automation. Despite its enormous potentials the use of Internet-based ICT tools in the construction industry is still low.

This paper aims to present the global perspective on the use of Internet-Based ICT in construction project management. Focus is laid on the web-based project management system (WPMS) in construction management. A detailed literature review is included to identify the current status of the use of ICT. It has been found that the patterns of ICT usage are different depending on the regions. Driving forces behind ICT usage are varied, as well. In Asia, owners (governments) are more proactive in introducing ICT in project management while in other regions such as the North America, United Kingdom and Australia, drive is usually self-motivated. It is also found that there is a general hesitance towards the use of ICT. Both internal and external factors are influencing the potential use.

3.3 Building Information Modeling

Paper 107, Page: 927-934

Building Information Modeling in Architectural Education: The Case of the Middle East

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Abstract

The construction industry in the 21st century is facing a huge challenge. Building Information Modeling (BIM) is emerging as a technological, procedural and strategic new approach to the fields of Architecture, Engineering and Construction (AEC) providing a way for iterating, documenting and managing a design through most of its life-cycle from conceptual design, design development to construction through operations and management. The bulk of the time spent on a design project is in the detailed design and construction document phases of a project, while the building's general appearance, performance and cost are largely decided during conceptual design.

Since CAD easily helps visualize the design concept, where the conceptual design phase is mainly the responsibility of the architect, most curricula in architectural education are currently designed with more focus on CAD and less or no focus on BIM. As a result, most architecture graduates do not possess enough BIM knowledge or skill that is urgently needed by employers. This creates a growing gap between academia and the design and construction industry that needs to be addressed. Also, of great importance is the unique situation of each region of the world with its different infrastructure and different work habits.

Through the survey of several case studies, this paper tries to answer these questions. Can BIM make the whole experience of teaching and learning architecture much simpler or more effective? When is the right time to introduce BIM to students of architecture? How should BIM be introduced to students of architecture especially in the early stages of design Studio?

Paper 108, Page: 935-942

Lessons Learnt from Implementing Building Information Modeling (BIM) Technology in Thailand's Architectural Industry

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Abstract

Building Information Modeling (BIM) has emerged in the architectural, engineering, and construction (A/E/C) industries to as an approach for storing and exchanging building information throughout the project life cycle. In recent years, BIM has been increasingly used by large international A/E/C firms for facilitating their design and document creation processes. A number of success stories about BIM in western countries have been publicized. However, there are still doubts that BIM could be effectively used at relatively small, local architectural design firms in Thailand. Therefore, these design firms started to investigate BIM capabilities and identify the possibility of using BIM to streamline their work flows and enhance their competitiveness. This paper presents a research study to investigate the current situation in the use of BIM technology in Thailand's architectural industry. It also discusses lessons learnt by design firms in promoting the use of BIM in their organizations. The result of this study could provide a basis for small and medium design firms to make informed decisions on selecting BIM-based applications in their architectural works.

Paper 109, Page: 943-949

BIM and Conditional Query Estimation

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Abstract

This paper discusses about the development of user friendly interface to generate quantity estimates for the schedule of activities that facilitate the project schedule implementation from subcontractor's perspective. Today, Building Information Model (BIM) plays an important role to draw quantity estimates during the different phases of project life cycle. Many BIM solutions are available to extract quantities and material definitions out of a BIM into a cost estimating system. Implementation of these existing exclusive BIM solutions partially generate an automatic quantity estimates for the schedule of activities of the entire project. During the construction phase, these generated estimates need to be tailored by the subcontractor to execute the daily construction activities. This process is tedious and not user friendly. A user friendly tool that helps to generate the quantity report for the specific duration which is tractable for the subcontractor's needs during the construction process is required. This paper discusses the conceptual framework which facilitates to generate a customized quantity estimate report from BIM. This paper discusses the feasibility of generating a customized report from BIM based on project schedule. It also discusses the pilot study conducted to develop the interface to generate a customized quantity estimate report by using Autodesk's BIM software.

Paper 110, Page: 950-957

Role of BIM for Facility Management in Academic Institutions

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Abstract

Recent research suggests that 85% of the lifecycle cost of a facility occurs after construction is completed. It is estimated that approximately \$10 billion are annually lost in the U.S. alone due to inadequate information access and interoperability issues during operations and maintenance phases. A building information model has the capability to store information about a building and its spaces, systems and components. Hence it could be extremely useful for daily operations and periodic and preventive maintenance of the facility. This study analyzes the industry's best practices concerning the use of BIM for facility management particularly in academic institutions and presents a preliminary plan for implementation of a BIM based facility management system at Auburn University. The paper begins by providing an overview of the use of BIM in the facility management industry. Next, brief case studies of some universities that have adopted, or are planning to adopt, BIM in the operation and maintenance of their facilities are presented. Finally, a plan for implementing BIM in the facilities division of Auburn University is discussed.

4. Construction Technology

4.1 Engineering Design Issues and Solution

Paper 111, Page: 958-966

Energy Dissipation Capacity of Columns and the Time of Collapse of Steel Structures

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Abstract

Steel buildings subjected to excessive gravity loads, such as debris pile up caused by controlled demolitions, fire or other extreme events, may suffer partial or complete collapse. This paper investigates the influence of the energy dissipation capacity of columns on the time of complete collapse or arrested collapse. The first part of the paper discusses a recent test program that deals with the energy dissipation capacity of square steel box sections subjected to continuous axial loading. Eleven hollow structural steel specimens were tested quasi-statically and they primarily exhibited crush progression of inward and outward folds propagating over the length. These tests suggest that hollow squares are much more desirable as columns than open sections in such circumstances. The second part of the paper employs Newton's laws of motion to predict the velocity profiles and time of the collapse of multi-story buildings undergoing gravity induced progressive collapse. A formulation of the problem of a building frame of "N" stories, subjected only to gravity loading is postulated that involves an analysis employing a generic one-dimensional discrete model of progressive collapse. An example 10-storey structure is considered to illustrate the method. For the design scenarios postulated, major differences in collapse times were found. Many of the cases considered resulted in collapse arrest of the building at some intermediate floor level.

Paper 112, Page: 967-974

Behaviour of the Stiffened Panels of Rectangular Industrial Ducts

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Abstract

Large rectangular industrial duct side panels often require regularly spaced stiffeners. Generally, the stiffeners are wide flanged steel beam sections with one flange connected to the steel panel and the other flange unsupported and unbraced. Under negative pressure (suction), the unconnected flange is in compression and the duct panel is in tension. The duct panel and the web to which the tension flange is connected they may provide a partial rotational restraint to the compression flange. This investigation concerns with the bending capacity and the design of such stiffened steel panels. Finite element analysis models for stiffened steel panels were built and this paper describes the features of this model and presents the convergence study results. The shell elements can model thick and thin shell structures, undergoing large displacement/small strains. The material model was elasto-plastic-multilinear material model with von Mises yield criterion. The model included geometric imperfections and residual stresses. The Load Displacement Control (LDC) method was used to capture the loading and unloading regions of the pressure load-lateral deflection response. Based on the comparison of results with the corresponding experimental results, it was concluded that the as built finite element analysis model can reliably establish the response of stiffened plates in the loading and in the unloading branches.

Paper113, Page: 975-983

The Robustness of SteFib in Composite Structural Member

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Abstract

New technology and materials have been implemented to develop new findings for new research products. In line with the new achievement of Green Building in construction industries, researchers are trying to reduce wastage from construction material by adding new or special material as an admixture to replace or reduce the usage of conventional construction material. Steel fibre (**SteFib**) is one of the materials used as a replacement for reinforcement bars, either partially or totally, and known as steel fibre reinforced concrete (**SFRC**). **SFRC** has been widely used to improve resistance to cracking, ductility, energy absorption and impact resistance characteristics. **SFRC** can reduce or even eliminate cracking in concrete. In this study hooked end steel fibre with a 0.75mm in diameter and 60mm length was added into concrete beams and slabs to study the failure pattern and to investigate the ability of **SteFib** in increasing the flexural strength and preventing crack propagation in the structural member. Concrete of grade 30 with 25kg/m³ and 30kg/m³ fibre dosage

were used in two beams and two slabs respectively. The Three Point Bending Test was carried out on all samples. Samples with **SteFib** embedded in concrete proved more effective in beams under flexural loads. High carrying capacity was found in beams with 50% ultimate load increment in **SteFib** beam. **SteFib** beams also showed high crack resistance by 80% and 87% the increment of crack length and crack width. The high strength and ductility of **SteFib** beams was shown at increments of 42% and 50% in strain and stress respectively.

Paper 114, Page: 984-991

RC Wall-slab Connection Enhanced with Steel Fibre under Lateral Cyclic Load

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Abstract

The natural problems of concrete, such as cracking and brittleness, have become major problems,

especially when it comes to the weaker point of a structure where there is connection. Extensive research work on steel fibre reinforced concrete (SFRC) has established that the addition of steel fibres to normal concrete improves its strength, durability, toughness, ductility and post-cracking load resistance. This paper presents the influence of steel fibres to the connection of wall-slab connection in terms of strength, ductility and cracks propagation under lateral cyclic load whereby each drift consists of two cycles for 60 seconds time duration. A dosage of 30kg/m^3 steel fibre with end hooks of 0.75mm diameter and 60mm length and concrete strength of grade 30 was used in the wall panel area only of the wall-slab sample. Steel fabric type B385 (B7) was used as reinforcement for the wall and slab panel. Two samples were constructed using two different connection detailing; anchorage and cross wall slab connections. The results show that the strength for cross connection (22.85 kN) is higher than anchorage connection (20.64 kN). In terms of ductility for both types of connection with steel fibres, the anchorage connection specimen is better at sustaining its load for larger displacement with 37.6% greater than cross connection. Further, based on the visual observation, anchorage connections perform well and prolong the propagation of cracks while the cross connection tends to experience damage faster as compared to the anchorage connection. Ductility of the specimen is considerably enhanced with the addition of steel fibre.

Paper 115, Page: 992-999

The Applicability of the Design Structure Matrix (DSM) Method in Representing and Prescribing the Architectural Design Process

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Abstract

Iteration is a key feature in the design process. Utilizing the iteration loops prevalent in the design process can help designers explore and understand

problems better. Furthermore, designers are able to clarify problems, generate ideas and gain the best solutions through these iterative loops. Understanding the characteristics of design iteration is fundamental to improving solution generating activities. Depending on different design situations, problem types, constraints and criteria, we may encounter different kinds of iteration, namely in terms of their positive or negative effects on the design process. So, identifying iteration characteristics will be crucial in the effective management of the design process. For this purpose, in this paper, we consider an explicit method to represent the clear and compact model of iterative processes that occur in architectural design. This method is derived from the Design Structure Matrix (DSM), which is a heuristic approach that enables us to capture activity iteration and probabilistic looping within the architectural design process. While this tool allows the modeling of sequential or parallel processes, it can address interdependencies (feedback and iteration) and many other complex activities.

Paper 116, Page: 1000-1007

Iterative Visualization Processes in Architectural Design

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Abstract

In recent times information and communication have become key features in any technological advancement. The situation is similar with the construction industry, where information and communication between designers, professionals and management team is important to the design outcome. It is obvious that designers' use some form of visualization techniques to communicate their design to parties involved in managing the design processes and construction activities. Therefore, as

the construction industry is involves with the construction of all sort of structures thus communication between designers and other parties in the industry is vital. The design is the blueprint of construction activities and the requirement for a construction site which is produced by the designer thus a design have to facilitate the ease in communicating the information to other professionals involve in the construction processes. In this case study about how designers use conventional methods to communicate their idea to other parties in the construction industry is paramount for understanding construction projects. Consequently this paper tries to look at the simplest visualization methods designers' use to communicate design information in the construction industry. Sketches are designers' tool for generation, production, and evaluation of the design idea in a similar vein designers use sketch as a tool to clarify ambiguous information contain in construction document thus sketch help in communication and documentation of design information. This study focuses on iteration in designers methods of visualization as manifested through conventional methods of representation like those found in sketches and production drawings. Iteration was chosen because according to the results of this study it was manifested that iteration in designers sketching activities enhance the accuracy and clarity of the design. During the preliminary stage of architectural design, sketch is use as a tool for idea development and adaptation. The character and behavior of sketches make it a medium for communication and documentation in design process. Sketch is worthy of study because it is a vital tool in design process. Finally, the aim of this research is to identify iteration in designers sketching using a standard method of representing iterative process. The timeline method of representing iteration was chosen and used in this study where by the iteration happen at the final embodiment of the design. Future research can determine whether iteration has a positive or negative role in designers sketching process.

Paper 117, Page:1008-1015

Isolating Fundamentals Design Element: Composite Drawing Representation the Case Study of Serenity House

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Abstract

A of piece of design is actually a series of development process where basically the fundamentals element such as line, shape, form, space, texture, value and color is organized and refined using basic design principles. The process is very much a rotating process and each one of produced design in reincarnated through refinement of next developed or more innovated design.

This paper aims to take the level of understanding in design process by reprocess the design by reversing the process till the most fundamental stage where each one of the element of the design is isolated to its basic substance. The fundamentals element is then reorganized by composing it into a new representation form of multifaceted element and projections. The case study of serenity house is chosen as it basically metaphor a 'man' and how this particular case is recomposed in depicting the complexity of a 'man' itself. An architecture is actually a mirror of a 'man' itself and like the 'metaphor'; it is actually a much more than a tangible entity, what fascinated us is the intangible substance than contain within it.

The outcomes of the research is a fascinating one, the composite is actually a symbiosis of cross design specialization, medium and media; and, incomplete and finish from design point of view. At least it can disturb the intelligence of the viewer and not pausing to the conclusion.

Paper 118, Page:1016-1024

Investigation of Ultrasonic Pulse Velocity on S+WPSA Brick

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Abstract

This paper presents an investigation of pulse velocity by using Pundit test on S+WPSA Brick. S+WPSA Brick is a brick that is produced by using sand and waste paper sludge ash (WPSA) as cement replacement. WPSA is collected from a paper recycle manufacturing industry. The S+WPSA brick mixes were made into 215 mm x 102.5 mm x 65 mm at normal consistency for compressive strength. The aim of the study is to estimate the mechanical properties and to evaluate homogeneity by identify void and honeycomb. 8 specimens of S+WPSA Brick of proportion 1: 2 were tested. The results obtained were compared with classification of concrete quality criteria. The results of this study illustrate that S+WPSA brick is classified as an excellent in quality and integrity. Therefore, S+WPSA brick is suitable for light construction that not use as a sustain load.

Paper 119, Page:1025-1031

Role of Tarbela Dam in Water Regulation of Indus River and its Effects

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Abstract

Tarbela Dam on Indus River is the only mega storage structure in the country which acts as its economic hub since more than 90% of the water is used for irrigation of agricultural land. Seasonal intense flow, and more than 70% availability of the annual water in 3 months time, demands a suitable solution for flood attenuation, and water storage for agricultural use in arid/semi arid conditions. Flow forecasting is one of the most important factors, for optimal utilization of water. A critical analysis shows the importance of this great structure; however certain improvements in water regulation, predicting inflow, power generation enhancement, flood control and educating the users (agriculturists) can further enhance the efficacy of this great hydraulic structure.

Paper 120, Page:1032-1041

Integration of Remote Sensing (RS), and Geographical Information Systems (GIS) to evaluate the waste water quantity at downstream area of Al Roma Wadi

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Abstract

An evolution of demographic growth within the Al Quasseem region especially in the downstream area of Aroma Wadi have provoked environmental damage. Large quantities of wastewater are being thrown within the Wadi neighborhood without proper management. The main cities being affected

are : Buraydah (the capital of Al Qasseem), Unayzah and Al Ras. Pollution resulted due to this wastewater has been investigated in this paper. Different digital methods (Remote Sensing, GIS and GPS) for collection and acquisition of geospatial data have been used. The satellite images for different dates have been taken and analyzed. The classification of these images have been made by Erdas Imagine software. The amount of wastewater has been estimated. The chemical composition of wastewater before and after processing has been determined. Death of some creatures has been identified. A true increasing of wild flora area has been observed. It is observed that after the last flood of Al Roma Wadi other areas have been indexed as damaged area within its downstream. The main results found in this paper are based on the data for the last ten years. It is suggested that this applied research may be continued in order to evaluate the impact of the wastewater on the groundwater in the Al Roma Wadi.

4.2 Innovative Construction Technologies and Techniques

Paper 121, Page: 1042-1049

A study of the importance of vernacular architecture in the formation of Contemporary Construction (Case study: Rural residential types of Guilan)

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Abstract

Guilan is a province situated in the northern part of Iran with a moderate and humid climate. The diversity of livelihood and vicinity to forests, mountain and sea, resulted in the formation of varied rural residential types which are built with local materials and indigenous techniques.

Although the mentioned dwellings have gradually achieved sustainability and harmony with their surroundings over a long period of time, recent decades and contemporary urban architecture lead to a decline in their valuable role from the dweller's perspective. Their perspective is influenced because of the lack of the dwellers' knowledge about

vernacular architecture and their trend within modern architecture. As it is observed, a fraction in the development and promotion process of vernacular architecture has made them weak in response to their inhabitants' demands compared to their modern counterparts.

To identify the importance of vernacular architecture in future buildings, a thorough assessment of their merits and demerits can play an effective role in recognition and formation of an adequate contemporary architecture with the usage of rural heritage. Accurate research on available indigenous types, relying on filed study and related texts, can be a clue for upgrading and simplifying the sustainability of future modern construction.

Paper 122, Page: 1050-1057

Natural disasters mitigation measures in vernacular residential types of Guilan

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Abstract

Guilan, as a northern province of Iran, has a humid and moderate climate due to its proximity to the Alborz mountain range, deep forests and the Caspian Sea which led to the formation of diverse vernacular building types. Each type has developed gradually over time to be in a harmony with its surroundings and climatic situation besides resisting probable natural disasters like flood, earthquake and heavy snowfall.

Identification of disaster mitigation measures in vernacular buildings according to their origins and study of their advantages and disadvantages for further use in new constructions can play an important role in decreasing the risk of disasters in modern buildings. As the field study indicates, vernacular buildings, despite being formed of a simple design, have intelligent capabilities to provide a better response to critical conditions in comparison with their modern counterparts.

Considering the diversity of vernacular rural types in Guilan, two types are selected for this survey located in different geographic and climatic zones and

exposed to different natural disasters (flood and earthquake). These types are deeply studied from the viewpoint of their capabilities in confronting natural disasters. Afterwards the possibility of the promotion of these capabilities is assessed in order to be applied in modern construction.

Paper 123, Page: 1058-1066

Effect of Lateritic Soils as an Aggregate Substitute on the Strength of Compressed Concrete Bricks

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Abstract

Construction materials used for interlocking load bearing blocks include cement, sand, and crushed granite. With the increase in these material costs there is a need to find more cost saving alternatives to maintain the cost of constructing houses at prices affordable to clients. One of the local materials that show a potential to be used as replacement aggregate is lateritic soil. The substitution of aggregate in the compressed concrete blocks mixes with lateritic soil, increasing workability and strengthening the blocks. A number of mixed proportions were tested and the compressive strength of the cube blocks on the 7th day and 28th day showed that lateritic soils at 25% - 50% , by weight, replacing crushed granite to reach the required strength to be used for construction of buildings. Using the formulated mixture, interlocking load bearing block are made using the CCA press. The resultant block is tested and the compressive strength is within the required specification for house construction. The design constraints and construction of a pilot house using this lateritic load bearing interlocking block is presented.

Paper 124, Page: 1067-1077

Reinforced Concrete Wall Panel Using Crushed Concrete Waste Aggregate (CCwA)

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Abstract

Steel fabric reinforced concrete wall panel is widely used in low and high rise building construction in Malaysia, especially in Klang Valley. Using this system offers several advantages in construction, such as a shorter construction time and a reduction on the dependency of unskilled foreign workers at a construction site. This paper discusses the behaviour of reinforced concrete wall panel using crushed concrete waste aggregate (CCwA) as coarse aggregate. This research involves laboratory experimental work testing of six samples under static compression test. The samples were prepared using Grade 30 normal Ordinary Portland Cement (OPC) concrete with a water cement ratio of 0.55, measuring 75 mm x 1000 mm x 500 mm (Thickness:Length:Height). The aspect ratio (H/L) and slenderness ratio (H/t) of the wall panel is 0.5 and 6.67 respectively. The samples were subjected to static compression tests with pinned-fixed end conditions at upper and lower ends until failure. Results from the experiments show that all the samples failed in compression shear, with crushing at upper and lower ends edges of wall panels. The average ultimate load for single and double layer steel fabric reinforced concrete wall panel using CCwA, is 1349 kN and 1643 kN, respectively. The percentage different between the usage of CCwA and NA in wall panels, in terms of ultimate strength decreased by 5.5 % and 6.6 % for single layer and double layers of wall panels, respectively. A single curvature crushing crack pattern is dominant for all samples with average maximum lateral displacement, including single and double layers of steel fabric reinforced concrete wall panels at 2.9

mm and 3.8 mm respectively, occurring at a 375 mm (0.7H) wall height. The double layer steel fabric shows 24 % higher lateral displacement than a single layer steel fabric sample. This shows that double layer steel fabric gives more ductility in terms of the prevention of cracking on wall panel. The structural behaviour of reinforced concrete wall panels using CCwA as a coarse aggregate is similar to wall panels using Natural Aggregate (NA) in terms of structural strength capacity, displacement profile, and mode of failure. The findings confirmed the performance of CCwA is as good as NA. This helps to reduce unnecessary wastages and also prevents the depletion of natural resources.

Paper 125, Page: 1078-1085

Performance of Concrete Containing Steel Slag Exposed To Sulphate Environment: A Comparison of Steel Slag and Natural Aggregate Use

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Abstract

Concrete behaves very differently when exposed to sulphate. Sulphate may exist in soil, ground water, sea water and effluent discharge by industry. As a result of sulphate attacks, cracking, expansion, spalling, and loss in volume and strength may take place. To minimize such occurrences, several factors need to be considered such as the water/ cement ratio, permeability of the concrete, condition of sulphate exposure, cement composition, and the curing condition need to be accounted. The idea of this study is to compare the behavior of normal concrete (containing steel slag aggregate) and normal aggregate under the exposure of two types of sulphate ions: sodium sulphate and magnesium sulphate with 0.3molar 5 % concentration for a period of twenty weeks. The durability of concrete

containing steel slag i.e. changes in physical, volume and strength after the immersion process has been observed. The result of different water cement ratio of 0.47, 0.52, and 0.55 and steel slag aggregate replacement of 10%, 50% and 100% of total aggregate proportion are presented and analysed. From the result, it shows that the durability of steel slag aggregate and natural aggregate concrete has the same performance.

Paper 126, Page: 1086-1093

A Study of Heated Sand With Thermoluminescence: An Estimation of Thermal History in Building Materials

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Abstract

When sand is heated slowly, an emission of light will appear and this luminescence phenomenon is called thermoluminescence (TL). TL can be observed by thermally stimulating sands at various temperatures and exposure times. The amount of TL however, is reduced if the sand is exposed to high temperature as in the case of fire. The objectives of this study are to evaluate the natural TL of prepared heated sand of 100°C and 300°C at various exposure times, to compare the natural TL of heated sand treated with 10% and 30% of HCl concentration and to estimate the maximum thermal history reached within heated sand based on self-normalisation method. This is to determine that whether the strength of concrete is structurally sound or not because sand is one of the constituent materials in concrete. The samples of heated sand were prepared same as that of fine-grained dating method and treated with two different HCl concentrations of 10% and 30%. Based on the results, it was found

that the natural TL reduced as the exposure times increased. The effect of using higher (30%) HCl concentration yielded 16.8% improvement and a clear TL glow curve shape. The estimation of the maximum thermal history of heated sand using self-normalisation technique is dependent upon the duration of thermal exposure. The result achieved can be used as guidance in estimating maximum thermal history reached within any building materials or structures that contained sand.

Paper 127, Page: 1094-1101

Effect of Supplementary Cementitious Materials on Properties of Concrete

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Abstract

An experimental investigation was carried out to evaluate fresh and harden properties of concretes containing supplementary cementitious materials in both binary and ternary systems. Different concrete samples with mix ratio 1:2:4 were prepared to have constant water-binder ratio of 0.50. The test variables included the type and the amount of the supplementary cementitious materials such as class 'F' fly ash (FA) and ground granulated blast furnace slag (GGBS). Portland cement was replaced with FA and GGBS up to a level of 60%. Hence, total eight mixes were prepared. The fresh characteristics were investigated in terms of slump whilst the harden properties were assessed from the compressive strength. Among all mixes OF46 mix (40% ordinary Portland cement + 60% fly ash) named OF (46) showed highest slump showing effect of FA on workability concrete. The addition of high volumes of supplementary cementitious materials decreased the compressive strength at early age but this difference was reduced considerably for long term (56 days) results.

Paper 128, Page: 1102-1109

Can water efficiency measures influence construction technology and ensure potable water sustainability?

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Abstract

Climate change has been a source of much discussion at government level and in the media for many years, with estimates showing that current levels of greenhouse gas emissions will lead to a rise in global temperatures of 2-5 degrees celsius sometime within the next twenty to fifty years. The consequences of climate change are varied but perhaps chief amongst them is the trend for less predictable weather patterns with many hotter summers than those currently experienced, which are likely to lead onto water shortages. It may surprise people to discover that the UK can be considered to have water supply problems. While the situation in the United Kingdom could not be considered to be as severe as that in Africa, many parts of the country, particularly in the South-East of England, are seeing water demand exceeding abstraction rates.

This paper will initially via a literature search establish the actual levels of water usage and the Government allowed levels of water usage per person per day. Then, by evaluation of a case study based on a notional housing development, see whether these limits are achievable or whether the introduction of additional technical solutions such as rainwater and greywater recycling will facilitate any advance towards limiting water usage. If successful these initiatives could then be considered by other countries. The paper will then conclude on the effectiveness of these initiatives which are needed to secure a sustainable domestic water supply, with the overall long term goal of water neutrality i.e. where water demand equals water supply.

Paper 129, Page: 1110-1118

Household toolkit for Water Efficiency in Existing Domestic Buildings

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Abstract

The balance between water supply and demand is increasingly difficult to maintain, as a result, water shortage is a challenge now faced in many regions around the world. The effects of climate change and global warming have significant impacts on how resources are managed globally and locally; underground water is taking longer to replenish due to increased surface water run-off especially in urban areas, and water contamination from flooding and prolonged periods of droughts.

In the UK, changes were made to the building regulations in 2010 to highlight the importance of conserving water in buildings. However, the quality and performance of the building assets does not guarantee efficient water consumption during its use. A joined up approach through proactive policy measures, behavioural change and technological interventions is required. Evidence suggests that change in behaviour alone may not promptly achieve the substantial levels of reduction which is required in buildings to mitigate ongoing and future projected water stress. Therefore, technological interventions are required. However, for dwellings in particular, socio-technological factors cannot be ignored for the deployment of technological solutions to yield long term, sustainable savings.

This paper introduces co-creation as the rationale for a proposed toolkit and discusses the proposed approach to engaging water customers in the debate for sustained change. The objective of the toolkit is to facilitate feedback and improve the adaptive capacity of the household to adopt new technologies and change behaviour all of which are necessary to improve water efficiency in the long term.

Paper 130, Page: 1119-1124

Indoor Air Quality Impact on HVAC Costs

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Abstract

The cost of procuring HVAC equipment for a new building or maintaining existing units can be significantly high. Hence, choosing the best method that satisfies indoor air quality (IAQ) requirements while maintaining a low cost becomes imperative. The objective of this paper is to establish the relationship between additional cost of retrofitting existing commercial HVAC units by adding reheating coils and the cost of procuring new units. Actual cost data for various elementary school projects across the United States were obtained from a third party HVAC retrofitting shop. Modifications were done on the units in order to increase the air volume and heating temperature. This retrofitting includes adding a reheating coil, fan, damper and economizer. The result indicates that the cost of retrofitting these units to meet specific heat output were 50% lower than procuring new units, hence making the lifecycle cost of the building efficient. Furthermore, HVAC contractors will find this helpful, as this will aid in cost comparative analysis for bidding purposes. The dependent variable within this study is the cost of the manufactured unit while the independent variable is the additional costs of retrofitting units by adding reheating coils.

4.3 Sustainable Construction Techniques

Paper 131, Page: 1125-1132

Green Buildings: A Framework for Social Sustainability

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Abstract

Despite the ongoing debate surrounding climate change, sustainability is increasingly a key consideration for building owners and tenants with the 'triple bottom line' as desired outcomes. The triangulated social, economic and environmental

goals of sustainability are now the mantra of many businesses. While much has been written of the benefits of green buildings to its occupants, comparatively fewer studies have been devoted to investigating the perceived drawbacks and measures to improve the social sustainability factor, i.e., user satisfaction. Therefore, the purpose of this paper is to consider the impacts of green buildings on its occupants by drawing together past empirical findings and summarizing the results. In addition, the paper will also present a case study of the Institute of Sustainable Development and Architecture, which is Australia's first 6-green star, rated educational building. Through these methods, the paper will identify gaps between green building performance and user satisfaction. Thereafter, it will introduce a social sustainability framework that seeks to improve the social performance of green buildings. The 6-P model is a holistic framework targeting the following factors that can influence user satisfaction of green buildings. These factors are: public perception, price, policies, psychological, physical and personal.

Paper 132, Page: 1133-1140

Key Sustainability Indicators for Infrastructure Systems: An Australian Perspective

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Abstract

Development of infrastructure projects generally receives vast amount of capital investment in any country. However, yet one of the main challenges in the provision of physical infrastructure is meeting the growing demand for new infrastructure, while maintaining, upgrading or replacing aging infrastructure. This has led to the recognition of the importance of ensuring infrastructure sustainability during its life cycle. Therefore, in an attempt to investigate current Australian infrastructure sustainability practices, a pilot questionnaire survey was conducted for gathering data required to identify key sustainability indicators (SI's) and to draw upon practitioners' opinions regarding the

importance of SI's in assessing sustainability performance of typical infrastructure projects. The research reported upon forms part of a larger study that aims to develop an integrated expert decision support system for sustainability performance assessment. This involves identification of relevant SI's and investigation of practitioners' preferences of their use.

Paper 133, Page: 1141-1148

Perspective of Corporate Social Responsibility in the Korea and Malaysia Construction Industry

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Abstract

The construction industry has always been criticized as one of the industries that capable of adversely affects the society if not managed well. Despite its contribution to the development of the society, the construction industry (CI) often becomes the target of environmentalists and governments pertaining to the environment and other social issues. One of the challenges of 21st century facing by construction industry is to minimize its unfavorable impacts to the society while maximizing its roles in the development of the society in a sustainable way. The strategically effective way of handling such challenge can be done through the implementation of Corporate Social Responsibility (CSR) approach. This paper aim to study the CSR perceptions and its implementation trend set by major construction-related companies in both Korea and Malaysia. Reference was made to companies' annual reports, sustainability reports, companies' homepage and CSR related website. The definitions and CSR initiatives applied by different companies were outlined and compared. The results presented in this study pictured the difference of CSR perceptions carried by major construction-related companies which serve as the standard, trend setter and implementer in the construction industry of both host countries. These results will show us how CSR is defined directly by the practitioners in the construction industry as compared to the various

definitions stated by other parties and institutional bodies.

Paper 134, Page: 1149-1156

A Comparative Study of Green Building Rating Systems

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Abstract

Harmful activities of the modern lifestyle to the environment have resulted into such chaos that the minimization of their negative impacts seems inevitable. Although there is no agreement on the concept of sustainable development among scientists, a variety of rating systems have been introduced to satisfy the sustainable construction criteria during recent years. There are different attitudes towards sustainable development in different countries around the globe and different approaches were adopted to reach different priorities. Also, different socio-economic, cultural, and climatic conditions of countries have caused some differences in the rating systems. However, the aim of all the rating systems is to achieve sustainable development in environmental, socio-economic, and cultural aspects. They mostly involve issues such as energy and resource efficiency, management, design, and materials. The aim of this study is to review and compare the major green building rating systems. For this purpose, the prerequisites of the rating systems, their weaknesses and strengths, scoring systems, and weightings are described and compared with one another through charts, tables, and graphs. The results of the study are expected to assist researchers in the development of a comprehensive green building code.

Paper 135, Page: 1157-1167

Evaluating the Awareness Level of Green Office Users: A Case Study

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Abstract

Green offices are office buildings constructed to reduce the impact of new construction on the sustainable development of society. In order to achieve the objectives of sustainable development, all the stakeholders of this sector need to work together. In this regard, the end-users of such buildings are one of the biggest and most important groups of stakeholders who will play a role in the operation phase of the project. A green office building can still perform poorly if the users are not aware of the facilities and services available in the office. The current study intends to evaluate the users' level of awareness in a green office building (Setia Eco Gardens, Johor) as a case study. It covers different aspects of sustainable practices which are tied with the users' choices in everyday office life. The data was gathered using questionnaires that were distributed among the office users and then processed and analyzed by means of statistical software. The results were presented through charts, graphs and tables. The results of the study can be used to clarify the areas where more emphasis is needed in educational materials including posters, leaflets and videos. They can also be used as a decision-making tool for the managers to recognize and implement sustainable-driven policies within the office.

Paper 136, Page: 1168-1174

Cost Impact of GBI Criteria on Non-Residential Green Buildings in Malaysia

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Abstract

The most significant factor for whether or not to go for green goals is the incremental costs of a green building compared to a conventional building. Lack of data addressing incremental costs of green buildings has discouraged the pursuit of the green movement, including by contractors and stakeholders, to consider green goals in their projects. The aim of this paper is to identify the Green Building Index (GBI) criteria that contribute to less project costs for non-residential buildings in Malaysia. In order to achieve this aim, a 4-point Likert Scale questionnaire was designed and given to green building experts including GBI facilitators and Malaysian developers who had contributed in green projects. The green building experts were asked to rate the proportion of Cost Impact of each GBI Criterion. The purpose of the questionnaire was to obtain a perception regarding cost impact of GBI criteria on Non-Residential buildings. In addition, the green building experts were interviewed and their points of view were gathered to identify factors affecting cost impact of GBI criteria in Malaysia. The responses from the questionnaires have been analyzed by SPSS 17. In conclusion, this study has identified the cost impact of GBI criteria whereby all parties including contractors, consultants, and developers can readily obtain and idea about the cost impact of each GBI criterion in order to align the budget to the project's goals.

Paper 137, Page: 1175-1180

Air-conditioning Energy Consumption Analysis in Malaysian Residential Buildings

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Abstract

The usage of residential electrical appliances for the last two decades has increased rapidly in Malaysia together with the increasing income per capita. Like other developing countries with hot and humid climates, Malaysia has been experiencing dramatic growth in the number and use of air conditioners, and the usage will be higher in the future. So, energy efficiency is one of the most important issues that be faced in Malaysia. The purpose of this study is to analyze air-conditioning energy consumption based on external walls in residential building sectors within the Malaysian construction industry. The study has been done by specifying twenty four masonry wall alternatives and then, air-conditioning energy consumption for each wall panel was calculated by modeling and simulating the selected case study. The results of the study illustrate that, highly dense insulated materials have the best function in terms of saving energy. After those low density insulation and air cavity wall panels have the second rank, while single layer materials are the worst. For each subgroup, double materials have a better function in comparison to single ones. Among brick, concrete and hollow concrete blocks as the main materials used in this case, hollow concrete blocks have the best function when compares to others. The results of this study have a crucial effect on selecting the optimum external walls in Malaysian residential construction projects.

Paper 138, Page: 1181-1191

Preliminary Study on Construction Waste Management in Malaysia: A Qualitative Approach

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Abstract

Throughout the years, the construction industry had made an important contribution in the lives of the society in Malaysia. Moreover, the Ninth Malaysia Plan RMK9 (2006-2010) had also played a significant role in the demands of executing major residential housing project developments where it has been observed that the construction wastes was one of the priority waste streams. Due to the increasing number of population that is actively involved in economic activities and the modernisation of the country, the types of construction wastes that are being produced are becoming more complex and identifying the sources is complicated. Therefore, appropriate action needs to be taken with respect to its effective management in handling the situation. The aim of this preliminary study is to investigate the existing process of the construction waste management currently practised in Malaysia. The interview method was chosen to obtain data from ten contractors and the data were

processed using the NVivo 9 software before being analysed. Throughout this study, useful information and better understanding of the existing process of construction waste management were identified. The detailed description of the existing process of the construction waste management was achieved to assist in improving the quality and awareness of the construction waste management practiced.

Paper 139, Page: 1192-1200

Materials Management in Construction Industry: Energy Requirements for Selected Materials

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Abstract

Materials management in the construction industry has become a major source of concern to all due to its effect on the social, economic and environmental well being. This has led to an increased pressure on the materials management on construction materials, which has a negative impact on the construction industry. This paper is aimed at reviewing the problems of management process and energy requirements of some materials in the construction industry. The review carried out from the current literature shows that the materials management processes has problems. It was found that poor planning and control, transportation, late delivery, inadequate storage and poor materials handling at site are the causes. The findings are expected to minimize these problems and benefit practitioners, stake holders in the construction industry, and government agencies in minimizing materials management in construction activities. This will also encourage the need for further research on materials management processes problems in the construction industry.

Paper 140, Page: 1201-1209

Recycling of Waste (Rice Husk and Quarry Dust) for Building Materials

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Abstract

In the past few years, the waste materials from large scale buildings and development activities have contributed to the problems of managing and disposing the waste materials. Such waste as cement, aggregate, timber or even demolition wastes have become the major environmental, economical and social issues as there are lacks of dumping area. Nowadays, the waste materials are commonly managed by reuse, reduce, recycling, incineration and land-filling in order to recover the increasing of the waste materials generated. On top of the options mentioned, the recycling is the best waste management disposal process. Actually, these wastes can be recycled and used as a whole or partially as building material, thus can eliminated the problems of waste management encountered. Researches into new and innovative uses of waste materials are grown continuously. In recent years, many researchers have found that the waste materials are capable to give return in terms of economy and also enhance the properties of concrete. Some of the commonly used waste materials that can be recycled as supplementary cementing materials are Rice Husk Ash (RHA), and Quarry Dust Fine Powder (QDFP). The used of these waste materials into supplementary cementitious material are identified to give enhancement in term of strength and durability performances of concrete. This paper highlighted the results of strength and durability of these mentioned materials. Studies shows that the replacement of RHA up to 30% can attained strength of 30 N/mm², however for QDFP concrete of 0.3, 0.4, 0.5 and 0.6 w/b ratio can replaced up to 15% except for 0.6 w/b ratio only up to 10%. In term of water permeability, replacement of OPC with RHA reduced the permeability of the concrete thus the presence of RHA resulted in lower coefficient of permeability. For superplasticized QDFP concrete, it can be

considered as having low permeability especially at low w/b ratio. With the results obtained, it can be said that there are potential uses of these recyclables waste materials as building materials in construction industry.

Paper 141, Page: 1210-1216

Green Campus Initiative: Introducing RWH System in Kolej Jati UiTM Malaysia

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Abstract

The annual rainfall in Malaysia is estimated to be around 3,000 mm per year but at the same time, we are facing with the challenge to manage and explore its potential to fulfill our needs and solve our water supply problems. The government has already put some efforts to overcome the water shortage in the country which include the rainwater harvesting. However, the response to use rainwater harvesting is still low due to the lack of awareness among the users. The harvested rainwater is actually suitable for many non-potable uses such as toilet flushing, washing, gardening, watering and other general cleaning purposes. With low bacterial contamination, those who are not fussy can even use the water for bathing. This would reduce the dependency on the treated water and consequently, help to lessen the wastage of precious treated water and also cut down the water bill. In a campus environment, this option can be adopted as part of a green campus initiative. In this paper, Kolej Jati, one of the male residential colleges in Universiti Teknologi MARA (UiTM) Malaysia is selected as a case study in order to determine the reliability of rainwater harvesting system (RWHS) installation. This study involved in measuring a suitable roof catchment area and determining the size of a storage tank to be used in the installation. After that, a suitable RWHS including the cost estimation of installing the system is proposed for the college.

Paper 142, Page: 1217-1223

Evaluating the Guidelines on Open Space: Making Neighborhoods Green

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Abstract

Open space is one of the social needs of residents and a requirement for any housing development. Based on the Open Space Guideline by the Department of Town and Country Planning Peninsular Malaysia (2002), the main policy related to planning and provision of open space is the Planning Standard Open Space and Recreation JPBD 21/97. In many cases there are inadequate provisions of open space in neighbourhood areas. In this research, the existing guidelines were reviewed to evaluate the sufficiency of open space that caters to the needs of the neighbourhoods in order to produce a comprehensive guideline for future open spaces and to make neighborhoods more green. These guidelines can be used by local authorities in Malaysia. The observation survey and semi-structured interview with key informants were carried out. Findings from the questionnaire survey indicated that the current guidelines on open space need to be reviewed. Discussion was made on the importance of planned open space, its provision as well as its effective function to the surrounding community in order to make the neighborhood green.

Paper 143, Page: 1224-1234

3RS Initiative in Malaysian Public University: A Case Study of Green Team, International Islamic University, Malaysia

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Abstract

Waste issues have been discussed in every nation. Reports and discussion papers retrieved in developed, developing and third world countries, shows that wastes are common issues and problems. One of the solutions is implementing the Waste Management Hierarchy. The aim of a Waste Management Hierarchy is to minimize the amount of waste from entering the landfill/dump sites. Three top initiatives in the waste management hierarchy is the 3Rs initiative, i.e. Reduce, Reuse and Recycle. As waste management is a subset of environmental management, it can also be a subset of Facilities Management. To cultivate a 3R culture in a society, it is important to train groups of people by creating an awareness programme towards implementing 3Rs initiative. It is essential to start by educating people with knowledge, especially among students in universities. Thus, the aim of this paper is to explore the current stage of 3Rs awareness among university students by using questionnaires and case study approach in the International Islamic University Malaysia. It is also the aim of this paper to suggest methods in creating awareness among students in universities by developing a Waste Minimization Awareness Model (WMAM).

Paper 144, Page: 1235-1242

Community Participation in Earthquake Reconstruction Program of Azad Kashmir

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Abstract

Communities are regarded as prime stakeholders to development work that takes place in their regions they reside. They play an equally vital role as the architects, engineers and developers of any development project. This paper focuses on the importance of community participation and to suggest a strategic frame work for effective reconstruction work in the earthquake hit areas. The paper examined how contributions of the local community were effectively harnessed by garnering knowledge that constituted the relationship between nature and the built environment. Measures were taken to generate public awareness on pertinent issues throughout the development phases of the projects executed during the reconstruction works. Meetings were conducted at the planning, designing, construction and handing over stages of the projects. Community participation was facilitated by making presentations, incorporating comments of the local people in the site selection and project implementation. Proactive engagement and consultation with the local community was adopted in the design and construction through frequent interactions. This work provided a framework which may be useful for calamity hit areas and can be adopted in any culture.

Paper 145, Page: 1243-1249

Sustainable Infrastructure Re-Construction Approaches for Flood Disaster Areas

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Abstract

Natural disasters bring about substantial damage to the built environment and lead to the perishing of many lives. Post disaster effects are highly variable

resulting in social distraction, prevalence of diseases and reconstruction of infrastructure. The 2010 Pakistan Floods caused great infrastructural damage; buildings, facilities, roads, railways, hospitals, cultivated areas, etc were destroyed. There is need to address the reconstruction and rehabilitation of flood affected areas using a sustainability oriented approach. The study is focused on formulating technical and managerial approaches for construction of infrastructure such as feasibility criterion, design provisions, specifications, construction material procurement, construction methodology, construction technology, plan-outs, construction management etc. The research included the evaluation of the best practices in reconstruction that were adopted by countries affected by disaster. Case studies from USA, Germany, Indonesia, Bangladesh and India have been studied for this purpose. It is intended that the paper will be useful to government authorities, private sector entities and NGOs engaged in the reconstruction of facilities in Pakistan's flood affected areas.

Paper 146, Page: 1250-1257

Encouraging Green Building in Pakistan

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Abstract

Pakistan is currently facing an energy crisis that many believe has resulted from an incredible growth in electricity consumption. Efforts are underway to encourage alternative sources of energy generation so as to reduce the generation - consumption deficit. These resources range from coal to wind, solar and geothermal. Despite the fact that Pakistan is naturally gifted to harness energy from these sources, their exploitation to date has remained severely limited. It is suggested that Pakistan's energy woes can be rectified by adopting a diversified approach entailing the strategy of energy conservation. Traditionally energy intensive sectors should be targeted, and due attention on improvisations in these sectors can also help bridge the current energy deficit. The consumption of the domestic sector for the year 2007-08 stood at 33,704 GWh, constituting 45 per cent of Pakistan's total consumption. A major chunk of the energy expended is in construction processes, in addition to the heating and cooling of buildings in urban areas, etc. The objective of this paper is, therefore, to explore energy conservation by means of

encouraging energy efficient buildings in Pakistan's housing industry. A commitment to reduce energy consumption in buildings is a sustainable way to approach economic development in Pakistan.

Paper 147, Page: 1258-1265

The concept of 'Sustainable Communities' and its application in the United Kingdom's Social Housing stock – is it successful?

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Abstract

The principles behind Sustainable Communities are far from new. However, The concept of Sustainable Communities as a holistic discipline, subject area and all encompassing aspiration is much younger and less entrenched in the psyche.

The emergence of academic degrees on this subject area is proof that the base principles have transcended into something more formal. Based in general on common sense principles it presents a semi-utopian vision that is considered the ideal for shaping the places we inhabit. It is therefore perhaps the key factor in influencing planning and development policy and public funding decisions.

The principles of Sustainable Communities are that they remain healthy and strong, without continued dependence on external elements or great reliance on the limited resources of the Earth. When it comes to practicalities however there does not seem to be concurrence.

The research looked at what is meant by a Sustainable Community within the United Kingdom's Social Housing sector and how effectively it operates. It drew conclusions on the success of the concept utilising case studies and primary data capture whilst investigating the theory, policy and environmental performance and acceptance of sustainable technology.

An overriding conclusion from the data collected is that currently Sustainable Communities as a concept is not yet successful within this Social Housing sector. It recommends implementing and monitoring fewer elements of sustainability and monitoring over a longer period of time to assess viability rather than

many short-term, high profile aspirational visions of the future.

Paper 148, Page: 1266-1273

Knowledge transfer in construction project teams delivering sustainable office buildings in the UK and Germany

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Abstract

One of the main barriers preventing construction industry worldwide shifting towards delivering sustainable buildings as standard is the transfer of knowledge on how to build sustainably. This is partly because still only a small number of professionals possess the specialised knowledge and experience to design, build and operate sustainable buildings successfully. Also, there is a lack of understanding on how knowledge can be transferred and widely adopted between all relevant professionals and operatives, despite the significance of this transfer in the delivery of sustainable buildings. This results in a gap between the design performance and the actual building performance in use. This gap needs to be closed in order to secure a certain quality of sustainable buildings. Therefore this paper reviews the relevant literature on sustainable construction, then discusses its benefits and main barriers, and concludes by providing a basic understanding on the possibilities to enhance the unique knowledge transfer of how to build sustainably. It presents the background of an ongoing research project, which compares knowledge transfer practices in construction teams delivering sustainable office buildings in the UK and Germany.

Green Building Policy, School Performance, and Educational Leaders' Perspectives in USA

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Abstract

The movement to construct high performance “green” buildings has had unprecedented market growth and continues to become mainstream practice for constructing schools in the United States. Green schools have economic, environmental and health benefits. Research provides information on the use of increased student performance found in green schools to justify building schools to a higher standard of indoor environment quality. There is clear and compelling evidence that schools currently built to specific green standards of indoor environmental quality, (e.g. thermal comfort, indoor air quality, acoustics and lighting,) result in healthier and more productive students and teachers. Current green building policies for schools in the U.S. provide educational decision makers with many choices in their selection of green building strategies. Educational leaders have perceptions of how green building strategies should be prioritized based on initial cost, long-term cost benefits, and governmental policy that requires building greener schools. This paper addresses the school construction industry, green building policy, research about indoor environmental quality and its affect on students along with educational leaders' perceptions of how they would implement new policies, which may assist with building a framework for the adoption of green building guidelines for schools internationally.

5. Additional Papers

Paper 150, Page: 1283-1289

Risk Management in Real Estate Projects (Application on MENA Countries)

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Abstract

Risk is defined as a discrete occurrence that may affect the project for better or worse. Risk management is the process concerned with conducting risk management planning, identification, analysis, responses, and monitoring and control on a project. The objectives of project risk management are to increase the probability and impact of positive events, and decrease the probability of events adverse to the project. The Real Estate fortune in the Arab countries is estimated at about \$23 Trillion USD. The Real Estate Investment Sectors in Arab & Islamic countries were affected by the International financial crisis. In an attempt to identify the Risk Break down Structure (RBS) in the Real Estate Projects in Arab and Islamic countries, a questionnaire survey was conducted to a sample representing different organizations working in this field. Consisting of two main parts, the questionnaire concentrates on the risk components at different risk categories to explore the RBS in the first part. In the second part, risk response strategies were adopted for the negative risks or threats. The survey results build the Real Estate projects Risk Break down Structure. Classifying the risks into Technical, Organizational, External and Project Management related categories, each category was analyzed showing that the most important factors were: lack of financing, international market conditions, prioritization and project dependencies and finally, preliminary/actual study discrepancies. Negative risk response includes: avoidance, transfer and mitigation.

Paper 151, Page: 1290-1297

Robust Value Management: An approach towards satisfying current and future end-users of a building

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Abstract

Value management is a service that is sought by construction clients in pursuit of value for money on their investments. Within some influential policy documents related to the UK built environment, satisfying current and future end-users' needs appears to be emphasised as the essence of achieving value for money. This paper argues that the quest to satisfy current and future end-users comes with implications, including; addressing needs in the face of uncertainty of the future; dealing with conflicting end-user needs; and addressing evolving, poorly articulated, and latent needs that are implicit until they emerge, often following use and experience. Consequently Robust Value Management is proposed as a pragmatic approach to value management that addresses the above mentioned implications. This is through the approach facilitating an emphasis on: keeping options to allow modifications, as necessary, of yet to be implemented parts of a plan; user participation and consensus building; and reflection and iteration to enhance learning. These measures are built into a generic method of implementation.

Paper 152, Page: 1298-1301

Movement is the Cause and Being of All Life

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Abstract

The time has come to change our habits, our behavior, and to consider the necessity of sharing and repairing the Earth's resources, to prevent blaming each other regardless of 'Globalization' and

share equally in the responsibility for worldwide climate problems. We would do better by bringing these problems back to manageable proportions clarifying where we stand, namely, a World fulfilling the basic needs of Mankind. We would do better by creating solutions to problems in a regional manner. Energy reduction and sustainable technology are required and only effective by appropriate local rural and urban planning. Tendencies such as growing (mega-) cities, diminishing food production look like global problems, but usually caused by local circumstances.

Our task as professionals is to find balanced solutions by 'thinking-out-of-the-box'. De Vinci speaks of the Adoration of the Magi, we need not adore our 'climate prophets/magi's', we need to behave as professionals with a comprehensive understanding by approaching these issues inclusively. Introverted disciplinary attitudes must be avoided in order to manage worldwide ecological, sustainable problems and dilemmas. The discussion's complexity requires technical experts and, for example, NGOs across the board. Education will play an imminently important role: students are the bearers of the future.

Paper 153, Page: 1302-1309

The Characteristics of Purpose Built Offices in Malaysia: A Review of Issues

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Abstract

The development of purpose-built office market in Malaysia is basically determined by a supply-demand market. Since the purpose built office market in Malaysia has shown positive developments plus increasing level of competitiveness, many building and location characteristics have emerged during the process of assessment of the office property involving property market appraisal and building performance evaluation. With these characteristics, property

market participants can evaluate their property efficiently based on their needs such as for investment, management, or business planning. Recently, many new characteristics of purpose built office have been revealed according to technology growth and national policy such as green technology, green building index, classification, energy saving and sustainable development. The purpose of this paper is to identify the existing characteristics of purpose built office in Malaysia and discuss the importance of these characteristics. Integral to achieving this objective, research on purpose built office characteristics in a global and local context will also be reviewed. As a result, the issues related to purpose built office characteristics in Malaysia will be identified, and documented with greater rigor.

Paper 154, Page: 1310-1313

Summary Judgment in Malaysian Construction Contract

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Abstract

This paper aims to identify what circumstances, limited as they may, that allow summary judgment to be available to the parties in a building contract mainly through documentary analysis of law journals. The construction contract has built-in potential for conflicts and disputes which arise between the contracting parties. Disputes, if not promptly resolved, will lead to losses and it is necessary for the parties to use the best method of dispute resolution to resolve their dispute. Litigation is one method, but the process takes a substantial period of time to come to determination. Therefore most disputes in construction contracts are resolved by arbitration or mediation. In a litigation process, there are procedures where the parties can obtain quick judgment without going to trial. It is known as a summary judgment procedure. However, it is available only in limited circumstances. Furthermore, it appears that it is not frequently used in construction contract cases. The results show that there are four circumstances where the summary judgment has been made available to the parties in a building contract in Malaysian construction cases. All four of these circumstances are related to claims for progress payments that the employer (or main

contractors) refused or failed to pay to the main contractor (or sub-contractors as the case may be). In conclusion, it can be said that this summary judgment procedure is only suitable for actions claiming undisputed payment.