

Seventh International Conference  
on Construction in the 21st Century

2013



**CITC-VII**  
*Bangkok*

*December 19-21, 2013*

Challenges in Innovation,  
Integration and Collaboration  
in Construction & Engineering

Bangkok, Thailand

Editors

Syed M. Ahmed, Norma Smith,  
Salman Azhar, Catherine Yaris,  
Attaullah Shah, Rizwan Farooqui,  
Ryan Pothyress



East Carolina University  
Department of Construction Management



Proceedings of the

# **Seventh International Conference on Construction in the 21<sup>st</sup> Century**

## **“Challenges in Innovation, Integration and Collaboration in Construction and & Engineering”**

December 19<sup>th</sup>-21<sup>st</sup>  
Bangkok, Thailand

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## Foreword

With a slowly recovering global economy, the construction industry is more relevant than ever. As a large contributor to many countries' GDP, the construction industry will be vital in driving economic growth and development in the 21<sup>st</sup> century. In lieu of this, the CITC- VII conference seeks to bring together an international group of practitioners, researchers, and educators to promote a novel exchange of ideas in a multidisciplinary fashion.

With ever increasing information and technology, there are unprecedented amounts of knowledge being generated. The exchange of this knowledge is vital in the construction industry, in particular with regard to methods and techniques. CITC-VII as a peer reviewed conference is a dynamic conduit for the exchange of this knowledge. New methods and techniques must be carefully scrutinized and rigorously tested before implementation, and the CITC-VII plays an integral role in this process. As the industry moves forward in an ever complex global economy, multinational collaboration will be crucial. Future growth in the industry will undoubtedly hinge on international teamwork and alliance.

This December marks the seventh CITC conference. Previous conferences include CITC-I in Miami of 2002, CITC-II in Hong Kong of 2003, CITC-III in Athens of 2005, CITC-IV in Gold Coast, Australia of 2007, CITC-V in Istanbul of 2009, and CITC-VI in Kuala Lumpur of 2011. All of these conferences were tremendously successful. As with previous conferences, this effort has been greatly supported by our friends and colleagues from across the globe. It is our pleasure to now present to you the *Seventh International Conference on Construction in the 21<sup>st</sup> Century: Challenges in Innovation, Integration, and Collaboration in Construction & Engineering (CITC-VII, Bangkok)*. This two and a half day conference is being held in Bangkok, Thailand at the Bangkok Millennium Hilton. This event has brought together a diverse group of academics, professionals, government agencies, and students from all over the world.

We intend to hold the CITC series of conferences at regular intervals. We gratefully appreciate your attendance, and hope that you will support future endeavors.

Thanks and kind regards,

Syed M. Ahmed

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**ISBN :978-0-9894623-0-3**

**December 2013**

**Printed in Greenville, North Carolina, USA**

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## Keynote Speaker



Dr. Naveed Anwar is the Executive Director of AIT Consulting and serves on its Advisory and Technical Board of Directors. Dr. Naveed also oversees the Asian Center for Engineering Computations and Software (ACECOMS) as Director and continues to teach structural engineering at the School of Engineering and Technology, both situated at the Asian Institute of Technology (AIT).

As Director of ACECOMS, Dr. Naveed has thirty years of extensive experience in development of software, use of computers in engineering application, and computer programming. He is the author of several programs which include ACECOMS GEAR, The SDL-1 Series, SYS DESIGNER, Frame2DX, BUILDCOST, BridgePad and main author of several user manuals and technical documentation for engineering software such as BATS 99 and BATS 2000, NichadaCAD, MonierCAD, CISDetailer, CSISection Builder, RISA Section, CSICOL.

Dr. Naveed has been invited to participate as keynote speaker in 120 seminars and workshops, conducted in 15 countries, and attended by a combined total of 4,000 engineers from 25 countries, including; Thailand, Malaysia, Laos, Cambodia, Pakistan, and Nigeria.

Dr. Naveed earned Doctoral and Master of Engineering in Structural Engineering at AIT and holds a Bachelor of Science in Civil Engineering from the University of Engineering & Technology, Lahore, Pakistan.

## **Cost & Financial Management**

**(Paper 1, ID 31)**

### **The Impacts of FOREX Fluctuations on Construction Business Performance: An Organisational Capabilities Perspective**

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### **Abstract**

Construction projects are a high risk business activity. When undertaking projects in an international context, it is further complicated by the risk of fluctuations in the foreign exchange rates (FOREX). Construction business performance is affected by these fluctuations. They affect progress and cause delays, which in turn create problems for subcontractors, namely cost overruns, disputes, arbitration, total abandonment and litigation. FOREX fluctuations also cause the price of raw materials to increase, leading the cost overruns. Managing FOREX risk is critical and past research have focused on the need for adequate insurance, careful planning and management, and foreign exchange futures hedging to overcome issues that have been caused by the FOREX risk. Analysis of FOREX risk in international construction business usually focused only on issues at the project level. There is currently lack of understanding of Organisational Capabilities (OC) to manage the impacts of FOREX risk, which when examined, are seen in isolation. This paper attempts to bridge the gap by discussing the impacts of FOREX fluctuations on the international construction business. The focus is on the OC perspective and the need to develop OC framework to mitigate the risk in sustaining construction business performance.

### **Keywords**

Foreign Exchange Rate (FOREX),  
Organisational Capabilities (OC), Business  
Performance, Construction Business

**(Paper 2, ID 51)**

### **A Research on Factors Influencing Labor Cost of Construction Projects based on VAR Model**

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## **Abstract**

The construction industry is a labor intense industry in China. In recent years, wages for Chinese workers, especially technical workers, rise a lot which causes the rapidly increase of labor cost in a construction project. Chinese construction enterprises and the industry are heavily influenced and suffering a hard time. In order to find influencing factors of rising labor cost on construction projects, the paper specifies a VAR model based on quarterly data from 2008 to 2013 and uses a Vector autoregression (VAR) model to analyze impacts of correlative factors on average daily wages of construction workers. The conclusion shows that development of the building industry and improving of overall wage level of the society have strong effects on the increase of labor wages. Meanwhile large demand of workers also has vital impact. Therefore influence of CPI is weak. However, there is not a significant relation between labor productivity and labor wages. In other words, the rising of wages are not a representation of efficiency and technology improvements and high cost doesn't bring high productivity for the enterprises. The result tells that current rising labor cost is a cause of industry development and promotion of migrant workers' awareness of rights. Chinese construction companies should take effective measures to deal with the situation and improve the efficiency of the industry.

## **Keywords**

Labour Cost; Construction Project; Impact Factors; VAR model

**(Paper 3, ID 82)**

## **An Assessment of Clients Satisfaction Relative to Building Project Delivery in Nigeria**

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## **Abstract**

The concept of customer satisfaction is regarded as the reason for companies' existence and operations. The underlying factor being continued improvement on quality and production. This study assessed the factors that are responsible for client satisfaction in building project delivery in Lagos State of Nigeria. The primary data for this study was collected through a structured questionnaire survey, distributed to a total sample of 86 clients. Probability sampling techniques was employed for the selection of samples. Simple random sampling was used to select the actual sample size. The questionnaire was administered to target population through post. Inferential statistics was used for the analysis of data.

Findings for the study revealed that high quality of final product is the most important factor responsible for client satisfaction, and next is project cost within budget, followed by project functionality and fitness for purpose. Top among the factors responsible for client dissatisfaction are, cost and time overrun, inability of contractor to fully establish client's needs, and Construction mistakes and defective works. These factors of client's dissatisfaction will lead to considerable amount of rework. Therefore, recommends include that attention should be paid/given to the factors responsible for client dissatisfaction by contractors to completely eliminate them during construction.

## **Keywords**

Building Project, Clients, Project Delivery, Satisfaction

(Paper 4, ID 109)

## **Uncertainties in subcontractor procurement: the case of scaffolding**

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### **Abstract**

The construction industry continuously deals with unique circumstances. Projects are carried through by temporary organisations, consisting of both internal staff and external staff, such as subcontractors. The purpose of this paper is to identify and provide an understanding of how uncertainty affects the process of procuring subcontractors in the construction industry. In order to do this, a literature study describing uncertainty, what types of uncertainty exist in construction projects and how these could be managed, is composed. Furthermore, a case study involving a construction contractor in Sweden is used as a way of investigating how uncertainty affects construction processes. The paper identifies eight key types of uncertainty that affect the process of subcontractor procurement. The findings also confirm that uncertainty does play an important role in projects, manifesting in e.g. cost deviations and time delays. Finally, the paper presents a quantification of uncertainty types dependent on subcontractor procurement processes as a

way of managing uncertainty, along with other recommendations.

### **Keywords**

Construction industry, managing uncertainty, project organisation, Sweden, tendering.

(Paper 5, ID 117)

## **Performance Analysis of Construction Enterprises using Financial Ratios' groupings: An application in the British Construction Industry**

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### **Abstract**

The current research focuses on the use of composite factors composed from financial ratios of annual financial statements for studying the performance of construction enterprises. The research follows the methodology of Ocal et al. (2007) and relies on nine financial ratios, out of the 24 ones initially considered, which make up the composite factors. For this particular study,

financial statements from five of the largest British construction companies listed among the twenty most profitable construction groups in United Kingdom were used. Through principal component analysis it has been able to create three new factors replacing the nine selected financial ratios and explaining 85% of the total variance of the initial factors representing the performance and the financial status of the five construction companies. The new factors identified in this research pertain a) to activity, b) to liquidity and c) to profit margin and development potential of the companies. These three factors can explain the combined effect of otherwise single financial ratios. This approach can be quite useful in examining in a comparative way firms of similar size in the same sector, provided that detailed financial data following the same specifications will be maintained.

#### **Keywords**

Financial Analysis and Ratios, British Construction Companies, Statistical Analysis, Factor Analysis

**(Paper 6, ID 130)**

### **Towards Effective Hedging For Construction Concessions Delays**

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#### **Abstract**

Public Private Partnerships' (PPPs) financial risks are addressed through various financial

instruments including hedging. Hedging arrangements affect the cost of debt or the breakage costs anticipated in termination compensation, while they are associated with significant costs for the concessionaire. Therefore, the capital structuring of a PPP should appropriately integrate hedging as a risk reduction technique that is inherent to the whole project's financial analysis. An appropriately structured hedging strategy should, also, be able to anticipate the occurrence of other risks and especially those that result in schedule overruns. An accurate benchmarking of hedging costs in relation to schedule overruns could increase the effectiveness of the risk reduction strategy by indicating boundary values for both the time period and costs, wherein hedging is efficient in concession projects with construction delays. This paper addresses the issue of applying hedging in PPPs and highlights the implications of schedule overruns to the efficiency of this technique. An approach to ensure the timely evaluation of efficient hedging for reducing risks

### **Procurement Management**

**(Paper 7, ID 54)**

### **Strategies to Manage Risks in Infrastructure Projects**

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#### **Abstract**

The City of Atlanta has utilized several delivery methods in previous water and wastewater infrastructure projects executed so far. The most commonly used in the past ten (10) years has been the Design-Bid-Build method with a Lump Sum Contract Price for project delivery. Facts

related to these projects have provided a common theme of cost overrun and delivery time extensions for each project. The objective of this study was to recommend a delivery method for projects to enhance delivery satisfaction through cost containment and curtailment of project delivery time. As a result of this study, four specific strategies emerged that empowers a public owner, to manage the cost and schedule risks in infrastructure projects. Project size, external design, oversight & management, risk sharing through the delivery method are the four specific strategies that could better manage cost and schedule risks for public owners. One major finding from the study was to utilize a Design-Build delivery method with a unit price contract in infrastructure projects. Suggested changes in the project delivery method would achieve higher productivity for each dollar spent on infrastructure projects.

**(Paper 8, ID 85)**

## **Relationship between Head Contractors and Subcontractors in the Construction Industry: A Critical Review**

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### **Abstract**

The interaction between head contractor and subcontractor in modern construction often contributes to the degree of success or failure of any large-scale construction project. In this paper, previous research on the relationship and interaction between head contractor and subcontractor is examined in order to establish how these relationships will affect the overall performance of a project. Based on the review, research questions on how to best manage the interaction and relationship between these two vital project participants are proposed and future research direction discussed.

### **Keywords**

Subcontracting, Head contractor, Relationship, Dispute, Review

**(Paper 9, ID 90)**

## **A Pragmatic Review of Workforce Motivation, De-motivation and Job Performance in the South African construction industry**

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### **Abstract**

The construction industry employs a high percent of workforce with the highest record of job losses when compared to other industrial

sectors. Notwithstanding, the demand for best performance in construction activity has also increased dramatically. South Africa is among the most financially advanced countries in Africa with only few large construction firms. The biggest challenge in the South African construction industry is an acute shortage of skilled workforce. Most of the construction firms are regarded as unorganized and fragmented in nature. This paper is focused on reviewing the workforce motivation and their impact on job performance in the South Africa's construction industry. The review is part of an ongoing research, which is focused on resolving the current issues of unemployment, shortage of skilled workforce, and poverty in the industry. The paper creates an insight into the construction workforce motivation in the South Africa's construction industry and how the work productivity is influenced.

**Keywords:** workforce motivation, project performance, motivation theories, and contractual procedure

(Paper 10, ID 95)

## Reducing Contract Risks through the Right Contracting Strategy

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## Abstract

Construction contract is one of the most important factors that affect the project success. Construction industry has different characteristics that may lead to claims and disputes between the different parties. The flexibility of owner to make changes during the execution phase, the distribution of risks between owner and contractor and the degree of owner involvement in the project control during construction time may vary from a contracting strategy to another. Typical contracting strategies include cost reimbursement, fixed price or lump sum, continuing services agreement, program management, and long-term partnering agreement. This paper will spot the lights on the details of various contracting arrangements; most commonly used contract clauses, advantages and disadvantages of each strategy, obligations of each party, the distribution of risks between parties, and the appropriate dispute resolution technique for each strategy in the construction industry in Egypt. A questionnaire survey was conducted to a sample representing different parties of construction industry. The first part of the questionnaire addresses factors affecting the choice of contracting strategy, which include: project level of scope definition, the flexibility of owner to make changes during the execution phase, the project cost and schedule considerations, the risk allocation between owner and contractor, and the possibility of applying Alternative Dispute Resolutions (ADR) techniques to resolve disputes. While the second part suggesting the appropriate contracting strategy for each construction party and the right ADR technique to be used in case of disputes arising from the application of the selected strategy.

(Paper 11, ID 99)

## **Interorganizational Cost Management in Australian Construction Alliance**

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### **Abstract**

Project alliancing/alliance is an alternative to traditional contracting methods in procuring infrastructure projects. Over the past decade, alliance has attracted wide research interest. However, previous research has less considered the interorganizational cost management (IOCM) practices in alliances. When looking at alliance as an interorganizational relationship in which both the owner and construction service providers play important roles, IOCM is highly relevant. In this study, IOCM in alliances is defined as contracting parties' coordinated efforts to reduce the shared costs. Through interviews with Australian alliance managers, this study investigated IOCM practices and techniques regarding how alliances develop the project proposal, set target costs, and make cost more effective during the delivery phase. A number of IOCM practices have been identified. As one of the only several studies regarding IOCM in the construction management discipline, this study is the first attempt to explore IOCM in construction alliances. The results indicated that many of the IOCM practices and techniques could also be used in construction transaction relationships.

### **Keywords**

Interorganizational cost management, project alliance, Australian construction industry

(Paper 12, ID 133)

## **Challenges of Private Financing of Building Projects in Lagos State, Nigeria**

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### **Abstract**

The outcome of an impact could be negative or positive. Challenges could pose serious problems, in form of time taken to overcome them, conditions that are to be met to overcome the challenges, and so on. Based on these, the study was initiated. A structured questionnaire survey was conducted in Lagos State. The sampling frame consists of: architects; clients; contractors; quantity surveyors, and engineers. Probability sampling was used for sample selection. Relative to this study, the findings are in two parts, those of the challenges of private financing and of the impact stemming from the challenges. The findings from the challenges to private financing include: poor system of government; high interest rates of banks, and inadequate legislation and gaps in existing statues adversely affect financing of project. Findings regarding impact of the challenges are: difficulty in loan acquisition; low income earnings on investment, and monopoly of building materials, these negatively affect project delivery. Recommendations were made based on the findings.

### **Keywords**

Challenges, Financing, Building Projects, Private Construction

## **Safety Management**

(Paper 13, ID 9)

## **Improving Health and Safety Culture – A Guide for Construction Clients**

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### **Abstract**

Many accidents and a general poor health and safety performance for both the construction industry and other high reliability industries have been blamed on the poor health and safety (H&S) culture that was prevalent at the time. Addressing H&S culture is therefore a very important step to eliminating accidents and thereby improve the general H&S performance within an organisation or industry. The current paper will therefore report on findings from an empirical study on improving H&S performance in a construction project and will also present a guide of how to improve the construction client's H&S culture.

The research conducted in South Africa and Botswana and whose results were modelled using structural equation modelling, found that with a better H&S culture, clients had a positive influence on H&S performance of construction projects. The client H&S culture was characterized by leadership, involvement, procedures, commitment, communication and competence (LIP+3C). A positive manifest of these factors in the client entity entailed a better H&S performance at project level.

This paper will therefore present a guide on how construction clients may improve their H&S culture and thereby impact positively on project's H&S performance. Further, the guide will exemplify how the concept of H&S culture may be operationalised in order to benefit from a concept that has been mooted as the panacea for the H&S problem in the construction industry as well as the concept that has been at the centre of major industrial disasters.

**Keywords:** clients, culture, Health and Safety, LIP+3C

(Paper 14, ID 16)

## **Studies of Accident Costs and Safety Investment in Construction: The Hong Kong Experience**

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### **Abstract**

Owing to the commencement of the Ten Mega Infrastructure Projects, the construction industry in Hong Kong is now enjoying the "Golden Ten Years". A significant growth in the construction industry implies a large amount of construction workers are working at construction sites and subsequently, safety issues in construction become a prime concern. In recent years, the promulgation of stringent safety requirements and regulations by the relevant government departments has driven contractors to provide more resources in safety management. As a result, the accident rate in the construction industry reached the lowest record of 49.7 per 1,000 workers in 2011. Through an investigation of previous research findings and relevant government's official publications, this paper is going to explore the relationships between safety investment and costs due to construction accidents, Gross Domestic Product (GDP) and insurance claims within the Hong Kong construction industry.

### **Keywords**

Construction accidents, safety investment, Insurance claims, Gross Domestic Product (GDP), Hong Kong

(Paper 15, ID 83)

## **Workplace safety implications of cultural diversity on Australian Construction Sites: A pilot study**

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### **Abstract**

Cultural diversity has become a distinctive feature of Australia's construction workforce. There is a need for a systematic investigation into the cultural divergences among workers in different ethnic groups and their implications for the workplace health and safety management in the construction industry. This research was proposed to examine the workplace safety implications of cultural diversity issues on construction sites. As the pilot study of a 3-year research program, this paper aims to identify potential workplace safety issues caused by cultural diversity on construction sites. Data were collected through semi-structured interviews with 10 safety professionals. The results of the semi-structured interviews indicate that cultural diversity has an influential impact on many aspects of safety practices on construction sites, e.g., management commitment; communication; workers' involvement; supportive environment; supervisory environment; personal risk appreciation; work pressure; training and

education; and rules and procedures. The issues that were identified from the semi-structured interviews will be used to develop a quantitative data collection instrument which aims to develop a framework for managing construction safety in a multicultural workforce (the second stage of this research).

### **Keywords**

Construction, safety, cultural diversity, Australia

(Paper 16, ID 84)

## **Managing Occupational Health and Safety Risks in Precast Factories: A Case Study in Australia**

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### **Abstract**

Statistics show that precast factories are linked to a high degree of occupational health and safety (OHS) risks. The aim of this study is to analyse the health and safety risks in precast factories in Australia through a case study. The specific objectives of this research are (1) to identify OHS risks in precast factories; (2) to investigate the severity and occurrence of those risks; (3) to rank those risks to help devising appropriate cost-effective control measures. A case study was conducted to obtain quantitative



data regarding OHS risks in a precast factory. A data collection instrument was designed to facilitate the collection of data. Participants at the selected factory were required to rate the identified hazards in terms of frequency and severity. The results indicate that the most significant risks identified in this case-study were traffic hazards, machinery hazards, occupational noise hazards, airborne hazards and hand and power tools hazards. The results may provide better understanding of OHS risks in precast factories in Australia and be used to help decision makers of the precast factories to formulate cost-effective control measures for the precast factory in Australia.

### **Keywords**

Risk management, occupational health and safety, precast factories, construction, Australia

**(Paper 17, ID 92)**

## **On-site wear trials to determine construction workers' preference for two types of cooling vest in combating heat stress**

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### **Abstract**

It is recognized that construction workers are always exposed to a high risk of heat-related illness during summer months in Hong Kong. Providing suitable personal cooling vest to construction workers is one of the effective and feasible measures to alleviate heat stress. In order to evaluate the effectiveness of two kinds of cooling vest, namely, 'frozen gel vest' (Vest A) and 'frozen gel and fan vest' (Vest B), and determine construction workers' preference for these vests, three field studies were conducted in construction sites during summer months of 2012 to assess the subjective and physiological responses of thirty-six construction workers when wearing these cooling vests. In this survey, no significant physiological differences between the two vests were detected. In terms of subjective preference, construction workers preferred Vest B to Vest A ( $p < 0.05$ ). The results of workers' perceptual responses indicated that Vest B was significantly better in the following attributes ( $p < 0.05$ ): being drier, lighter, smoother, more pliable, easier to move, more comfortable, and more practical. The common shortcoming of the two cooling vests was their temporary cooling effect as perceived by the workers. Additional comments provided by the subjects shed light for potential improvement on the cooling capacity and acceptability of the cooling vest in future.

### **Key words**

Construction workers, heat stress, cooling vest, wear trial, physiological and subjective response

**(Paper 18, ID 127)**

## **Measuring Construction Safety Climate in Supervisory Environment with Multi-level Analysis on Projects in Pakistan**

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### **Abstract**

Supervisory level acts as conduit to proper implementation of safety on construction projects, lie in the alignment of safety perceptions of cross supervisory levels which includes sub-engineer/overseer, inspector and superintendent. This study focused on within group consensus and differences among the supervisory representative in terms of safety climate. Safety climate of overseer was found positive, partially positive for contractors and weak for consultants. There is no significant difference between safety climate of superintendents and inspectors. Overseers have highly significant difference in perceptions of safety climate with inspectors. Variation in perceptions leads to distraction of safety instruction from managerial level towards front line workers level and cause non-conformance of stake-holders as overseer, inspector and supervisor to attain zero level accident on projects. Positive and clear perception of supervisors at cross level increase effectiveness of safety implementation in construction operations.

### **Keywords**

Safety climate, Supervisory level, Safety performance, Construction, Pakistan

(Paper 19, ID 128)

## **Relating Construction Safety Performance Lagging and Leading Indicators**

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### **Abstract**

Injury/fatality rates in construction have been increased in last decade and mostly unreported due to lack of legislative body for administration of occupational health and safety in economic sectors. There is major difference found in types of construction accidents investigated in previous research studies and national statistics. Highlighted types are tool accidents; fall from height; struck by material; heat strokes; head and eye injuries which are mainly caused by defective equipments with low maintenance operated by operatives with less knowledge. Recording accidents including injuries and fatalities with proper investigation on construction sites is a lagging indicator used by contractors to measure their safety performance in specific period of time fortnightly, monthly, quarterly, biannually and annually. These statistics are used in project reports to head office and even clients. Few construction firms analyze the cost of accidents and incorporate in site overheads. Contrary, safety climate is mostly adopted leading indicator which is a measure of psychological construct of safety culture defined as product, manifestation, indicator, abstraction; snapshot and temperature of safety on construction site. A safety climate questionnaire survey (based on likert scale 1 ~ 5) was conducted on twenty three construction sites of diversified types as infrastructure, high rise buildings, facility buildings, roads and bridges. 76% of response have been received from sixty one workers of different trades (for work, steel fixing, concreting, plaster, scaffolding and related helpers). Results showed mean score of safety climate statements (related to construction hazardous, incidents and accidents) revealed as investigations are mainly used to identify who is to blame (3.61); my supervisor/safety manager welcomes reporting safety hazards/incidents (3.70); in our work environment working with defective equipment is not allowed under any circumstances (3.61); and accidents which happen here are always

reported (3.82). Responsibility of accidents is not taken by either management or workers but role of supervisors is also critical which relate safety issues with self-performance. Productivity has given priority on safety due to tight schedules on construction projects which urge managers and supervisors to ignore hazardous conditions. Major reason of accident is defective equipment endorsed in psychological perspective including site ergonomics and, plant and equipment. Accident reporting is not efficient part of site culture as contract based or daily wage workers have job insecurity which leads number of incidents to a severe accident. There is clear weak relation between lagging and leading indicators of safety performance as most accidents are happening due to tools but workers perceive that proper PPE is provided and no tools are defective. In light of current study, it is recommended that construction firms should provide tools and equipment without defects and well maintained site environment.

#### **Keywords**

Accidents, Safety climate, Workers, Safety performance, Pakistan

**(Paper 20, ID 132)**

### **Towards an Exploration of Safe Work Method Statements as a Safety Management Strategy in Construction: Background and Theory**

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#### **Abstract**

Construction is one of the largest industries in the world, hence is an important contributor to the social and economic fabric of our society. However, it is also the most dangerous because

of the high number of fatalities and incidents experienced by construction workers. Compared to manufacturing, however, construction is generally a more complex industry to work in, and this creates additional challenges for policy makers, researchers and practitioners. There is no doubt that more innovation solutions for managing safety in the industry are needed. Regulators in Australia, however, have continued to rely on contemporary approaches for managing safety in the industry. This paper briefly discusses the state of construction safety in Australia and some of the complexities that characterizes construction. Next one contemporary approach, safe work method statements is introduced, followed by a discussion of four myths around its use as a safety management strategy. Resilience engineering is then introduced as an innovation in safety management, and a proposal put forward for researching resilience engineering using SWMS. The paper concludes with a discussion on two organizational theories upon which such research can be advanced.

#### **Keywords**

Construction Safety, Safe Work Method Statements, Systems Theory, Resilience Engineering, Social Construction.

**(Paper 21, ID 136)**

### **An Assessment of the Combined Effects of Quality and Safety on Construction Productivity- The US Experience**

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## **Abstract**

Quality and safety concerns have been main issues in construction industry for a long time. Previous researchers suggested various theories and models to increase quality and safety in organizations from construction and other industries. There is a plenty of work pointing out the importance of quality and safety but their combined impact on productivity still needs further investigation. This study aims to reveal the mutual influence of quality and safety practices on productivity in the limits of construction industry and gather information about the current perspectives of construction companies regarding the correlation of quality, safety and productivity. This objective was achieved by a two-step approach. Firstly, the existing quality and safety management practices were examined by a detailed literature review. Secondly, a survey was conducted to learn U.S. construction companies' perspectives and applications for quality and safety management as well as their impression on productivity in construction. The survey enabled the researchers to gather information about the current situation and point of view of the U.S. construction companies. Additionally, questions regarding the interrelation of these three concepts were analyzed. It was learned that the companies were aware of the correlation among quality, safety and productivity; however they need to exert more practical efforts to execute their ideas in real working environment.

## **Keywords**

Quality, Safety, Productivity, Mutual influence, Correlation

(Paper 22, ID 137)

## **An Empirical Assessment of Factors Affecting Safety Performance of Subcontractors: The US Industry Perspective**

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## **Abstract**

Subcontractors perform most of the construction works which is apparent in different activities of construction. Therefore, subcontractors need more attention in order to minimize the fatalities and accidents in the industry. The aim of this paper is to identify, evaluate, and rank factors that influence safety performance according to their relative importance. The study was initiated with literature review in the area of safety management, however the study heavily relies on the primary data that is collected via questionnaire survey. The analysis of the responses concluded that reported accident rates will decrease among subcontractors and their workers if new workers are trained well, on the work site workers are informed about dangerous places, a workable safety plan is well preplanned. The results also showed that reported accident rates increased among subcontractors when old, unsafe equipment is used and due to difficulty of the construction sites. From the analysis of the responses, it is recommended that owners and General Contractors need to stipulate strict clauses for safety in the contract for improving safety record of subcontractors, construction workers must receive proper job related safety training and subcontractors and workers should attend continuing safety programs on regular basis as part of their perquisite to work on construction sites.

## **Keywords**

Subcontractors, safety management, safety plan, safety training

## **International Issues**

(Paper 23, ID 21)

# **Evaluating U.S. Air Force Construction in Afghanistan: Applying Lessons Learned to Future Austere Construction**

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## **Abstract**

In order to support U.S. national strategic objectives as well as operational commanders' tactical objectives, wartime military construction often represents one of the primary components for not only defeating enemies, but also for fulfilling the United States' greater strategy of democratic nation building. In the troop surge associated with OPERATION ENDURING FREEDOM in Afghanistan in the early part of this decade, the U.S. military faced unprecedented challenges in accomplishing billions of dollars of construction throughout Afghanistan. The Air Force Civil Engineer Center was responsible for managing several billion dollars of construction projects for the Army Corps of Engineers who were nearly over-capacity with their even larger program. The projects served both U.S. and Afghan military interests. As the United States works towards their 2014 deadline for redeploying back from Afghanistan, this paper evaluates construction metrics like cost and time growth for projects completed from 2006 to 2012. Best business practices to overcome austere construction challenges and recommendations to improve future construction programs in developing nations are presented. Specifically, the authors propose globally shared information resources

for construction standards and methods in austere areas around the world.

## **Keywords**

Afghanistan, Air Force, Central Asian States initiative, Construction in Developing Countries, Construction Metrics, Contingency Operations

**(Paper 24, ID 89)**

## **An investigation of the critical factors affecting the delivery of low-income housing and their effects on residents' satisfaction**

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## **Abstract**

The South Africa Constitution (Section 26) states that all South Africans should have the basic right of access to adequate housing. The South Africa State has been empowered to utilize all legislative and economic resources at its disposal, in order to achieve this right as stipulated in the constitution. Though the state has mobilised resources and manpower to achieve these objectives, many challenges remain in the facilitation and provision of adequate affordable housing for the low-income groups. This paper presents findings on the critical factors which affect the delivery of low-income housing in South Africa and the effect of these factors on the residents' satisfaction with their housing units. Data used in the study was obtained through a Delphi Study, where the views of housing experts were solicited on the critical factors which affect low-income housing delivery in South Africa. Since panellists form

the cornerstone of the Delphi Technique, clear inclusion criteria was applied and as a means of evaluating the results and establishing the study's potential relevance to other settings and populations. Hence, each expert was required to meet at least five criteria's. These include the length of residency in South Africa, educational background amongst others. Results emanating from the study revealed that seven factors were considered critical by the experts after consensus was achieved. Amongst these include: limited budget (dwindling tax base) and the lack of appropriate policy to handle informal settlement upgrading, etc. The study contributes to the body of knowledge on the subject where no consensus has been reached pertaining to the critical factors affecting the delivery of low-income housing in South Africa. However, a limitation of the study was the reliance on a structured questionnaire survey in the three iterative rounds of Delphi technique to reach consensus and experts were not allowed to add any more indicators.

### **Keywords**

Low-income, residents' satisfaction, Delphi technique, subsidised housing, South Africa

**(Paper 25, ID 101)**

## **An Empirical Analysis of Macroeconomic Factor that Affect the International Construction Market**

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### **Abstract**

Over the past decade, the international construction market has been sensitive to macroeconomic issues, such as the East Asian currency crisis and the later global financial crisis. Although this market has emerged as an attractive market for multinational enterprises, the influences of macroeconomic factors pertaining to the construction industry have rarely been examined. In relation to this, this paper aims to analyze the effects of macroeconomic factors on the international construction market empirically. Through an extensive literature review, five major factors are initially derived (gross domestic product, the dollar exchange rate, the oil price, stock indexes, and the trade balance). We then collected panel data from a Korean national sample over a period of 21 years (1990-2010). Using the vector autoregression model (VARM), we analyzed the relationship between macroeconomic factors and the international contract volume of Korean construction firms. The results show that of the five major factors, the oil price had the largest correlation compared to the other factors, as most of the international contracts were in Middle Eastern countries in which oil is procured. This implies that international construction fluctuates due to macroeconomic factors and that consideration of these factors is needed for a successful project.

**(Paper 26, ID 107)**

## **Improving work-life balance of civil engineers in UAE**

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### **Abstract**

The United Arab Emirates (UAE) has one of the highest per-capita expenditure on construction and the industry employs 15% of the total workforce. The intense pace of construction activities places a high demand on professionals working in this industry. This study investigates the work-life experiences of civil engineers working in the UAE in relation to job satisfaction, motivation, challenges and the effects of multicultural diversity at the work place. The effects of work life on family life, the responsibility of the organisations towards employees' well-being and the need for work-life balance policies are also considered. The research data is collected through face to face interviews using a semi-structured questionnaire. Interview transcripts are analysed and categorised inductively into themes for descriptive analysis. The study shows that a majority of civil engineers are dissatisfied with their work life balance. There is an overwhelming desire for flexible working hours, yet it is currently offered by very few employers. The paper concludes that the negative work-life experience of civil engineers could impair their performance. Construction companies should adapt work-life balance policies and provide the necessary training and support to maintain their well-being.

### **Keywords**

work-life balance, motivation, UAE

## **Information Technology**

(Paper 27, ID 91)

## **Contractor Quantity Surveyor Using ERP System in Cost Reporting**

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### **Abstract**

Quantity surveying is the key profession in cost management for construction business. However, construction industry is notorious in using information technology that makes reporting inefficient. A construction company in Hong Kong has been using an enterprise resource planning system as the information communication technology in management and cost reporting backbone since 2003. This paper investigates if such system represents an efficient tool for quantity surveyors and any intervening actions are required to enhance its efficiency. In doing so, a team of surveyors interviewed and then the soft system methodology was used as the research approach to depict the situation. This leads to the improvement needs and list of actions. Participants have prioritized working closely with top/senior management to design a proper report format; avoiding unnecessary adjustments and undue influence to reporting, and ensuring accurate data as the top three critical actions crucial for reliable cost reporting.

### **Keywords**

Cost Management, Cost Reporting, Enterprise Resource Planning System

(Paper 28, ID 106)

## **A Comparative Study of Classification Methods for Contractor Prequalification Models**

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### **Abstract**

Contractor prequalification has been an important issue in construction business practice and academic research studies for quite a long time. The main objective of contractor prequalification is to differentiate contractors that have the necessary financial, physical, and human resources to undertake construction work for those that do not have such resources. This objective is commonly achieved by using either statistics-based or machine learning-based classification methods. A succinct review of previous contractor prequalification models revealed that there is no comparative study available in the construction management literature for evaluating the relative performance of the various classification methods. The research presented in this paper addressed this missing research issue by using simulation experiments to compare the relative classification performances of logistic regression (LR), artificial neural networks (ANNs), and support vector machines (SVMs) for the combinations of two different data characteristics, i.e., 1) the strength of correlation between input variables and 2) the complexity of the functional relationships between input variables and the output variable. The results of the simulations suggested that SVMs consistently outperformed ANNs and LR.

**Keywords:** Contractor prequalification, statistical, machine learning, performance, classifiers.

(Paper 29, ID 119)

## **A Study of Using Digital Photos to Document Construction Progress**

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### **Abstract**

The use of digital photos for documentation in the construction industry has vastly improved over the last several years. As technology has improved, so have the benefits of photo documentation on construction projects. This study purposes to investigate the benefits of the current photo documentation services available to contractors and owners, with an emphasis on owners. As part of this research, an interview was conducted with a representative of one of the leading companies that provides this service, a case study was reviewed on a construction project that the owner chose to add the photo documentation service, and questionnaires were sent to numerous contractor and owner representatives. This research provides that there are benefits to the owner and contractors in many areas of construction. The owners in this study agree that the photo documentation provides better as-built documentation, improves their involvement on the project by being able to view updated progress remotely, and reduces maintenance and upgrade costs over the life of the facility.

### **Keywords**

Digital Photo, Construction Documentation, As-built Photos



(Paper 30, ID 120)

## **A Preliminary Study of the Use of Tablets and Their Applications On Construction Jobsite Operations**

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### **Abstract**

Over the past years, tablets have changed the way we think about technology. A person can download an application, and in a matter of minutes, completely alter the interface and function of the machine. Researchers have conducted a study to investigate tablets and their applications and how they are impacting construction jobsite operations. The basis and scope of this study includes review existing research and publications, and conducting surveys and interviews with employees who have constructed basic building projects with tablets. The result of this study leads to the conclusion that tablets and their applications are helping save time and money and help overall constructability. Data collected also gives insight in to how effectively tablets are being used on jobsites and what the future holds for tablet technology in the construction industry. This paper introduce details of this research study and presents preliminary findings of its literature review.

### **Keywords**

Tablets, iPad, Android, IT, Information Technology, Construction, Apps, Applications

## **Risk Analysis and Decision Making**

(Paper 31, ID 146)

## **Investigating Delay Factors of Construction Projects in Metropolitan City of Lahore**

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### **Abstract**

The problem of delays in the construction industry is a global phenomenon and new metropolitan cities like Lahore is no exception. The main purpose of this study is to identify the delay factors and their impact (effect) on project completion and allocation of responsibility for delay causes. Earlier studies either considered the causes or the effects of project delays, separately. This study takes an integrated approach and attempts to analyze the impact of specific causes on specific effects and allocation of responsibility .A questionnaire survey was conducted to solicit the causes and effects of delay from clients, consultants, and contractors. About 26 respondents participated in the survey. This study identified 10 most important causes of delay from a list of 53 different causes and as result different effects of delay. Ten most important causes were: (1) Delay in Payments, (2) Poor Weather Conditions, (3) Less Use of Highly Technology Mechanical Equipment's, (4) Ineffective Planning and Scheduling of Project, (5) Rework Due To Errors during Construction, (6) Delay Due To Subcontractor, (7) Poor Site Conditions, (8) Coordination Problem with Other, (9) Late in Reviewing and Approving Design Documents, and (10) Unclear Design Details in Drawing. Five main effects of delay were: (1) time overrun, (2) cost overrun, (3) Arbitration, (4) loss of interest of stakeholder

and (5) black listing. This study has also established an allocation of responsibility for each group of factors causing delay in construction projects. Overall responsibility allocation shows that contractor has 40%, consultant 21%, owner 9%, and 30 % responsibility shared among the stakeholder due to contingencies. This study helps foreign and indigenous stakeholders to monitor and control delay risk by understanding pivotal causes in context of Lahore.

### **Keywords**

Delay factors, Delay effects, Construction projects, Lahore

## **Environmental Management**

(Paper 32, ID 103)

### **Implementation of ISO 14001 Environmental Management System in the Macau Construction Industry**

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### **Abstract**

Macau, a colony of Portugal for over 400 years, has been developing at an amazing pace since the opening up of the gaming industry in 2001. This economic growth resulted in a long period of booming in the local construction industry. Though the ISO 14001 environmental management system standard has been adopted in many parts of the world since early 2000s, its adoption in the Macau construction industry is still slow. It is estimated that only around 10% of the local contractors have implemented the system. In order to explore the contractors'

attitude towards the implementation of ISO 14001, a questionnaire survey was conducted together with interviews with contractors with and without registration to ISO 14001. The results indicated that the majority of contractors do not plan to implement the standard because there is a lack of incentive and motivation from the government. Extra financial burden is also one of the main obstacles as most local contractors are small-scaled. Due to high operating costs, those contractors certified to ISO 14001 have perceived a reduction in competitiveness as most clients do not include the standard as a criterion for tendering.

### **Keywords**

Environmental management system (EMS), ISO 14001, construction contractors, Macau

(Paper 33, ID 105)

### **The Development of the Municipal Solid Waste Recycling Dynamic Model at Transfer Station**

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### **Abstract**

With the high amount of municipal solid waste (MSW) in Bangkok, Thailand, a number of efforts to reduce and recycle the MSW were performed. However, landfilling is still be the most usual destination for MSW in Bangkok. Landfilling method might lead to a number of environmental problems such as water and air pollution and gas emission. Apart from that, the higher land cost and more restrictive

environmental regulations regarding the siting and operation is hard to manage. Some efforts to reduce and recover the MSW were performed in Bangkok, in order to reduce more waste. Householder is one of the factors that help in reducing MSW. Recycling program implemented could lead to reduce more waste by householder, besides that, the other factors such as; private sector and public sector (government) could help in reducing waste also. This paper, therefore, utilizes system dynamic modeling to develop the model based on factors and related relationships that affect the amount of recycled MSW, in order to help decision-makers to assess MSW recycling waste situation in Bangkok. The simulation results could help make the proper recycling plan to reduce the landfill usage.

### **Keyword**

Municipal solid waste, Private sector, Public sector, Recycling, System dynamics modeling

**(Paper 34, ID 110)**

## **Case Study: Cost Analysis For The Implementation Of The Clean Water Act And Storm Water Pollution Prevention Plan**

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### **Abstract**

This paper presents a cost analysis and a description of a qualified storm water pollution prevention practitioner (QSP) for the implementation of the Clean Water Act, more specifically for a Storm Water Pollution Prevention Plan (SWPPP). Keeping harmful pollutants out of storm water has become an important aspect for construction in the United

States of America. Through laws and regulations, constructors are required to take precautionary measures to ensure pollutants stay on jobsites as opposed to running into the storm water system. This paper will break down the costs associated with storm water pollution prevention on a twenty-five acre, \$70,000,000 high school project that had a construction schedule of two years. The primary roles of the QSP for this project is also discussed. Cost analysis was taken from historical data and was applied in a quantity takeoff. The SWPPP cost for this project was 0.25% of the total project cost. This equated to 1/12<sup>th</sup> of the constructors profit. Additionally, the cost savings of having an internal QSP versus hiring a third party consultant are provided and discussed.

### **Keywords**

Storm Water Pollution Prevention Plan (SWPPP), Clean Water Act (CWA), Qualified SWPPP Practitioner (QSP).

## **Total Quality Management**

**(Paper 35, ID 141)**

## **Role of Leadership towards implementing TQM: The US Experience**

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### **Abstract**

Total quality management can be a key element of a successful business but if not properly implemented can also lead to failure. This occurs in many cases because there is a substantial lack of understanding on the part of

individuals tasked with implementing total quality management programs. One bottleneck for TQM implementation is the leadership and employees of an organization. Academics and practitioners both agree that appropriate managerial leadership is one of the factors that affect the successful implementation of TQM. Owing to the importance of leadership towards TQM, this study investigate the leadership behavior and its skills set on the successful implementation of the total quality management and how does leadership play its role in the total quality management. The instrument used in the study was a survey questionnaire which consisted of 49 questions for a sample that consisted of 50 executives and managers who are working under functional heads of operations, marketing, human resources, and finance departments working in the U.S construction industry. The analysis is carried using descriptive statistics and simple correlation analysis. Conclusively, the study reveals a moderate relationship between leadership and success of TQM and high dispersion (incoherence among the respondents) was found between leadership and successful TQM implementation. The authors argue that sustainable and successful TQM implementation can be achieved through persistence, positive hands-on leadership, upfront preparation and continuous maintenance of a successful plan.

### **Keywords**

TQM, Leadership, U.S construction industry, TQM-Leadsship relationship

## **Lean Construction**

(Paper 36, ID 39)

### **Construction Workers' View on Standardised Work Procedures and its Influences on Freedom and Innovation**

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### **Abstract**

Implementation of standardisation in manufacturing has been considered straight forward, contrasting the construction industry. This is often explained by a uniqueness of the construction industry and a traditional resistance to change. This paper presents an empirical study performed within a large Swedish housing development company, which is leading in standardisation and one of the first construction companies in Sweden that attempts a large-scale implementation of standardised work procedures. Interviews were conducted with 23 construction workers and five site managers, as well as the head of production development. The results show that standardised work procedures affect construction workers freedom and innovative thinking negatively as well positively. In terms of contextualising the role of the workers, the workers seemed adamant about that it could never be fully contextualised. This study adds to the understanding of standardising operations on construction sites in Sweden.

### **Keywords**

Standardisation, Construction industry, Change management, craftsmanship, Lean Construction.

## **Information Systems**

**(Paper 37, ID 27)**

### **The impact of information sharing misalignment in the Thai construction industry**

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#### **Abstract**

Conventional construction process of design-bid-build is being used by most multi-national construction companies in Thailand. During detailed design development there are many elements not incorporated into designs, including constructability, often relegated to on-site construction processes by design engineers. There is sometimes misalignment between information needed by design engineers and by construction engineers, both from each other and from other stakeholders such as clients, architects, designers, project managers or suppliers. This problem is not always seen as a management problem in companies because construction management is seen only as a subset of an engineer's or an architect's work. This research uses conceptualizations of information sharing theory to identify points where information / knowledge sharing are misaligned and its impact on the building design and construction processes, using multiple case studies of major construction projects in collaboration with construction stakeholders. The research shows that resolving the knowledge/information sharing issue is essential in construction projects to improve quality of built environment design, to minimize design changes, to increase the accuracy of cost estimation and budget control, enable more timely project completion and improve owner and stakeholder's satisfaction. The research will assist Thai construction companies to add value to the construction processes and demonstrate the capabilities of the Thai construction industry that can be transferred elsewhere.

## **Keywords**

Construction information management, information sharing misalignment, information integration

**(Paper 38, ID 28)**

### **Information management/sharing problems during the inspection stage of construction: A case study in Australia**

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#### **Abstract**

Information is one of the vital assets to the organizations irrespective of its industries. If information is utilized effectively in the construction process, it will allow users to plan, operate, and make decisions to maximize benefits. This paper reports the information management practice problems among stakeholders during the inspection stage in a building construction project in an Australia urban-based university. The study explores how specific information was generated, recorded, disseminated, used and stored during the inspection stage in the construction process through the roles of architects and builders. Data was collected over 14 week period through

document analysis, shadowing, observations, photography, and one-on-one interviews with builders and architects involved in the project. The research shows that information was recorded, stored and reused through both personal and enterprise information management; that stakeholder's tacit knowledge played an important role affecting how the information was generated, stored and reused; and that the complexity of information and dynamic nature of procurement method used in this project had an impact on how information was utilized during the inspection process. The paper concludes with suggested methods to record unstructured information generated on-site and better ways to utilize and reuse information in construction.

### **Keywords**

Information Sharing, Information management, Construction Defects Inspection

## **Knowledge Management**

(Paper 39, ID 96)

### **Sticky knowledge and the role of Human Resource management in facilitating the knowledge transfer process**

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### **Abstract**

This paper presents a brief literature review of sticky knowledge and both Knowledge

Management (KM) and Human Resource Management (HRM). It also presents the link between these two concepts. The paper also explores the role of KM and HRM both in sustaining Intellectual Capital (IC) within an organization, particularly in the case of hiring for employees' replacement. Further, it also explains the relationship of HRM's main domains such as: selection, training, appraisal and rewards with KM in detail and their roles in the effective installation of KM system. Based on the literature review, it argues that a new worker could be transformed to a knowledge-worker if appropriate transition processes were in place for knowledge retention and captured from out-going employee. This paper also confirms that the learning organizational structure provides conducive environment for employees to realise his/her potentials.

### **Keywords**

Knowledge Management, Human Resource Management, Intellectual Capital, Sticky Knowledge

(Paper 40, ID 98)

### **Knowledge Management Tools and Techniques Used in the Australian Construction Industry**

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### **Abstract**

Knowledge is considered as a unique asset and its significance is becoming increasingly appreciated by scholars and, more recently, practitioners. Many research studies were

carried out in order to understand how to efficiently benefit from this asset. Knowledge management (KM) aims to organise knowledge through six main aspects, which are: (1) Creation; (2) Identification; (3) Storage; (4) Capturing; (5) Transfer; and (6) Mapping. Each of these six aspects consists of several KM tools/techniques (T/Ts) which can be used to achieve their purpose. Through a detailed review of the previous literature on the topic of KM, a list of major T/Ts used in each of these aspects were identified and used as a framework for further investigation. This research aimed to present an investigation on the use of those KM T/Ts in the Australian construction industry (ACI) context by identifying the extent of use and effectiveness of those T/Ts and outlining the key barriers to their implementation. This was achieved through an organised research method which included the use of questionnaire surveys of construction firms around Australia, and interviews with senior representatives of construction firms. The findings from the quantitative phase of this research identified the top five T/Ts used among the sampled companies; these are: (1) Softcopy databases; (2) Office automation systems; (3) Internet for research purposes; (4) Hardcopy databases; and (5) Project reports. The qualitative section of the research provided support and explanation to the results from the quantitative survey. More importantly, the qualitative phase identified the key barriers in the implementation of KM T/Ts, which were categorised into three main factors: (1) resources; (2) time; and (3) organisational culture. Based on these findings, the paper provided a number of practical implications regarding the use of KM T/Ts in the industry, aiming to overcome the barriers and enhance the use of those T/Ts.

### **Keywords**

Australia, Barriers, Construction, Knowledge Management

## **Design and Build**

(Paper 41, ID 93)

### **Developed Design and Build: Changing procurement landscapes**

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### **Abstract**

Calls to integrate design and construction in order to improve the effectiveness of the UK construction industry have played a central part in construction best practice advice over the last 70 years. The latest Government Construction Strategy repeats this call and harnesses a range of new procurement routes in order to meet this need (GCS, 2011). This research explores the nature of Design and Build in use in the UK construction industry. It finds that developed forms of Design and Build are becoming increasingly popular with a large amount of degree of pre-contractor design and specification development. The principal reason for this movement is risk transfer with various sub-categories that are explored in turn. It is argued that this move to more developed forms of Design and Build are counter to the prevailing calls for integration in the industry.

### **Keywords**

Design and Build, Traditional Contracting, Procurement, Integration, Risk Transfer

## **Sustainable Construction Technology**

(Paper 42, ID 13)

### **Insights about Concrete Spalling in a South African Region**

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### **Abstract**

Cosmetic and structural damages due to concrete spalling could manifest as a result of poor concrete pouring, harsh chemical actions, and in extreme cases, exposure to freezing temperatures. Given the impact that this anomaly could have on project performance in terms of the frequency of defects and rework, a study was embarked upon so as to examine the issue from a regional perspective in South Africa. The overall objective of the study was to identify the causes of concrete spalling among the general contractors (GCs) interviewed so that remedial measures suitable for the region can be put forward. The findings based on the semi structured interview instrument used for the study indicates that indeed concrete spalling could be a major problem in the regional industry. It was discovered that concrete usually suffer from damages arising from acid attacks (sulphates and carbonation) that cumulates in corroded reinforcements. The respondents perceived that a combination of inadequate concrete cover and workmanship perpetrate the malaise, especially at Port Elizabeth. In order to circumvent concrete spalling induced rework in the industry, it can be argued that improved

specification writing and craft workmanship should be engendered.

**(Paper 43, ID 17)**

## **Life Cycle Cost Analysis of Green Construction Sites**

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### **Abstract**

Due to the tremendous growth of construction and infrastructure in most of the countries with the high shortage of raw materials, the various stakeholders are compelled to adopt Green technologies and management techniques for the project. Construction industry in India is considered to be one of the largest economic activities which is growing at an average rate of nearly ten percent as compared to the global average of five percent and contributes ten percent of Gross Domestic Product. Life Cycle Cost (LCC) provides a significantly better assessment of the long-term cost effectiveness of a project than alternative economic methods that focus only on first costs or on operation related costs in the short run. Green building is a way of enhancing the environment, which benefits human wellbeing, community, environmental health, and life-cycle costs. It belongs to the concept of “sustainable development,” which also serves as the driving force. An attempt has been made to analyze the life cycle cost of building construction site has been carried out in this research. The research outlines the various cost involved at various stages of project construction site and estimates the Savings to Investment Ratio (SIR). The study estimates Adjusted Internal rate of return (AIRR) of the Green project construction site with that of conventional site. The comparative results of



this study between green project construction site and conventional site of similar scale highlighted the cost saving and advantages to the stake holder in adopting the green techniques.

### **Keywords**

Life cycle cost, Green construction projects, AIRR, SIR

**(Paper 44, ID 55)**

## **Evaluation of Double Skin Facades**

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### **Abstract**

Double-skin facades used in intelligent buildings provide natural light, heat and solar control, noise isolation and most importantly, natural ventilation. This study aims to evaluate the double skin facade systems according to design criteria and helps the designers and builders to take the right decision for double-skin facade system selection. The evaluation has been done to the multi-storey, corridor-type, shaft-type and box-type facade systems. The criteria affecting system selection in double-skin facade systems are identified as noise and heat conductivity, day lighting, wind and fire resistance, cost, aesthetics, and construction process. A survey was prepared to evaluate the double-skin facade systems and design criteria. The survey was sent out to 34 individuals, but the responses of only 21 individuals with prior experience in similar construction and project activities were evaluated. Architects and engineers actively working at construction yards answered the survey questions. Facade systems are evaluated for each design criteria (noise and heat conductivity, day lighting, fire and wind resistance, cost, aesthetics, construction

process). Also, design criteria are evaluated. The results of the study are then offered to designers and builders as a source of information for taking the right decision with regard to double-skin facade system selection.

### **Keywords**

Double-skin facade, design criteria for double skin facades, multi-storey facade, corridor type facade, shaft-type facade, box-type facade.

**(Paper 45, ID 124)**

## **Thermal Performance of Sustainable Building Skins in Hot Climate**

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### **Abstract**

Modern building practice in United Arab Emirates (UAE) has resulted in constructing high-rise buildings and mega-projects characterized by glazed façades. The trend of such building development which is rapidly experienced in Dubai and Abu Dhabi has great impacts on the natural environment. Minimizing this impact and the efforts to improve the ecological performance are the main concerns of sustainable building development in the country. These ideologies have been acknowledged by architectural firms designing and constructing energy efficient buildings. This paper examines the increasing interest in integrating glass façades and living walls into sustainable buildings exposed to the UAE hot climate. The main purpose is to increase energy efficiency by improving thermal performance of building skin

and reducing cooling loads. Advanced building skins, including Double Skin Façade (DSF) and Green Wall systems have been simulated and integrated into a high thermal performance building façade.

As part of a study carried out by the author, two case studies were selected to investigate the thermal performance of the building skins in the hot climate. The first case study examines the thermal transmission coefficient (U-value) of DSF, using box-window type. The second study investigates the performance of a vegetated living wall installed on a school building façades in the Emirate of Abu Dhabi. To achieve the aim of the study, various issues will be considered: sustainable performance of building skin; the impact DSF on energy efficiency in buildings; and the behavior of the green wall technique in terms of energy saving.

#### **Keywords**

Building skin, Energy efficiency, Double skin facades, Living walls, Thermal performance, UAE

(Paper 46, ID 131)

### **Improvement of Energy Efficiency in Housing Sector of Pakistan**

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#### **Abstract**

Pakistan is in the grip of worst energy crises of her history that is not only affecting all sectors of economy but also various segments of the society. Major causes of energy crises include economic and political instability, inefficient and faulty distribution system, poor management of energy resources, lack of energy conservation practices and last but not least the lack of accountability on the part of those who stay at the helm of affairs.

Electricity has a wide range of uses in residential as well as in commercial sector in Pakistan. Residential consumption of electricity has the highest share of 45.6% followed by industrial

consumption of 28.4%. Households mainly use electricity for refrigerating, cooling, heating, washing and lighting etc. This paper identifies potential areas in the household sector of Pakistan where employing efficient energy use will reduce energy consumption and will present unwanted energy loss. The study specially focuses on the patterns of household electricity consumption to identify the barriers which are preventing from achieving energy efficiency goals.

#### **Keywords**

Electricity, Household, Efficiency, Energy, Lights, Appliances

### **Recycling of Construction Waste**

(Paper 47, ID 97)

### **Recycled Aggregate Concrete: Strength Development and Future Perspectives on Steel Fibers and Cost-benefit Analysis**

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## **Abstract**

The use of recycled aggregate (RA) in concrete opens possibilities in the ways in which recycled materials can be used for structural applications; indeed, it may be an important breakthrough towards sustainable development. The utilisation of RA is an effective solution to the problem of possessing excess waste materials while simultaneously maintaining satisfactory concrete quality. The utilisation of waste construction materials should be related to the application of quality guarantee systems to achieve suitable product properties. A complete understanding of the characteristics of new materials is, therefore, extremely important so that its potential in applications can be thoroughly studied. This paper investigates the physical and mechanical properties of recycled aggregate concrete (RAC). The experimental works on RAC from different mix proportions, including replacement ratios of RA from 0%, 30%, 50%, 70% and 100%, are investigated on compressive strength. Further research on steel fibres addition and cost-benefit analysis are also explored.

## **Keywords**

Recycled aggregate, recycled aggregate concrete, strength, steel fibre, cost-benefit analysis, Australia

(Paper 48, ID 134)

## **Flexure Strength behavior of over Burnt Brick Ballast Aggregate Concrete**

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## **Abstract**

Regional conditions enforced engineers to generate a study on concrete which incorporate Over Burnt Brick Ballast Aggregate partially due to their abundance. 5%, 10%, 15%, and 20% ( $M_{05}$ ,  $M_{10}$ ,  $M_{15}$ ,  $M_{20}$ ) incorporation was used as partial replacement of natural coarse aggregate in concrete. Analysis of incorporated concrete was done in fresh state as well in hardened state to evaluate different properties of concrete i.e. slump value, compaction factor value, unit weight, flexural strength and Los Angeles abrasion value. From experimental approach it is concluded that Concrete formed with over burnt brick ballast aggregate showed beneficial performance as compared with the concrete made up of natural aggregate obtained from Sargodha. It reduces the cost of concrete by reducing the aggregate cost and produces economical infrastructure system. The waste generated from the brick kiln is utilized efficiently, making environment friendly encouraging green construction.

**Keywords:** Over Burnt brick Ballast Aggregate, Kiln, Green construction

## **Integration of Design and Construction Process**

(Paper 49, ID 26)

## **Integrated Project Delivery (IPD) for a Sustainable Design and Construction**

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## Abstract

The paper discusses a proposal for an integrating partnership for decision making at pre-construction stages of major construction projects. The environment proposed is one that fully utilizes the strengths of intelligent collaborative computer agents that interact with the multi-discipline pre-construction team to interrogate and refine the design solution before construction commences. Better opportunities therefore exist to concurrently view the effect of environmental decisions that impinge on the many contributors. All contributors are collaboratively drawn into the design and pre-construction process. IPD and BIM form essential tools and strategies in this decision environment. IPD linked to the “Big Room” concept will be discussed. The presentation will also focus on the new “Living Building Challenge 2.0” strategy and look at some of the challenges that are presented and ways that might assist creating a greener and more sustainable environment. In the model proposed the complexities of the design process can be broken down over numerous agents in different countries. Finally, the environment is extendable to continually monitor and assist environmental decisions throughout the life cycle of construction projects. The author's investigation measured the views of practitioners in the main building professions; architecture, engineering and construction management before proposing the collaborative system that is called for. The conclusion of the work is a conceptual model of the system proposed, a definition of the contractors' construction management computer agents and a specification based on scenarios of how they would interact with design agents.

## Keywords

Sustainable, Collaborative Engineering; Integrated Project Delivery (IPD); Virtual Design and Construction; Knowledge Based Engineering; Intelligent Agents; BIM; Big Room.

**(Paper 50, ID 86)**

## Sustainable Urban Consolidation in Australian Cities

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## Abstract

It is now recognized that the sustainability of major cities is integral to their quality of life in the future. This has been recognized around Australia, and in the last decade seen all the major cities produce planning schemes aimed at the long term sustainability of growth. However these plans are struggling to come into fruition. The schemes have been recognized as being a great success at an ideological level for introducing limits on urban boundaries and supporting urban consolidation. However the requirement of the schemes on increasing the density of existing built up areas is met by residents concerned with the effect of consolidation on their local communities. This paper identifies two facets of consolidation schemes that have the potential to defuse

negative connotation within residential communities. Firstly the ability of schemes, using Melbourne 2030 as a basis, to communicate the visual impact of consolidation to community groups. Secondly the ramifications negative views of development within community groups are having on the efficiency of the development application process. Further study into the communication to residential community groups is recommended as showing great possibilities for reducing the fear of infill developments.

### **Keywords**

Urban consolidation, Residential communities, Sustainability, Australia

**(Paper 51, ID 114)**

## **Reducing Co2 emissions through the Code for Sustainable Homes – The Challenge for Housing Associations in the UK.**

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Nathan Deen

*Bromford Housing Association, UK*

### **Abstract**

The protection of the environment is one of the most debated issues across the globe “Because of the trans-boundary nature of pollution and the characteristic of the environment as a global public good, international co-operation is highly desirable” (Marsiliani, 2003, p.6). Houghton (2004) comments “Co2 levels within the Earth’s atmosphere have increased by 30% in the last two Centuries. Concentrations of greenhouse gasses in the atmosphere are at their highest in 800,000 years and global temperatures have risen by over 0.7°C since the 1700’s. More disturbingly 0.5° of this increase has occurred during the last Century”. Subsequently, Watson (2007) stated global temperature increases need to be limited to no more than 2°c compared to pre industrial levels to have a good chance of

reducing the risks of dangerous climate change in the future.

Whilst exact details about the impacts of climate change on society still contain uncertainties, there is a clear body of economic and scientific evidence that continuing along the current path is no longer tenable and that urgent action is needed first to slow the growth in carbon emissions and then reverse it. Without bias there is a collective acceptance that more can be done to prevent energy wastage and more sustainable and innovative solutions can be found to provide more effectiveness and efficiency surrounding domestic house design and retro-fit maintenance.

The construction industry and the ways buildings are operated contribute to almost half of the UK’s carbon emissions; as such the industry has a commitment to protect and enhance the environment and to tackle climate change. The Stern Review published in October 2006 noted that in 2004 the UK emitted over 150 Million tons of Co2 (MtCo2) with the energy use in buildings accounting for nearly half these emissions. This figure then increased to 550 MtCo2 in 2005 and more than 25% of this figure came from the energy used to heat, light and run our homes (Department of Communities and Local Government, 2006).

### **Keywords**

Climate change, Code for sustainable homes, Housing associations.

## **Innovative Construction Materials**

**(Paper 52, ID 144)**

## **Effectiveness of Polypropylene Fibre in Improving the Flexural Capabilities of Light Weight Aggregate Concrete**

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### **Abstract**

The presented study examined the flexural behaviour of lightweight aggregate concrete modified with Polypropylene (PP) fibres through testing of six (06) beam specimens casted, cured and tested after 28 days for the purpose. The experimental design included mix design of concrete at a target strength of 21 MPa for control sample Natural aggregate (NC) as well as for synthetic aggregate (Light Weight Aggregate) modified with PP Fibres (LFC). Compressive strengths of both categories of concrete were also evaluated by crushing the cylindrical samples at the age of 7, 14, 21 and 28 days. The casted beams were later subjected to application of two point loading test till failure. It was found that the LFC was better resistant to cracks as compared to NC both in terms of number and crack width. It can be concluded on the basis of results that the light weight aggregate if modified with PP fibres could revolutionize the concept of using lightweight aggregates in regular structures consequently saving the environment from ill effects due to production of natural aggregates. Also since the LFC is light weight concrete, this advantage will result in reduced quantity of steel required which in turns could affect the overall cost of structure.

### **Keywords**

Light Weight Aggregate polypropylene Fibre Concrete (LFC), polypropylene (PP) Natural aggregate concrete (NC), flexural behaviour, compressive strength.

## **Construction Engineering**

**(Paper 53, ID 19)**

### **An investigation of the critical factors affecting the delivery of low-income housing and their effects on residents' satisfaction**

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### **Abstract**

The South Africa Constitution (Section 26) states that all South Africans should have the basic right of access to adequate housing. The South Africa State has been empowered to utilize all legislative and economic resources at its disposal, in order to achieve this right as stipulated in the constitution. Though the state has mobilised resources and manpower to achieve these objectives, many challenges remain in the facilitation and provision of adequate affordable housing for the low-income groups. This paper presents findings on the critical factors which affect the delivery of low-income housing in South Africa and the effect of these factors on the residents' satisfaction with their housing units. Data used in the study was obtained through a Delphi Study, where the views of housing experts were solicited on the critical factors which affect low-income housing delivery in South Africa. Since panellists form the cornerstone of the Delphi Technique, clear inclusion criteria was applied and as a means of evaluating the results and establishing the study's potential relevance to other settings and populations. Hence, each expert was required to meet at least five criteria's. These include the length of residency in South Africa, educational background amongst others. Results emanating from the study revealed that seven factors were considered critical by the experts after consensus was achieved. Amongst these include: limited budget (dwindling tax base) and the lack of appropriate policy to handle informal settlement upgrading, etc. The study contributes to the body of knowledge on the subject where no consensus has been reached pertaining to the critical factors affecting the delivery of low-income housing in South Africa. However, a limitation of the study was the reliance on a structured questionnaire survey in the three iterative rounds of Delphi

technique to reach consensus and experts were not allowed to add any more indicators.

### **Keywords**

Low-income, residents' satisfaction, Delphi technique, subsidised housing, South Africa

**(Paper 54, ID 33)**

## **Industrial Policy Impact Analysis on China's Construction Industry Development**

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### **Abstract:**

With the advance of urbanization of China, construction industry has made great progress in recent years. In the initial stage of industry development, the role of industrial policy on the development of construction industry cannot be ignored. Therefore, ascertaining the impact of industrial policy will help to guide the sustainable development of construction industry. The paper combining the theory of policy evaluation is to build construction policy evaluation system, then determine the index weight through questionnaire survey subjectively and entropy method objectively based on the construction industry statistical data from 2001 to 2011, finally analyzing the practical effect of construction industry policy

by fuzzy optimization model. The result shows that industrial policy plays a vital role in the rapid development of China's construction industry, but there are still many deficiencies which lead to a series of significant problems in the construction market.

### **Keywords:**

China, Construction industry, Industry policy evaluation, Fuzzy optimization model

**(Paper 55, ID 34)**

## **Comparison of Pavement Network Management Tools and Its Probabilistic of Pavement Engineering for Western Australia**

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### **Abstract**

Since the Association of American State Highway Officials (AASHO) road test of 1956-62 at Ottawa in Illinois, enormous efforts have been devoted to improve the methodologies and engineering techniques of pavement performance predication. For instance, the successful implementation of the Network Optimization Systems (NOSs) in the Arizona Department of Transportation (ADOT) in the 1980-82 was one of a tremendous effort that represented advancement in predication methodology and engineering technique by using Markov Chain-Process based to define the transition process of pavement network

condition. The main role of this paper is to evaluate and analysis the pavement network performance of Western Australia (WA) and also applied the existing pavement management tools relevant to WA road networks. Two approaches were used to evaluate and analysis the pavement network of WA. First, the current pavement performance data was used to assess the State road networks and then, predict the future from the past and current pavement network data. Second, the Probabilistic network – Markov-Chain Process and Chapman-Kolmogorov method was used to predict the pavement behavior in Western Australia. The results showed that the pavement performance of the predicting model using probabilistic network process (i.e. Linear) perform well in all categories as compared to the past 30 years LRDM data inventory. This study will draw into appropriate and effective pavement engineering management system to account for proper pavement design, preliminary planning, future pavement M & R networks, service life and functionality.

### **Keywords**

Pavement engineering; pavement management; Markov chain-process; pavement network-probabilistic behavior; Western Australia

**(Paper 56, ID 71)**

## **Simulation-based productivity analysis of dynamic compaction operations**

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### **Abstract**

Dynamic compaction is a very common construction method for ground improvement. Despite its popularity, there is dearth of published research from a productivity point of view. As such, this paper analyses the activities that constitute the dynamic compaction paradigm and explores the main factors that affect the on-site productivity. A simulation model is created based on the STROBOSCOPE simulation language and key production parameters are identified. Field data are collected and the created datasets are statistically elaborated to determine the input of the simulation experiment. The model's output is compared to actual results for verification and validation purposes. As such, baseline reference estimates of expected productivity are created and their robustness is tested in an actual project setting. The main inferences emerging from the study indicate that the method statement plays an important role in determining the model's structure. In addition, the selected grid spacing of a given area, as well as the number of hits has been found to significantly affect dynamic compaction operations' productivity.

### **Keywords**

Dynamic compaction, Productivity, Simulation

**(Paper 57, ID 111)**

## **A Comparative Analysis of Flood Resistant Design and Construction Strategies in Australia and USA**

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### **Abstract**

A flood is an overflowing of a large amount of water beyond its normal confines, especially over what is normally dry land. There are many factors that contribute to floods, the most important being rainfall. Flooding is a natural process that human beings have had to deal with for a very long time. Flooding in the United States of America and Australia causes billions of dollars in damages every year. The need to protect property and assets from flood damage is of upmost importance for Americans and Australians alike. In order to prepare for and protect property from flood damage, a flood management plan must be created and utilized. To mitigate risk, one must look at both the chance of a flood and its potential impact. Potential impact can be minimized by implementing design characteristics that favor flood resistance which include building code and regulations. Flood protection practices may be used to minimize damage due to flooding on buildings and communities alike. By performing a comparative analysis of flood resistant design and construction strategies in the U.S. and Australia, one would hope to determine what institutional factors contribute to a more effective flood protection strategy and thus, how flood damage can be minimized.

### **Keywords**

Flood Mitigation, Flood Resistant, Emergency Management, Flood Management

(Paper 58, ID 138)

## **Marketing New Home Construction: What Do Buyers Value?**

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### **Abstract**

This study aims to examine the priorities of new home customers and measures the level of importance of different home features for them. The study focuses on three key areas in new home construction: 1) Identification of reasons to purchase a new home, 2) Interior and exterior features, and 3) Qualities of a builder. In this study a questionnaire is used that contains four parts Demographic data, identification of top reasons to purchase a new built home; prioritizing of new home features i.e. Internal & External on the basis of buyers willingness to pay against those features and identifying key qualities that customers look for in builders for their new built home construction. This study assesses the difference in perception of male vs. female buyers and high income vs. low income buyers when buying a new home. Results from the study indicated that there are only minor differences between any groups and that for the most part; they can be predicted using conventional wisdom.

### **Keywords**

New homes, Interior features, Exterior features, Builder qualities.

(Paper 59, ID 139)

## **Need of Marketing Strategies for the Winning Construction Company**

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### **Abstract**

Marketing departments and strategies are prevalent tools that can be found in almost every successful company and industry, but considered a rarity amidst the construction industry. The aim of this paper is to provide current and factual reasons for the small role that marketing strategies and strategic plans are playing in the majority of companies within the construction industry. Few questions that need to be addressed are “Do construction contractors feel they need marketing?”, “Are they currently employing any marketing strategies?” etc. In order to answer these questions a questionnaire survey was conducted from the US Contractors. It is attested by the results of the survey that a majority of construction companies and firms believe they can take advantage by reinvesting in their businesses through marketing. It is important to understand and categorize the marketing strategies employed by construction firm in contrast to the general manufacturing or services marketing methods which need serious customization to cater the needs of construction industry. Ultimately, by foreseeing and understanding the advantages of possessing a marketing department and strategic plan in the construction industry, a company or firm (of any size) can have a leg up on its competition. The paper first discusses the importance of Construction Industry and its relationship with the U.S. economy. Next, a discussion is made on the need of development of marketing strategy for the construction industry. Then results of the survey are presented that concieve logical and reasonable solutions to the problems that are faced by the construction industry.

### **Keywords**

Marketing Strategies, Construction Industry, Strategic Management, Competitive Advantage

**(Paper 60, ID 140)**

## **Professional Ethics in Construction Industry**

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### **Abstract**

The pursuit of moral knowledge dates back for thousands of years to the time of Socrates, Aristotle and Cicero, but it was mostly the influence of moral thought that continued to shape ethics today. Thus, ethics could be defined in easy terms as the study of what is morally good and bad. Consequently, this paper specifically illuminates the issues faced by construction stakeholders to explain how important ethical behavior is, and to evaluate the level of professional ethical standards and its practice in the construction industry in the world today. For this purpose, the survey performa was distributed among various stakeholders within the construction industry, i.e. owners, architects and engineers (A/E), construction managers, general contractors and subcontractors, determining results from the survey analysis showing that ethics is neither emphasized as black nor white, but actually falls under the category of grey area verifying that it is not definite.

### **Keywords**

Construction industry, ethical behavior, survey performa, survey analysis

**(Paper 61, ID 143)**

## **Suggested Formula to Predict Concrete Compressive Strength**

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### **Abstract**

Prediction of concrete strength ahead of required age of 28 days can help in reducing waiting time associated with reinforced concrete (RC) construction. This paper presents the details of a strength prediction model formula which was developed to predict 28-day concrete compressive strength. The data of observed concrete strength in the existing literature have been employed in the development and validation of the models. The model takes the effects of cement chemical composition and fineness into account. The predictions are made by using 7-day concrete strength. The proposed model provided good correlation with the observed concrete strength data available in the literature.

### **Keywords**

compressive strength; regression analysis; chemical composition; prediction formula; fineness of cement.

**(Paper 62, ID 145)**

## **An Assessment of Productivity Measurement Tools -Effectiveness, Satisfaction and Problems: The Florida Construction Industry Experience**

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### **Abstract**

Productivity, especially in the construction industry, has always been very difficult to measure. Tools available for measurement are not effective. Through a questionnaire survey perception about effectiveness of currently available productivity measurement tools was assessed & it was found that tools available are not meeting the needs of the construction industry because majority of the respondents perceived that they have to develop their additional tools for compilation & extrapolation of the productivity data. So there is a need for improvement in currently available productivity measurement tools, further an interesting fact was established that majority of the people believed that their response to questions would have changed if their role in the construction industry would change. So it's an important fact that separate surveys should be performed for project managers, engineers, owner, architects and other stakeholders. Using separate survey pools would yield a more accurate representation of the metrics being investigated.

## **Management Education**

**(Paper 63, ID 12)**

## **Engineering Graduates & the Practice of Construction Management**

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### **Abstract**

The education and training of civil engineers in South African universities, and internationally is done with the full intention of impacting knowledge and understandings that could spur graduates to contribute significantly to the physical transformation of the environment through innovative designs and construction. However, the practice of construction management by civil engineering graduates requires general management skills and core competencies central to the ability to manage construction projects and businesses successfully. The principal theme of this discourse is concerned with the need to examine the adequacy of construction management related education and training that civil engineering students and graduates are exposed to in South African universities. Through document analysis in terms of university curricula examination and a survey conducted among fellows of the South African Institution of Civil Engineering (SAICE), salient issues were identified. The research outcome identified gaps in teaching / curricula that could further develop the ability of civil engineering graduates to become astute construction managers, especially in a developing country context. Such gaps pertain to knowledge, skills and core competencies required for both business and career ascendancy in the field.

### **Keywords**

Construction Management, Developing Countries, Education and Training, South Africa

## **Research and Practices**

(Paper 64, ID 74)

### **Contractors' practices in bidding processes: a comparative study between China and Sweden**

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### **Abstract**

Adopting formal and analytical models to assess and price project risk at the tender stage to practice is challenging due to the lack of improved understanding of the actual process on how contractors decide to bid or not. The aim of this paper is to investigate how the bidding process is organised and managed in large and medium-sized construction companies, with a focus on how risks are considered when deciding whether to bid or not as well as on deciding price level. The paper is further a benchmark between how the process is organised in Chinese and Swedish construction companies, since it is believed that there are significant differences based on, among others things, cultural issues. Interviews are made with managers within two Chinese companies and two Swedish companies. Among issues covered in the interviews are those of who are involved in the process, the structure of meetings, how decisions are made and project preferences. The study is expected to increase the understanding of the context of decision-making in the bidding process.

### **Keywords**

Risk management, risk behaviour, decision-making, construction projects, tendering

(Paper 65, ID 76)

# **User Satisfaction with Transport PPP projects: The Case of the Bangkok Mass Transit System (BTS)**

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## **Abstract**

Use of the Build-Operate-Transfer (BOT) approach to infrastructure delivery has become popular since the 1950s and it is currently being utilised in diverse countries as a key concept for Public-Private Partnership (PPP) transportation infrastructure development. In addition, BOT projects have already been completed or are in progress in several developing countries around the world, including Thailand. One such project is the Bangkok Mass Transit System (BTS) SkyTrain, operated by Bangkok Mass Transit System Public Company Limited (BTSC) under a concession agreement with the Bangkok Metropolitan Administration. Due to the commercial nature of infrastructure projects adopting the BOT approach, user satisfaction is a major cause for concern. In order to assess the levels of user satisfaction, it is essential to study the actual benefits being derived by the real users against the levels of their satisfaction.

The focus of this study is to identify and evaluate the benefits associated with a PPP project in Thailand and to develop a model of

user satisfaction with PPP by using data from the BTS project. Furthermore, this research examines the satisfaction levels of users and considers how satisfaction may be enhanced before leveraging the model for devising implementable policies on user satisfaction

## **Keywords**

Bangkok Mass Transit System, Modeling and Simulation, Public-Private Partnerships, User Satisfaction

**(Paper 66, 92 ID)**

## **On-site wear trials to determine construction workers' preference for two types of cooling vest in combating heat stress**

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## **Abstract**

It is recognized that construction workers are always exposed to a high risk of heat-related illness during summer months in Hong Kong. Providing suitable personal cooling vest to construction workers is one of the effective and

feasible measures to alleviate heat stress. In order to evaluate the effectiveness of two kinds of cooling vest, namely, 'frozen gel vest' (Vest A) and 'frozen gel and fan vest' (Vest B), and determine construction workers' preference for these vests, three field studies were conducted in construction sites during summer months of 2012 to assess the subjective and physiological responses of thirty-six construction workers when wearing these cooling vests. In this survey, no significant physiological differences between the two vests were detected. In terms of subjective preference, construction workers preferred Vest B to Vest A ( $p < 0.05$ ). The results of workers' perceptual responses indicated that Vest B was significantly better in the following attributes ( $p < 0.05$ ): being drier, lighter, smoother, more pliable, easier to move, more comfortable, and more practical. The common shortcoming of the two cooling vests was their temporary cooling effect as perceived by the workers. Additional comments provided by the subjects shed light for potential improvement on the cooling capacity and acceptability of the cooling vest in future.

#### **Key words**

Construction workers, heat stress, cooling vest, wear trial, physiological and subjective response

(Paper 67, ID 100)

### **Probabilistic method to predict activity duration for critical path method with increased reliability**

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#### **Abstract**

Critical path method (CPM) is a deterministic technique that has been used extensively for managing projects because of its simplicity compared to other techniques. CPM analyses a

project considering resources and time taken to complete each activity based on available data at the time of project planning. However, the predicted activity duration for a similar activity in a similar project will be different with the time, due to advancement in technologies, improved materials and various other factors. This paper reviews available methodologies used to predict activity duration and attempts to introduce probabilistic method to predict the project duration. The method uses simulation technique to generate probability distribution function based on contractor's previous performance on similar project. It enables project manager to detect level of uncertainty on the project duration and how extra resources could be launched with increased confidence to accelerate certain activity to complete the project on time.

#### **Keywords**

Critical path method, Probabilistic method, Project duration

(Paper 68, ID 112)

### **Experience of using Delphi method in construction health and safety research**

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#### **Abstract**

This paper discusses the Delphi method which is an inductive approach to research. It has been argued that Delphi method is an essential vehicle of reaching consensus in issues that cannot be resolved in a once off discussion. This paper reports on the experiences achieved by the authors in using the Delphi method among a group of experienced health and safety (H&S) experts in two separate case studies in the construction industry in South Africa. The first

case study used three rounds of iteration whilst the second case study used four rounds of iteration. The authors argue that the Delphi method is a comprehensive method of attaining consensus on challenging issues of H&S in the construction industry. Furthermore the method requires proper communication to achieve the required results.

**Keywords:** Experience; Inductive approach; health and safety

(Paper 69, ID 121)

## **Thoughts and Musings on the Development of a Theory for Rework Causation in Construction**

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### **Abstract**

To learn ‘how’ to mitigate rework, organizations involved in the delivery of construction projects need to be able to make sense and learn from events that lead to its occurrence. The process of retrospective sensemaking can provide an understanding that can inform and direct actions to eliminate rework, which can threaten project performance. In this paper, sensemaking serves as a conceptual foundation to develop a

theoretical underpinning for determining the systemic nature of rework. The use of sensemaking can provide an ameliorated understanding of rework causation and enable theory to be developed, as currently no coherent one exists. There is a need for a general set of assumptions, propositions, or accepted facts that attempts to provide a plausible or rational explanation of cause-and-effect relationships for rework. Having a theory in place and subsequently being able to understand ‘how’ and ‘why’ rework arises can provide the feedback required to enable organizational learning to occur and eventually a learning organization.

### **Keywords**

Construction, leaning, rework, retrospective sensemaking

## **Engineering Design Issues, Problems, and Solutions**

(Paper 70, ID 57)

## **Shear Capacity of Rectangular Industrial Duct Panel**

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### **Abstract**

The end panels of a large rectangular industrial duct experience significant internal pressures and considerable transverse shear at the support locations. Though the designers depend on the

plate girder design methods, the structural dimensions and the arrangements, the loadings and the resulting behaviour of the such end panels are significantly different. Large aspect ratio of the end panels gives rise to multiple bands of tension fields and significant membrane action, whereas the plate girder web design is based on one tension field. In this investigation, a nonlinear finite element model was developed to simulate the behaviour of industrial duct end panel subjected to transverse shear and internal pressures. The model considered the geometric imperfections and constitutive relations for steels. Six scale independent dimensionless parameters that govern the behavior of such end panels were identified as  $b/t\sqrt{F_y/E}$ ,  $\Delta/t$ ,  $\sigma_m/F_y$ ,  $h/b$ ,  $V/[ht(F_y/\sqrt{3})]$ , and  $\delta/b$ , which were then used in an extensive parametric study, which primarily established the ultimate shear strength of end panels. It was concluded that the plate slenderness dominates the shear strength of stockier end panels, whereas, the aspect ratio and plate slenderness influence the shear strength of slender end panels. This paper proposes design aids for shear strength of thin end panels subjected to concurrent transverse shear and internal pressures.

### **Keywords**

Thin Plate, Transverse Shear, Tension Field, Finite Element Analysis, Parametric Study, Design

(Paper 71, ID 58)

## **Energy Dissipation Potential of Concrete Floors Containing Temperature Shrinkage Control Reinforcements**

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### **Abstract**

This paper experimentally investigates the energy dissipation potential of two types of concrete floors, namely, normal concrete and light weight concrete containing temperature shrinkage reinforcements. The test program considered the following temperature shrinkage reinforcements; (a) traditional welded-wire steel mesh, (b) steel fiber and (c) poly composite fiber. To estimate the extent to which crushing of floor slab materials would help absorb energy, a series of concrete penetration tests employing patch loading was undertaken on scaled down model slabs. Each combination considered square concrete slabs of 50 mm in depth, and with square plan dimensions ranging from 50 mm to 500 mm, resulting in a total of 30 test specimens. The first part of the paper discusses the specimens, the test setup, and the test procedure. The second part of the paper presents the experimental results and establishes the energy dissipation of different concrete - temperature shrinkage reinforcement combinations. Sieve analysis results of the crushed specimens were used to derive a “work index” value that relates pulverization distributions to energy inputs, which can be used to assess the energy dissipation potential associated with floor slabs in buildings undergoing progressive collapse. The results indicate that floors with temperature shrinkage reinforcements could play an important role in helping arrest global progressive collapse mechanisms.

### **Keywords**

Concrete floors, Light weight concrete, temperature and shrinkage reinforcements, Energy dissipation, Penetration tests, Sieve analysis



(Paper 72, ID 116)

## **An exploratory study of the major causes of construction disputes in the South African construction sector**

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### **Abstract**

The construction industry is mired in disputes. It is one of the leading industries that is involved in a number of disputes. This paper examines the major causes of disputes in the construction industry and it further identifies the effects disputes have on projects and investigate the forms of minimizing the disputes and how to resolve them. This study was conducted through the use of secondary data from the use of journals, books and internet to achieve the objective for the study. The review of literature looked into details the different views from different scholars about the causes of disputes then deduce from those views the major causes the major causes of dispute in the South Africa construction sector. The findings from the literature review showed that the major causes of disputes revolve around people, process and project characteristics. It was also mostly mentioned that project uncertainty, contractual problems and opportunistic behaviour cause construction disputes. The purpose of this academic paper was to justify the need to know the major causes of disputes in the South African construction industry and to further establish the effects disputes have on construction and to suggest ways to minimize and resolve disputes in projects. It is said that

the people, process and projects characteristics are major causes of disputes and so is the project uncertainty, contractual problems and opportunistic behaviours. As a way to resolve disputes, alternative dispute resolutions are put in place and so are adjudication, arbitration and litigation.

### **Keywords**

Dispute, Construction Industry, Project characteristics, adjudication

(Paper 73, ID 129)

## **Sustainability Assessment of Bitumen with Polyethylene as Polymer**

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### **Abstract**

Now a day's increment in percentage of waste material due to excessive use of polyethylene in daily use products has become a great problem. Most of the waste materials are of types which are non-biodegradable. These materials require difficult and challenging methods to dispose safely and in underdeveloped countries like Pakistan it is even a bigger problem of concern. Also the continuous increase in number of vehicles emphasizes on need of sustainable infrastructure of roads with better quality and engineering design. Grinded plastic is used as polymer in Bitumen in this research by 0% ,0.5 %, 1%, 1.5 % and 2 % .The properties evaluated are Fire point ,Flash point, softening

point and penetration of Bitumen. Regardless of the replacement ratio, Bitumen as a polymer had a satisfactory performance.

**Keywords:** Bitumen, Polyethylene, Polymer, Sustainability

(Paper 74, ID 133)

### **Flexure Strength behavior of over Burnt Brick Ballast Aggregate Concrete**

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#### **Abstract**

Regional conditions enforced engineers to generate a study on concrete which incorporate Over Burnt Brick Ballast Aggregate partially due to their abundance. 5%, 10%, 15%, and 20% ( $M_{05}$ ,  $M_{10}$ ,  $M_{15}$ ,  $M_{20}$ ) incorporation was used as partial replacement of natural coarse aggregate in concrete. Analysis of incorporated concrete was done in fresh state as well in hardened state to evaluate different properties of concrete i.e. slump value, compaction factor value, unit weight, flexural strength and Los Angeles abrasion value. From experimental approach it is concluded that Concrete formed with over burnt brick ballast aggregate showed beneficial performance as compared with the concrete made up of natural aggregate obtained from Sargodha. It reduces the cost of concrete by reducing the aggregate cost and produces economical infrastructure system. The waste generated from the brick kiln is utilized efficiently, making environment friendly encouraging green construction.

**Keywords:** Over Burnt brick Ballast Aggregate, Kiln, Green construction

## **Education and Training**

(Paper 75, ID 43)

### **Delivering E-Learning in Project Management: Determining Participants' Infrastructure Priorities and Constraints**

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#### **Abstract**

Powered by the advent of the computer and the Internet, e-learning has become a globally accepted mode of knowledge management, sharing and transfer arising from its numerous benefits especially in distance and conference learning in virtual environments. However, several indices including those of the World Development Report suggest that most developing countries seem unable to key into, and benefit from this development. This paper reports the result of a study of e-learning stakeholders/participants perception of infrastructure priorities and constraints affecting the delivery of e-learning in project management. A self-designed questionnaire was administered using the multi stage technique in a typical developing country institutional environment and posits feasible solutions to the lacked critical constraints as basis for national planning. The questionnaire was analysed using statistical package for social scientist whose results showed that attributes of teachers

positively influences delivery of e-learning. Our findings also revealed that hardware infrastructural challenge negatively influences the delivery of e-learning.

### **Keywords**

e-learning, synchronous, asynchronous, infrastructure, project management.

**(Paper 76, ID 115)**

## **An assessment of the effectiveness of learnership programmes in the South Africa Construction Industry**

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### **Abstract**

The objective of this paper is to investigate the effectiveness of learnership programmes in the South African construction industry. This will be achieved by first establishing whether the Learnership System introduced under the Skills Development Act No. 97 of 1998 is an appropriate system for training construction professionals and by investigating the quality of the learnership outcome. The paper is also aimed at investigating the major obstacles faced in delivering effective learnerships in the construction industry. The methodology for the research was solely a literature review. The literature review was based on literature focused on the legislation governing the learnership programmes, stakeholders involved in the delivery of learnership programmes, the outcomes of learnership programmes and major obstacles hindering the effectiveness of learnership programmes. The literature survey

revealed that there is a considerable confusion and ignorance amongst training providers. This factor was found to have a negative impact on the delivery of efficient and effective learnership programmes in the construction industry. Further findings also revealed that other factors contributing to the ineffectiveness of construction learnership programmes are poor administration and bureaucracy within the Construction and Education Training Authority, poor outcome of learnerships, dissatisfaction with the system amongst learners and employers for different reasons and technical incompetence amongst trainers. Learnerships in the construction industry have not been effective and efficient in terms of skills development as predicted. This is attributable to many factors such as ignorance and confusion amongst stakeholders, bureaucracy and poor administration within CETA, lack of support from various relevant stakeholders and low levels of employer participation in the delivery of learnership programmes.

### **Keywords**

Learnership, construction industry, skills shortage

**(Paper 77, ID 147)**

## **Gender Based Perceptions of Project Managers' Attributes**

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### **Abstract**

Construction enterprises depend on the performance of Project Managers (PMs). This paper is aiming at defining the Greek Project Managers' cognitive abilities, personality characteristics and skills through the eyes of Greek female and male engineers. The research survey recorded 305 responses, originating from engineers throughout the Greek Construction Industry. The study statistically identifies the most significant PM's attributes and compares the views associated with each gender - group. Finally, a correlation analysis highlights the perceptions of each group of participants regarding PMs' attributes.

### **Keywords**

Project Managers, Statistical Analysis,  
Perceptions, Attributes, Gender

## **BIM and Virtual Construction**

(Paper 78, ID 42)

### **Building Information Modeling (BIM) Application in Construction Planning**

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### **Abstract**

Building information modeling (BIM) has been used in high-profile and complex projects in several countries such as America, United Kingdom (UK), China, Hong Kong, and Australia. Currently, BIM is also used by Architecture, Engineering and Construction (AEC) industry in Malaysia. It has been introduced to manage construction planning activities such as design, cost estimating and project scheduling. BIM utilization in construction planning can detect any clash analysis during design phase, improves project schedule, cost and quality of project as well as communication between construction players. This paper aims to explore BIM application in construction planning. A literature review explores previous BIM studies on definition of BIM, benefits, importance, barriers and BIM tools in construction planning. Furthermore, a semi-structured interview was made with client of the first Malaysian project using BIM. The interview reveals on necessities and benefits of implementing BIM in construction planning as well as challenges faced by the client in implementing BIM. BIM is necessary to construction planning because BIM can detect problems before and during construction phase. A critical analysis of the literature review and the interview results lead to a solid reason of showing the effectiveness of implementing BIM in construction planning. It also show that BIM in construction planning helps to reduce project delay, risk, cost overrun, clash analysis and disputes between construction players.

### **Keywords**

Application, Building Information Modeling (BIM), Construction planning, Construction projects

(Paper 79, ID 94)

**Will small and medium sized  
enterprises within the United  
Kingdom's West Midlands region  
meet the challenge of implementing**

## **Building Information Modelling by 2016?**

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### **Abstract**

The construction sector in the United Kingdom (UK) plays a major part within the overall UK economy, representing typically between 7-10% of GDP around £110bn per annum of expenditure, with 40% of this being in the public sector, with central Government being the industry's biggest customer.

Building Information Modelling (BIM) was introduced into the United Kingdom in the 1970's. Whilst primarily adopted by a few major practitioners, BIM participation and use has been extraordinarily slow. BIM has recently hit the construction news headlines, and for a very good reason. In May 2011 The UK Government under the guidance of its Chief Construction Adviser, published 'The Construction Strategy' which addressed the use of Building Information Modelling within the UK. The Government UK stating it will require full collaborative 3D BIM (with all project and asset information, documentation and data being electronic) as a minimum by 2016.

This paper will investigate this challenge at both strategic and operational levels and will evaluate through semi-structured interviews how small and medium enterprises' in the UK conurbation of the West Midlands will meet the challenge of implementing BIM 2016.

### **Keywords**

Building Information Modelling, Construction Strategy, Small and Medium enterprises

**(Paper 80, ID 125)**

## **Barriers in Adoption and Implementation Strategies for**

## **Building Information Modeling In Pakistan Construction Industry**

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### **Abstract**

Building Information Modeling (BIM) is one of the most recent developments in the construction industry. In Pakistan, research on BIM in academia and construction industry is relatively a new phenomenon. This paper has tried to find out the barriers and implementation strategies for BIM adoption in Pakistan construction industry. The main objective of this research is to investigate the barriers in BIM adoption and its implementing strategies in construction industry in Pakistan for coordinating and managing construction projects. The methodology for this research was based on a questionnaire survey to collect data. The questionnaire was designed comprising on research variables for barriers in BIM adoption and BIM implementation strategies. This survey was conducted among Architects, Designers, Engineers, Contractors, Sub-contractor, MEP consultants, Academia, Developers, and Facility Owners. The collected data were analyzed by conducting different statistical procedures to make inferences.

Results of this survey indicated that the barriers for implementing BIM were lack of awareness, lack of support from consultants and contractors, lack of industry motivation, and lack of knowledge by owners. The main BIM implementation strategy was the dissemination of BIM knowledge to government departments, academia and the industry. Workshops on BIM benefits are required to be conducted to create more awareness among all stakeholders. This research work recommends that BIM need to be

implemented in the local context apart from some adoption barriers.

### **Keywords**

Building Information Modeling (BIM), Virtual Building Construction, Object-Oriented CAD Systems, Virtual Design and Construction

### **Keywords**

Construction delays, Project management, US Army Corps of Engineers, Savannah District

## **Additional Papers**

(Paper 81, ID 149)

### **Construction Delays: A Case Study of US Army Corps of Engineers**

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### **Abstract**

The construction industry plays a pivotal role in the nations' economy and must be effectively managed in order to ensure success. Part of that management requires personnel to ensure that construction delays are identified and properly mitigated. With proper insight to the causes of the construction delay, many possible delays can be mitigated or avoided altogether. This research study explored the causes of construction delays on US Army Corps of Engineers construction projects within the Savannah District footprint in order to identify the most significant delay factors. First, the general causes of construction delays were identified by researching literature and published data. The identified delay causes were utilized to develop a survey questionnaire to solicit input from various construction professionals, both contractor and USACE employees. The information gathered was then analyzed to determine the primary factors of construction delay in USACE projects.

(Paper 82, ID 150)

### **Engineering and Construction Expertise Transfusion: The U.S. Army Corps of Engineers' Knowledge Management Program**

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### **Abstract**

Knowledge Management (KM) is the collection and transfusion of an organization's critical information, skills, experience, and identity, held by senior individuals, to successor generations for action. A great deal of the technical expertise in the U.S. Army Corps of Engineers (USACE) has been departing through retirement of the most experienced employees over several years and continues to do so today. Without robust technical competency an organization as large as USACE cannot continue to perform design and construction functions effectively. This research study defines KM, reviews best practices from industry and assesses how USACE is performing at the working level. The research data obtained identified key needs and subsequent recommendations for additional efforts or improvements to existing initiatives. Data was collected through interviews of eight managers at a USACE District Office to make assessments and determine steps to be taken to ensure critical expertise is retained and mission execution continues effectively. This study found that at the working level the current KM program is primarily based on mentoring and

informal communities of practice, and not in top down information systems based approaches. USACE would benefit greatly from reconciling different approaches, eliminating redundant items, and a coordinated approach at all levels of leadership to champion processes that work.

### **Keywords**

Knowledge management, US Army Corp of Engineers, Project Management

**(Paper 83, ID 151)**

## **Causes of Change Orders and Slippage of Schedule and cost Baselines in the Construction Projects in Pakistan**

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Kamran Waheed

*Graduate student, CASE Islamabad Pakistan*

Ehsan.U.Qazi

*Deputy Director General NISTE Islamabad Pakistan*

### **Abstract**

Construction industry is exposed to high vulnerability and involves multiple stakeholders. These factors and actors influence the projects either directly or indirectly, ultimately affecting the progress of the projects. The primary stakeholders are contractors, consultants and clients. Apart from these stakeholders, project variations and slippage occurs due to several other factors like slow cash flow, design errors, constructability issues and lack of planning. This paper is an attempt to identify and analyze the sources of variations, their effects on projects and control measures to avoid these VOs. The author conducted structured interviews and surveys with construction professionals, contractors, architects, design engineers, suppliers and sub contractors. Similarly pertinent literature on the subject has been

studied and consulted in order to reach at concrete findings and conclusions. A questionnaire was distributed among respondents on performance of various completed and ongoing construction projects, with a view to find out major sources of variation orders which trigger the construction schedule from schedule baselines.

The major findings and conclusions derived from this paper are; lack of Change Control Board(CCB),lack of detailed planning, delay in decision making on shop drawings, poor site management, delay in site mobilization by contractors, and lack of project integration management, lack of design technology, frequent changes during execution and site inaccessibility.. There is need to explore more the factors which slip the project timelines, in order to build reputation of the industry. Similarly the research of this paper was limited to surveys and interviews in Rawalpindi and Islamabad cities of Pakistan. The paper defines practical problems as these exist today in Construction Industry of Pakistan.

### **Keywords**

Causes, Construction, Change Orders Pakistan

**(Paper 84, ID 148 )**

## **The Implementation of Project Management Performance**

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Imran Saleem

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Mangers (EFQM) business excellence model to investigate the relationship of attributes on project management performance (PMP). The

empirical study through questionnaire has been conducted in construction industry of Pakistan to investigate the practical implication of PMPA Model. Based on literature review and survey data, it is investigated that the performance in construction projects could be increased at different management levels. The study has concluded that a variation exists between the attributes of the model to measure the level of effectiveness in PM performance. The results have also shown that while enhancing the knowledge of project life cycle process and highlight the key performance indicators the PM Performance could increase.

**Keywords**

Project management, PMPA Model, Construction in Pakistan, Performance Assessment



# Appreciation

We appreciate the hard work and help of the following persons in the organization of this conference:

*Mrs. Brenda Battle-Simms*

*Mrs. Amy Taylor*

*Mr. Hao Leng*

*Mr. Hafiz Ehsan*

*Mr. Zach Rowe*

*Ms. Brantlee Job*

*Ms. Erin Acree*

*Mr. Rosun Khan*

*Mr. Shinavuth Maturaprateep*

## CITC-VII Review Committee

We would like to express our sincere gratitude to the members of the International Scientific Committee who participated in the review process for CITC-VII:

*Sittimont Kanjanabootra*

*Patrick Suermann*

*Sulzakimin Mohamed*

*Kai-Chi Ying*

*Fidelis Emuze*

*Rizwan Farooqui*

*Yingbin Feng*

*Attaullah Shah*

*Olatunji Ayodeji Aiyetan*

*Mohamed El Agroudy*

*Gunasekaran Kandaswamy*

*Eric Chan*

*Kishor Shrestha*

*Arun Chandramohan*

*Zehra Waheed*

*Kriengsak Panuwatwanich*

*Chibueze Ogbonna*

*Serdar Kale*

*Ken Sivakumaran*

*Justus Agumba*

*Innocent Musonda*

*Salman Azhar*

*Esra Bostancioglu*



## ***“Challenges in Innovation, Integration and Collaboration in Construction & Engineering”***

The abstract book for the **Seventh International Conference on Construction in the 21<sup>st</sup> Century** contains abstracts from more than eighty peer reviewed papers. The conference was held at the Millennium Hilton in Bangkok, Thailand, December 19<sup>th</sup>-21<sup>st</sup>, 2013. Twelve countries were represented, including Australia, Canada, Egypt, Hong Kong, India, Malaysia, Nigeria, Pakistan, South Africa, Turkey, United States, and South Korea.

*(The full published papers are located on the accompanying CD attached to the back cover of the abstract book).*

## **CITC-VII Themes:**

- ❖ Cost and Financial Management
- ❖ Supply Chain Management
- ❖ Procurement Management
- ❖ Safety Management
- ❖ International Issues
- ❖ Information Technology
- ❖ Electronic and Mobile Commerce
- ❖ Web-based project Management
- ❖ Risk Analysis and Decision Making
- ❖ Construction Process Reengineering
- ❖ Environment Management
- ❖ Total Quality Management
- ❖ Lean Construction
- ❖ Design-Build
- ❖ Intelligent Decision Support Systems
- ❖ Innovative Construction Technologies
- ❖ Automation and Robotics in Construction
- ❖ Engineering Design Issues, Problems, and Solutions
- ❖ Future Design and construction of Tall Buildings
- ❖ Education and Training in Related Disciplines
- ❖ Building Information Modeling and Virtual Construction
- ❖ Recycling of Waste
- ❖ Integration of Design and Construction Process
- ❖ Innovative Construction Materials
- ❖ Sustainable Construction Techniques

## Hotel Information



*(Map of CITC-VII venue, Millennium Hilton, Bangkok, Thailand)*

The Millennium Hilton Bangkok hotel is just 8km out of Bangkok's bustling city center, and has a free shuttle boat running from the private pier to Saphan Taksin and River City every 20 minutes. Take in some history and visit the famous Grand Palace, built in 1782 to home the Thai King and the Royal court, or see the murals and sculptures collected at the Wat Pho Buddhist temple. Immerse yourself in the local culture and visit the floating market in Damnoen Saduak, which features hundreds of wooden rowboats each laden with goods to trade. Enjoy a river tour of the Chao Phraya River, or explore the shops, bars and restaurants of the nearby Chinatown.

### MILLENNIUM HILTON BANGKOK

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123 Charoennakorn Road, Klongsan, Bangkok 10600, Thailand

## Thursday, 19 December 2013

15:00-17:00	Registration (Hilton Lobby)
17:00-19:00	Welcome Reception (Three Sixty Lounge, Millennium Hilton)

## Friday, 20 December 2013

8:00-8:30	Welcome Ceremony with CITC-VII Chair, Dr. Syed M. Ahmed and Keynote Speaker, Dr. Naveed Anwar (Thonburi Ballroom)	
8:30-10:30	<b>Breakout Room A</b>	<b>Breakout Room B</b>
	Parallel Session 1 Chair: Dr. Ken Sivakumaran	Parallel Session 1 Chair: Dr. Anoop Sattineni
	<i>Evaluation Of Double Skin Facades</i> Esra Bostancioglu; Pinar Arslangiray	<i>Strategies To Manage Risks In Infrastructure Projects</i> Khalid Siddiqi; Marcia Hurd-Wade
	<i>Improvement Of Energy Efficiency In Housing Sector Of Pakistan</i> Rafique Khattak	<i>Towards An Exploration Of Safe Work Method Statements As A Safety Management Strategy In Construction: Background And Theory</i> Manikam Pillay; David Borys
	<i>Insights About Concrete Spalling In A South African Region</i> Fidelis Emuze; Hendrik Duminy; Winston Shakantu; John Smallwood	<i>Managing Occupational Health And Safety Risks In Precast Factories: A Case Study In Australia</i> Yingbin Feng; Samuel Camille; Xiaohua Jin; Yong Xiang
	<i>Implementation Of Iso 14001 Environmental Management System In The Macau Construction Industry</i> Raymond Aoieong; Jielu Gong	<i>Workplace Safety Implications Of Cultural Diversity On Australian Construction Sites: A Pilot Study</i> Yingbin Feng; Xiaohua Jin; Peng Wu; Shang Zhang
	<i>The Development Of The Municipal Solid Waste Recycling Dynamic Model At Transfer Station</i> Chaiwat Manasakunkit; Thanwadee Chinda	<i>An Exploratory Study Of The Relationship Between Accident Costs And Safety Investment: Hong Kong Experiences</i> K.C. Ying; Guomin Zhang; W.M. Daniel Chan
	<i>Thermal Performance Of Sustainable Building Skins In Hot Climate</i> Mahmoud Haggag; Sarah Elmasry; Ahmed Hassan	<i>Measuring Construction Safety Climate In Supervisory Environment With Multilevel Analysis</i> Rehan Masood
<i>Case Study: Cost Analysis For The Implementation Of The Clean Water Act And Storm Water Pollution Prevention Plan</i> Scott Kelting; Eric Freedman	<i>Construction Workers' View On Standardised Work Procedures And Its Influences On Freedom And Innovation</i> Egill Daði Gíslason; Agnar Sigurjónsson; Per-Erik Josephson	
10:30-10:45	Morning Coffee/Tea Break (Common area in front of Thonburi Ballroom)	
10:45-13:00	<b>Breakout Room A</b>	<b>Breakout Room B</b>
	Parallel Session 2 Chair: Dr. John Smallwood	Parallel Session 2 Chair: Dr. Georgios Aretoulis
	<i>Reducing Contract Risks Through The Right Contracting Strategy</i> Mohamed El Agroudy; Mohamed El Mikawi; Ibrahim Nossair	<i>Simulation-based Productivity Analysis Of Dynamic Compaction Operations</i> Antonios Panas; John-Paris Pantouvakis; Sergios Lambropoulos
	<i>Interorganizational Cost Management In Australian Construction Alliance</i> Gang Chen ; Guomin Zhang; Xiao-Hua Jin	<i>Industrial Policy Impact Analysis On China's Construction Industry Development</i> Ming Luo; Guiwen Liu; Pengpeng Xu
<i>Challenges Of Private Financing Of Building Projects In Lagos State, Nigeria</i> Olatunji Ayodeji Aiyetan	<i>Comparison Of Pavement Network Management Tools And Its Probabilistic Behavior Of Pavement Engineering For Western Australia</i> Ainalem Nega; Hamid Nikraz; Colin Leek	

10:45-13:00	<i>A Pragmatic Review Of Workforce Motivation, Demotivation And Job Performance In The South African Construction Industry</i> Amaka Chinweude Ogwueleka; Marthinus Johannes Maritz	<i>Recycled Aggregate Concrete: Strength Development And Future Perspectives On Steel Fibers And Cost-benefit Analysis</i> Vivian Tam; Olivia Mirza; Sepani Senaratne; Won-Hee Kang; Duangthidar Kotrayothar
	<i>An Assessment Of Clients Satisfaction Relative To Building Project Delievery In Nigeria</i> A.O. Aiyetan; M. Ajayi; Oluwaseun Abolarin	<i>A Comparative Analysis Of Flood Resistant Design And Construction Strategies In Australia And Usa</i> Steele Taylor; Anoop Sattineni; Salman Azhar
	<i>A Research On Factors Influencing Labour Cost Of Construction Projects Based On Var Model</i> Cenfei Sun; Guiwen Liu	<i>Shear Capacity Of Rectangular Industrial Duct Panel</i> Ken Sivakumaran; T Thanga; B Halabieh
	<i>The Impacts Of Forex Fluctuations On Construction Business Performance: An Organisational Capabilities Perspective</i> Mohd Amizan Mohamed; Bambang Trigunarsyah; Melissa Teo; Stephen Kajewski	<i>Knowledge Management Tools And Techniques Used In The Australian Construction Industry</i> Mohammed Al Zadjali; Kriengsak Panuwatwanich
	<i>Information Sharing Problems During The Inspection Stage Of Construction: A Case Study In Australia</i> Sittimont Kanjanabootra; Huan Vo-Tran	
13:00-14:00	Lunch	
14:00-15:00	<b>Breakout Room A</b>	<b>Breakout Room B</b>
	"Partnering in Construction Industry: Malaysian Experience" Dr. Hamimah Adnan	"Unlocking the Potential of Earned Value Management in Increasing Time and Cost Certainty in Construction Projects" Dr. Monty Sutrisna and Dr. Brad Carey
15:00-15:15	Afternoon Coffee/Tea Break (Common area in front of Thonburi Ballroom)	
15:15-17:15	<b>Breakout Room A</b>	<b>Breakout Room B</b>
	Parallel Session 3 Dr. Scott Kelting	Parallel Session 3 Prof. Jim Carr
	<i>Sustainable Urban Consolidation In Australian Cities</i> Xiao-Hua Jin; Jian Zuo; Yingbin Feng; Peng Wu	<i>A Study Of Using Digital Photos To Document Construction Progress</i> David DeLoach; Junshan Liu; Scott Kramer
	<i>Integrated Project Delivery(ipd) For A Sustainable Design And Construction</i> Barry Jones	<i>A Preliminary Study Of The Use Of Tablets And Their Applications On Construction Jobsite Operations</i> Michael Bringman; Junshan Liu; Scott Kramer
	<i>Reducing Co2 Emissions Through The Code For Sustainable Homes</i> Paul Hampton; Nathan Deen	<i>Performance Analysis Of Construction Enterprises Using Financial Ratios' Groupings: An Application In The British Construction Industry</i> Theofili Apostola; Georgios Aretoulis; Panagiotis Papaioannou; Glykeria Kalfakakou; Aikaterini Seridou
	<i>Building Information Modeling (bim) Application In Construction Planning</i> Suzila Mohd; Aryani Ahmad Latiffi	<i>Towards Effective Hedging For Construction Concessions Delays</i> Yiannis Xenidis; Sergios Lambropoulos; Panos Papaioannou
	<i>Relationship Between Head Contractors And Subcontractors In The Construction Industry: A Critical Review</i> Xiao-Hua Jin; Guomin Zhang; Bo Xia; Yingbin Feng	<i>Contractor Quantity Surveyor Using Erp System In Cost Reporting</i> Eric W.L. Chan; Caroline T.W. Chan

15:15-17:15	<i>Will Small And Medium Sized Enterprises Within The United Kingdom's West Midlands Region Meet The Challenge Of Implementing Building Information Modelling By 2016?</i> Pauline Corbett; Neil Chapman	<i>A Comparative Study Of Classification Methods For Contractor Prequalification Models</i> Evren Ülkeryildiz; Serdar Kale
	<i>Barriers In Adoption And Implementation Strategies For Building Information Modeling In Pakistan Construction Industry</i> Ar. Kifayat Hussain; Dr. Rafiq Muhammad Choudhry	<i>Uncertainties In Subcontractor Procurement: The Case Of Scaffolding</i> Christian Lyckell; Christian Legnerot; Per-Erik Josephson
19:15-21:30	Dinner Cruise: Please meet at the Hilton dock area at 7:15pm to board the boat and enjoy dinner while cruising down the Chao Phraya River. (Time subject to change)	

### Saturday, 21 December 2013

	<b>Breakout Room A</b>	<b>Breakout Room B</b>
	Parallel Session 4 Chair: Prof. Pauline Corbett	Parallel Session 4 Chair: Dr. Albert P.C. Chan
8:00-10:15	<i>Gender Based Perceptions Of Project Managers' Attributes</i> Aikaterini Seridou; Georgios Aretoulis; Panagiotis Papaioannou; Glykeria Kalfakakou; Theofili Apostola	<i>Probabilistic Method To Predict Activity Duration For Critical Path Method With Increased Reliability</i> Nirdosha Gamage; Guomin Zhang; Chun-Qing Li; Sujeeva Setunge
	<i>Engineering Graduates &amp; The Practice Of Construction Management</i> Fidelis Emuze; John Smallwood	<i>Effectiveness Of Polypropylene Fibre In Improving The Flexural Capabilities Of Light Weight Aggregate Concrete</i> Adnan Qadir; Mah Talat Mirza
	<i>Energy Dissipation Potential Of Concrete Floors Containing Temperature Shrinkage Control Reinforcements</i> Xiao Fan; Ken Sivakumaran; Robert Korol	<i>Improving Work-life Balance Of Civil Engineers In Uae</i> Farah Fatima; Siew Wei Gan; Yu Hoe Tang
	<i>Assessment Of Management Knowledge And Professional Education Amongst The Small And Medium Sized Contractors In The Free State Province Of South Africa</i> Godfrey Mofokeng; Wellington Didibhuku Thwala	<i>Practice In The Bidding Process Of Contractors: A Comparative Study Between China And Sweden</i> Josephson Per-Erik; Liu Jun Ying; Rong Shu
	<i>Developed Design And Build: Changing Procurement Landscapes</i> Andrew King	<i>The Impact Of Information Sharing Misalignment In The Thai Construction Industry</i> Sittimont Kanjanabootra
	<i>An Emperical Analysis Of Macroeconomic Factor That Affect The International Construction Market</i> Jung Ki Lee; Jaebum Lee; Kang-Wook Lee; Seung Heon Han; Pil-sun Jung	<i>Thoughts And Musings On The Development Of A Theory For Rework Causation In Construction</i> Peter Love; Brad Carey; Chun-Pong Sing; Jane Matthews
	<i>An Investigation Of The Critical Factors Affecting The Delivery Of Low-income Housing And Their Effects On Residents' Satisfaction</i> Clinton Aigbavboa; Wellington Thwala	<i>User Satisfaction With Transport Ppp Projects: The Case Of The Bangkok Mass Transit System (bts)</i> Worapong Tangkitsiri; Stephen Ogunlana; Adekunle Oyegoke; Michael Oladokun
	10:15-10:30	Morning Coffee/Tea Break (Common area in front of Grand Ballroom)
	<b>Breakout Room A</b>	<b>Breakout Room B</b>
10:30-11:30	"Improving Construction Project Performance through 21st Century Lean Methods" Chair: Dr. Syed Ahmed and Dr. Lincoln Forbes	"Project Leadership, Leading Teams in Optimal Environment to Achieve Project Success and Minimize Risks" Chair: Dr. Mohamed Agroudy
11:30-12:00	Closing Ceremony (Thonburi Ballroom)	
12:00-13:00	Lunch	



# Program at a Glance

## Thursday, 19 December

15:00–17:00 Registration

17:00–19:00 Welcome Reception

## Friday, 20 December

08:00–08:30 Welcoming Ceremony with CITC-VII Chair, Dr. Syed M. Ahmed and Keynote Speaker, Dr. Naveed Anwar

08:30–10:30 *Parallel Session 1*

10:30–10:45 Morning Coffee/Tea break

10:45–13:00 *Parallel Session 2*

13:00–14:00 Lunch

14:00–15:00 Workshops:

*"Partnering in Construction Industry: Malaysian Experience" and "Unlocking the Potential of Earned Value Management in Increasing Time and Cost Certainty in Construction Projects"*

15:00–15:15 Afternoon Coffee/Tea break

15:15–17:15 *Parallel Session 3*

19:15–21:30 Dinner Cruise

## Saturday, 21 December

08:00–10:15 *Parallel Session 4*

10:15–10:30 Morning Coffee/Tea break

10:30–11:30 Workshops:

*"Improving Construction Project Performance through 21st Century Lean Methods" and "Project Leadership, Leading Teams in Optimal Environment to Achieve Project Success and Minimize Risks"*

11:30–12:00 Closing Ceremony

12:00–13:00 Lunch