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Irtishad Ahmad  
Syed M. Ahmed  
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## **DESIGN AND CONSTRUCTION FOR THE REST OF US**

**Boyd C. Paulson, Jr.**

Charles H. Leavell Professor of Civil and Environmental Engineering Stanford University, Stanford, California, USA

### **ABSTRACT**

Civil engineering academics are caught between a science-based university culture on one side, and on the other the expectations of students and practicing engineers in industry who want practical knowledge to apply today. The science-based culture primarily measures faculty by research projects and funding, Ph.D. students produced, and by papers refereed primarily by academic peers for publication and citation in scholarly journals. There are strong pressures to produce these outputs, which are duly quantified for tenure and promotion decisions, but the system does not directly reward time spent gaining practical experience in full-time or part time jobs prior to academic employment, or later in summers or sabbaticals, or in solving problems through consulting.

This paper will address the balance between academia and practice, and will focus on the residential building sector of the design and construction industry as one largely neglected by engineering programs. In particular, it will show where the design and construction of residential structures can provide opportunities to enhance engineering education and open new avenues for broad, interdisciplinary research that are different from those where engineering academics normally travel. In conclusion, it will focus on academics who successfully bridge from academia to the world around them.

### **KEYWORDS**

Construction, Design, Education, Research

## **CONSTRUCTION INDUSTRY CHARACTERISTICS AND THE IMPLICATIONS FOR RESEARCH: A HONG KONG PERSPECTIVE**

**Michael Anson**

Chair Professor of Civil Engineering,

Department of Building and Real Estate The Hong Kong Polytechnic University, Hong Kong

### **ABSTRACT**

The paper gives a brief overview of the results of the recent analysis conducted by Hong Kong's Construction Industry Review Committee (CIRC) and alludes to a number of similar exercises conducted in other countries. The importance of the role for the research community is identified and in particular the need for researchers and industry to work together. In doing so, academics should be involved in field experiments, i.e. using industry as the laboratory, much more than we usually do.

### **KEYWORDS**

Construction Industry Change, Innovation Culture, Industry Based Research

## **NON VALUE-ADDING COSTS IN BUILDING PROJECTS: THE MISSING THOUGHTS**

**Per-Erik Josephson**

Associate Professor, Department of Building Economics and Management, Chalmers University of Technology Göteborg, Sweden

**Peter Samuelsson**

Department of Building Economics and Management, Chalmers University of Technology, Göteborg, Sweden

### **ABSTRACT**

There is common agreement within the building and construction industry that the costs are too high, but disagreement on which cost elements and what reasons lie behind this situation. The Swedish Construction Federation states that the burden of taxation on new houses in Sweden is 65%. Other groups of actors mean that the production is inefficient or that material prices are too high. An alternative way to tackle the problem is to identify activities that do not add value to the customer. This paper aims to broaden the thinking considering non value-adding activities and associated costs. Some examples of such activities found in Swedish construction projects are presented.

## **KEYWORDS**

Non Value-adding Costs, Poor Quality Costs, Building Project, Costs

## **APPLYING EARNED VALUE TECHNIQUE TO KOREAN CONSTRUCTION INDUSTRY**

**Sang-Chul Kim**

Resercher, Department of Architectural  
Engineering., Yonsei University, Seoul, South  
Korea

**O-Cheol Kwon**

Manager, Samsung Engineering and  
Construction Co., Seoul, South Korea

**Joon-Hong Paek**

Professor, Department of Architectural  
Engineering., Yonsei University, Seoul, South  
Korea

## **ABSTRACT**

Earned Value is a concept of project control technique which provides a quantitative measure of schedule and cost information and evaluates work progress in order to identify potential delay and overruns. In Korea, there has been not used this concept, however, the Korean Government legislated that EV should be used in those construction projects that would be over 40 billion dollars in 2000. The concept of EV is based on the integration between WBS used in schedule and CBS used in cost. However, the construction projects are controlled by cost breakdown in Korea, EV can hardly be applied. This paper mainly describes that the integration model of the cost information that is related to cost breakdown and schedule information is suitable for Korea. And the proposed model is developed to EV system. It is proven by comparing actual budget and simulated budget based on schedule through case study.

## **KEYWORDS**

Earned Value, Schedule Control, Cost Control, Integrated Model, Cost Breakdown

## **BRICKLAYERS' PERSPECTIVES ON THE 'BUILDABILITY' OF THE BED-JOINT AND THE THREAT TO STANDARDISATION VIS-À-VIS COST OPTIMISATION**

**Vasantha Abeysekera**

Senior Lecturer, UNITEC, Auckland, New  
Zealand

**A Thorpe**

Professor of Construction Information  
Technology, Loughborough University,  
Loughborough, UK

## **ABSTRACT**

Although a unique metric size of 10mm has been accepted as the 'standard' for all brickwork joints, current perceptions and practices show the use of a wide variety of joint sizes. The 'buildability' of these sizes was investigated under this study from a bricklayer's perspective, where it was found that most found is easier to build to a size neither small nor large (but larger than 10mm). In contrast, some failed to differentiate size with buildability. Given a free hand, bricklayers would choose a size of their convenience. As such there is a need to exercise control especially when using a small or a large size. These discoveries have brought to light the possibilities of manipulating joint sizes for potential productivity and cost gains – an approach that goes against the use of a 'standardised' approach to joint sizes. Given that the bed joint occupies a larger space than all other joints put together, it presents the greatest potential for manipulation. This is made easier by the use of two powerful concepts labelled as 'cost polarity' and 'cost homogeneity'. Despite the use of brickwork since the dawn of civilisation and an enormous amount of research conducted, there is still much scope for exploration; what has been learnt from science is still incomplete, and sometimes distorted as evidenced by the enormous emphasis placed on the standardisation process despite shortcomings. It is time that an attempt is made to lay the foundations for a 'theory on brickwork'.

## **KEYWORDS**

Buildability, Brickwork, Cost optimisation,

Productivity, Standardisation

## **ECONOMIC RESULT OF LEARNING LESSONS**

**E. William East**

Principal Investigator, U. S. Army Construction Engineering Research Laboratory, Champaign, Illinois, USA

**Jeffrey G. Kirby**

Principal Investigator, U. S. Army Construction Engineering Research Laboratory, Champaign, Illinois, USA

### **ABSTRACT**

Learning Corporate lessons occur when employees recognize better ways of accomplishing work. Ideally these lessons can be reused by not only the original developer of the lesson but also other persons involved in future projects. Unfortunately these lessons cannot be easily shared outside the immediate project team. The U.S. Army Construction Engineering Research Laboratory has developed the Corporate Lessons Learned (CLL) architecture for the distributed capturing, storing, and sharing of corporate lessons. The first phase of this system development, which addresses design quality lessons learned, has been fielded and there is enough experience to begin estimating the benefits derived from its usage. A recently completed economic analysis shows a payback of \$120 for every dollar spent to document and approve a lesson learned. Sharing of an initial set of lessons captured at one Corps office has the potential to save all Corps offices \$53 Million during the first seven years of operation of this system.

### **KEYWORDS**

Lessons Learned, Collaboration, Learning, Process Improvement

## **CASH FLOW FORECASTING MODEL USING MOVING WEIGHTS OF COST CATEGORIES FOR GENERAL CONTRACTORS ON JOBSITE**

**Hyung-Keun Park**

Graduate Student, Constructon Engineering and

Management, University of Wisconsin,  
Madison, Wisconsin, USA

**Jeffrey S. Russell**

Professor, Constructon Engineering and  
Management, University of Wisconsin,  
Madison, Wisconsin, USA

### **ABSTRACT**

This research introduces the development of for a project-level cash flow forecasting model in construction stage based on planned earned value and cost from a general contractor's view on a jobsite. Previous most models have been developed to assist contractors in their pre-tender or planning stage cash flow forecasts.

The key to cash flow forecasting at the project level is how to build a cash-out model. The basic concept is to use moving weights of cost categories in a budget. The cost categories are classified to compile resources with almost the same time lags. Time lag, as used here, is based on contracting payment conditions and credit times given by suppliers or vendors. For cash-in, net planned monthly-earned values are simply transferred to the cash-in forecast, to be applied there with billing time and retention money.

Validation of the model involves applying data for four real projects in progress for 12 months. Through comparative analyses of the simulation results based on the proposed model and results based on existing models, the proposed model is more accurate, flexible and simple than traditional method for construction jobsite employee who is not oriented financial knowledge.

### **KEYWORDS**

Cash Flow Forecasting, Moving Weights, Cost Categories

## **HISPANIC AND NON-HISPANIC WAGE DIFFERENTIALS: IMPLICATIONS FOR THE U.S. CONSTRUCTION INDUSTRY**

**Paul M. Goodrum**

Assistant Professor, Civil Engineering,  
University of Kentucky, Lexington, Kentucky,  
USA

## **ABSTRACT**

The shortage of skilled construction workers is considered to be one of the greatest challenges facing the U.S. construction industry. To meet workforce demands, the industry is increasingly relying on Hispanic construction workers. The result has been a strong increase in Hispanic construction workers, especially in the Western and Southern United States where Hispanics already comprise 31% and 24% of the total construction workforce respectively. Using data from the U.S. Bureau of Labor Statistic's Current Population Survey (CPS), this study examines relative differences in hourly wages between Hispanic and non-Hispanic construction workers. The finding suggests that Hispanic workers earn less than their non-Hispanic counterparts controlling for experience, occupation, schooling, and geographical location. The implication of the increasing size of the Hispanic construction workforce with respect to industry real wages and education needs is discussed, along with the workforce's ability to adopt future technologies and workforce strategies.

## **KEYWORDS**

Construction, Workforce, Wages, Technology, Economics

### **APPLICATION OF ORACLE/CASE IN PROJECT COST CONTROL SYSTEM DESIGN AND DEVELOPMENT**

**Guangbin Wang**

Research Institute of Project Administration and  
Management, Tongji University, Shanghai,  
China

**Wenjuan Zhang**

Shanghai Zhangjiang Hi-Tec Development Co.  
Ltd., Shanghai, China

**Yan Jin**

American Industrial Design Company  
(Shanghai), Shanghai, China

**Yongsheng Zhao**

AETNA School of Management, Shanghai  
Jiaotong University, Shanghai, China

## **ABSTRACT**

CASE emerges from application of computer-aided technology to software engineering. Both in research and application, it is a hot field and development direction for the integrated design and development environment and tools of software. Based on the application of ORACLE/CASE in Project Cost Control Information System (PCCIS) design and development, this paper analyses some important topics including system develop strategy, CASE design process and CASE\*Dictionary in PCCIS.

## **KEYWORDS**

CASE□Project Cost Control, Software  
Development Environment and Tools, ORACLE

### **ROLE OF FINANCE IN THE COMPETITIVENESS OF INDIGENOUS CONTRACTORS – THE CASE OF HONG KONG**

**Theresa Y. M. Chan and Y.H. Chiang**

Department of Building and Real Estate, The  
Hong Kong Polytechnic University, Hong Kong

## **ABSTRACT**

This paper examines the competitiveness of indigenous contractors of Hong Kong focusing on the accessibility and availability of finance. By glancing the market performance of the contractors in various sectors of the construction industry, their competitiveness seems to be undermined by financial and technological inferiors. Their positions in the markets are further retarded by market domination and industry fragmentation, multiple layers of sub-contracting and labour-intensive construction. Hong Kong is a world-class financial centre and has one of the largest representations of international banks in the world (HKMA, 2002). Yet findings indicate there is a mismatch of supply and demand of construction finance in Hong Kong. Indigenous contractors have found no easy access to finances. This study reviews sources of finance in Hong Kong and concludes how finance in associate with key elements for competitive advantages, technology and human resources

could help boosting the competitiveness of indigenous contractors and thus productivity of the construction industry.

#### **KEYWORDS**

Competitiveness, Indigenous Contractors, Finance, Technology, Hong Kong

#### **MODELING CONCESSION PROJECT INVESTMENTS UNDER UNCERTAINTY: A CRITICAL REVIEW**

**Alison McCowan**

PhD Candidate, Griffith University, Gold Coast, QLD, Australia

**Sherif Mohamed**

Senior Lecturer, Griffith University, Gold Coast, QLD, Australia

#### **ABSTRACT**

The concession contract is becoming progressively popular as a procurement mode for large infrastructure projects worldwide. The long-term nature of these projects, coupled with the pressure of an increasingly competitive international market, exposes construction companies to greater risk than ever before. Several decision support systems (DSSs) combining economic and risk analyses have been developed for the evaluation of concession project investments (CPIs). These are structured using a wide variety of frameworks, predominantly adopting the probability theory as a mathematical modelling technique. However, there is a new school of thought that the frameworks adopted in these DSSs do not accurately reflect reality, and that the possibility theory would be more appropriate as a modelling technique. This paper discusses the key requirements of an effective yet efficient DSS, and provides a critical review of currently available systems according to two selection criteria: (1) a suitable DSS framework, and (2) an appropriate mathematical modelling technique. It then proposes that a DSS that uses an Analytical Network Process (ANP) framework in conjunction with possibility theory achieves both effectiveness and efficiency for the specific application of modelling CPIs.

#### **KEYWORDS**

Concession Project Investment, Decision Support System, Economic Analysis, Risk and Uncertainty, Possibility Theory.

#### **A CONCEPTUAL MODEL FOR HOLISTIC DECISION MAKING IN PROJECTS**

**Ali Jaafari**

Professor of Project Management, The University of Sydney, NSW, Australia

**David Gunaratnam**

Senior Lecturer, The University of Sydney, NSW, Australia

**Kitsana Kit Manivong**

Postdoctoral Fellow, The University of Sydney, NSW, Australia

#### **ABSTRACT**

Decision models available in traditional project management systems are based mainly on quantitative data, such as resource quantities, rates, costs etc. Qualitative aspects of the projects, such as customer and stakeholders' satisfaction, quality, safety, statutory requirements and due diligence are not generally treated as variables but as constraints, even though these have major influence on all capital projects. The paper describes a multi-criteria decision model, with a hierarchical structure, that allows an optimum project plan to be determined based on a life cycle objective function, which takes into consideration both the quantitative and qualitative aspects of the project. The progression through the hierarchy is by a series of transformations that generate high-level attributes of project with reduced dimensionality, leading to a set of quantitative and qualitative criteria and finally to the single overall objective. The information and knowledge required for progression through the hierarchy are derived from case studies of projects, domain knowledge and the preferences of project managers.

#### **KEYWORDS**

Multi-criteria, Decision Model, Life Cycle, Project Management, Information System

Project Manager

**AN INTELLIGENT DECISION SUPPORT  
SYSTEM FOR PROJECT MANAGERS**

**Saad H. Al-Jibouri**

Assistant Professor, Department of Construction  
Process Management, University of Twente, The  
Netherlands

**Michael. J. Mawdesley**

Senior Lecturer, School of Civil Engineering,  
University of Nottingham, UK

**G. Al-Mohamdi**

PhD Student, School of Civil Engineering,  
University of Nottingham, UK

**ABSTRACT**

Projects are executed to overcome an existing problem by providing a solution to it. The solution is accomplished by a collaboration of efforts of different participants (under direct or indirect control of a project manager) bringing together their various capabilities to achieve specific objectives. In order to achieve these specific objectives, a number of tasks have to be performed. These tasks interact in a complex manner: each task require information before it can be performed and produces information once it has been performed. The information moves towards the objective in a timely manner through the organisation of the projects until it reaches the person who performs the task. The flow of information between the tasks and the links between the information is a key factor, as it will provide the basis for planning, monitoring and controlling.

This paper describes an effort to identify the information required by these tasks and to model their interdependencies. In particular the paper concentrates on the development of a decision support system, which will furnish pertinent information to the project manger. It is aimed to enhance the effectiveness of the project manager's decision-making abilities in planning, monitoring and control of his project.

**KEYWORDS**

Decision Support System, Knowledge-based System, Project Control, Information Flow,

**EFFICIENT RESOURCE PLANNING FOR  
INFRASTRUCTURE PROGRAMS**

**Tarek Hegazy**

Associate Professor of Construction  
Management, University of Waterloo, Waterloo,  
Ontario, Canada

**Ahmed Elhakeem**

Graduate Student, University of Waterloo,  
Waterloo, Ontario, Canada

**ABSTRACT**

This paper investigates the effectiveness of various resource planning options on the duration and cost of construction / maintenance operations in large infrastructure networks such as buildings, highways, bridges, and water/sewer networks. The investigation utilizes a generalized scheduling model that suits multiple distributed sites with non-typical tasks and work conditions. The scheduling model also employs an information system to store data related to various work sites, tasks' optional construction methods, and available resources. Using this scheduling model on an example project, 800 scheduling experiments were conducted using various planning options: site scheduling order, staggered versus parallel crews, crew movement time/cost, and site productivity conditions. Based on these experiments, site order, crew moving, and site productivity are found to have a significant impact on schedule and have to be considered in developing realistic plans. Suggestion to improve crew scheduling are then made.

**KEY WORDS**

Construction Management, Infrastructure, Resource Planning, Repetitive Projects, and Computer Applications

**SCOPE DEFINITION AND PROJECT  
RISK ANALYSIS**

**Yu-Ren Wang**

Ph. D. Candidate and Graduate Research  
Assistant, University of Texas, Austin, Texas,  
USA

**G. Edward Gibson, Jr.**

Associate Professor and Austin Industries  
Endowed Faculty Fellow, University of Texas,  
Austin, Texas, USA

**ABSTRACT**

The Project Definition Rating Index (PDRI) is a project scope definition tool developed under the guidance of Construction Industry Institute (CII). The PDRI allows a project team to evaluate the completeness of scope definition prior to detailed design or construction. It also helps the project team quickly analyze the scope definition package and predict factors that may impact project risk. This paper will summarize the application of the PDRI in the project risk management process. Data from 78 building projects representing approximately \$1.1 billion were collected and the relationship between PDRI scores and project performance will be demonstrated. Used in a project team environment the PDRI facilitates discovery of project risk areas and related potential cost escalation, allowing generation of risk control measures. The use of the PDRI as a project risk management tool will be demonstrated.

**KEYWORDS**

Scope Definition, Project Definition Rating Index (PDRI), Project Risk, Risk Management

**RISK IDENTIFICATION AND  
MECHANISMS FOR MITIGATION**

**Mark W. Cohen**

Vice President and Corporate Manager of the  
Dispute Resolution Division The Nielsen-  
Wurster Group, Inc., Princeton, New Jersey,  
USA

**ABSTRACT**

All engineered and constructed projects have goals and risks associated with their achievement. As construction projects worldwide become more technically and contractually complex, the risks associated with them are magnified and the negative impacts to their execution are enhanced. These risks are further exacerbated by the current international

trend of increased multinational participation/execution of projects. Thus, timely and adequate risk identification is paramount in order to enable risk to be adequately managed and administered.

This paper examines some of the major sources of risk on international engineered and constructed projects. This is accomplished through the analysis of the life cycle of a typical engineered and constructed project to understand the execution processes that occur during the stages of a project, their timing, relationships and dependencies. This knowledge is utilized to allow the identification and understanding of some of the major sources of risk that occur during the life of an engineered and constructed project, as well as the timing and magnitude of the resulting impacts. This paper offers insight and discussion relative to potential mechanisms and processes for mitigating the impacts resulting from the major sources of risk. Specific examples are detailed to offer insight to contractors, construction managers and owners involved with international engineered and constructed projects in order to properly identify and assess major sources of risks.

**KEYWORDS**

Risk, Impact, Delay, Disruption, Planning

**RISK MANAGEMENT IN DESIGN/BUILD**

**Talal Abi-Karam**

Senior Principal Engineer, Hazen and Sawyer,  
P.C., Hollywood, Florida, USA

**ABSTRACT**

The design/build delivery method has emerged as an innovative method for delivering private and public works projects. Despite an increase of its use, design/build is not a “cure-for-all” method that will solve all problems for the parties involved in the design and construction process. While design/build theoretically eliminates the adversarial relationships between the parties, reduces project duration, claims, and cost overruns; it is not a risk-free method. Opponents advocate that design/build merely rearranges the players and associated risks in the

construction process. The design/build method carries some of the conventional risks, as well as, a new set of risks related to using new model Contract Agreements, selection process, and teaming up engineers and contractors in a joint venture.

This paper will identify risks associated with the design/build delivery method from the Owner, Architect/Engineer, and Contractors perspectives.

#### **KEYWORDS**

Design/build, Risk, Project, Construction, Management

### **ANALYTIC HIERARCHY PROCESS: A DECISION-MAKING METHOD FOR CONSTRUCTION MANAGEMENT**

**Eddie W.L. Cheng**

Research Associate, The Hong Kong Polytechnic University, Hunghom, Kowloon, Hong Kong

**Heng Li**

Professor, The Hong Kong Polytechnic University, Hunghom, Kowloon, Hong Kong

#### **ABSTRACT**

This paper discusses the use of the analytic hierarchy process (AHP) in making construction management decisions. AHP involves assigning weights to a group of elements. The weighting of elements serves two purposes. First, it can be employed to prioritize (rank) elements in order to identify the key elements. This may for example help to establish the key measures for project performance. Second, assigning weight to selected measures (or criteria) may provide a more accurate judgement. It is, therefore, useful in making management decisions, such as the selection of contractors' tenders or candidates for jobs. In order to illustrate its utility, two examples adopting the AHP are presented. The first is the selection of a group of candidates for a construction management job, while the second is about the determination of the key factors for project success. In addition, descriptions and comments regarding the AHP

method are also provided, including ways to improve consistency.

#### **KEYWORDS**

Construction management, Analytic hierarchy process, Multi-criteria decision making, Methods

### **ECONOMIC RISK EVALUATION FOR RESIDENTIAL HOUSING PROJECTS Abraham Warszawski**

Professor, Faculty of Civil Engineering, Technion - Israel Institute of Technology, Haifa, Israel

#### **Rafael Sacks**

Lecturer, Faculty of Civil Engineering, Technion - Israel Institute of Technology, Haifa, Israel  
Currently: Research Scientist, College of Architecture, Georgia Institute of Technology, Atlanta Georgia, USA

#### **ABSTRACT**

The level of economic risk in construction projects is often great. Providing management with accurate assessments of the probabilities of project net present value outcomes could enable strategic decision making with explicit consideration of risk. Previous work focused on presenting a practical multi-factor approach to this problem, which would allow risk calculation with a minimum of user input and effort. The needs for accurate risk factor probability distribution curves, juxtaposed with the difficulty of eliciting data from management, solving complex activity networks, and accounting for real-world correlations, are dealt with in this continuing research. Accurate probability distribution curves for significant risk factors, such as project licensing and marketing, are currently being investigated: the potential impact of their use in improving risk analysis accuracy is explored. Lastly, an effective and accurate method for assessing the sensitivity of a project's net present value (NPV) to fluctuations in individual risk factors is presented.

#### **KEYWORDS**

Multi-Factor Economic Risk Analysis, Net

Present Value, Sensitivity Analysis, Probability  
Distribution

**RISK-BASED DECISION IN THE  
CORRODING GAS PIPELINES  
MAINTENANCE**

**N. Yahaya**

Associate Professor, Faculty of Civil  
Engineering, University of Technology  
Malaysia, Johor, Malaysia

**J. Wolfram**

Professor, Department of Civil and Offshore  
Engineering, Heriot-Watt University,  
Edinburgh, United Kingdom

**ABSTRACT**

The conventional method of assessing the integrity of corroded oil or gas offshore pipeline is based the deterministic method using the ANSI/ASME B31G-1984. Previous studies have shown that a decision of when and where to repair or replace the damaged pipeline based on this approach, was very conservative. Furthermore, the cost of repair and replacement is extremely expensive. Recent applications in aerospace and nuclear industries have shown that reliability method is probably a more superior approach for the integrity assessment of corroding pressurized offshore pipelines. This method quantifies the probability that the structure will not perform its desired function, i.e. the probability of failure. This alternative approach can be extended into risk-based methodology in the asset maintenance to ensure safety and reliability. The proposed risk-based inspection procedure carried out in the study is more systematic and reliable to account for a huge amount of collected data usually obtained in an on-line inspection using the intelligent devices. The outcomes of this risk-based methodology can be very useful in the decision-making process by the operation management. This in turn will produce an efficient inspection, repair and maintenance program and enhanced the optimized return in investment.

**KEYWORDS**

Assessment, Corrosion, Inspection, Pipelines,  
Reliability, Risk-based method

**A RISK MODEL FOR APPRAISAL OF  
CONSTRUCTION PROJECTS AT  
TENDER STAGE**

**Saad H. Al-Jibouri**

Assistant Professor, Department of Construction  
Process Management, University of Twente, The  
Netherlands

**Michael. J. Mawdesley**

Senior Lecturer, School of Civil Engineering,  
University of Nottingham, UK

**P.J. Dawson**

Professional Engineer, Carillion plc,  
Wolverhampton, UK

**ABSTRACT**

This paper describes a project risk model which has been developed to combine the various sources of uncertainty to allow the effective communication of the uncertainty with respect to the objectives for the project. The identification of the sources of uncertainty is the most difficult part of that process, which uses proven techniques of checklists and structured brainstorming. A simple method of modelling those uncertainties, here termed risk factors, is used. Monte Carlo simulation is used to combine those various sources, producing the uncertainty in the project. In order to enable the communication of the resulting risk and opportunity, a classification system was developed which related the uncertainty to the objectives. This classification was shown to adequately reflect the views of managers when changes to a test project were made or projects were compared. The project risk model was tested on projects as their tenders were being produced. This approach to testing in a live situation confirmed the applicability of the model in practice as well as in theory.

**KEYWORDS**

Construction, Risk, Model, Project Appraisal,  
Cash Flow

**MANAGING INTERNATIONAL ASPECTS  
OF ENGINEERING RISKS**

**John Ciccarelli**

Mid-Atlantic Regional Manager, The Nielsen-  
Wurster Group, Inc., Princeton, New Jersey,  
USA

**ABSTRACT**

The need for effective Risk Management at the engineering stage of the project life cycle is critical for a project's success and can prevent disputes and increase profits for both owners and contractors. The engineering stage of a project, while not the most costly, can impact the budget and schedule of subsequent, more costly phases. Multinational contracting firms compete globally for projects, making price competition fierce, lowering profit margins, and making cost a key distinguishing factor. In addition, owners have high expectations of contractors and are transferring ever more project risk to contractors. To increase profit, execution plans are adding an international component to project risks by outsourcing detailed engineering to offshore organizations that use less expensive labor to perform engineering – commonly referred to as “low-cost centers.” In addition to managing engineering risks such as design coordination, changes, errors and omissions, staff availability, new technology and roles and responsibilities, contractors magnify these risks by using low-cost centers. Because of these new realities, implementing a comprehensive Risk Management system from the earliest planning stages has become essential for every EPC contractor to minimize risk at the engineering phase.

**KEYWORDS**

Risk, Management, Engineering, Outsourcing

**INNOVATIVE INITIATIVES IN  
INTEGRATING CONSTRUCTION  
SUPPLY CHAINS**

**Mohan M. Kumaraswamy**

Associate Professor, The University of Hong  
Kong

**M. Motiar Rahman**

Ph.D. Candidate, The University of Hong Kong

**Ekambaram Palaneeswaran**

Senior Research Assistant, The University of  
Hong Kong

**S. Thomas Ng**

Assistant Professor, The University of Hong  
Kong

**ABSTRACT**

Recent research into innovative procurement systems in general and ‘relational contracting’ in particular, lead to a proposed model for relationally integrated construction supply chains. Formidable barriers, such as those arising from ingrained adversarial industry cultures, have hitherto hampered the integration of segregated and fragmented functions, and hindered the elimination of supply chain inefficiencies and operational deficiencies. This paper draws on: (a) the growing body of ‘lessons learned’ from recent bold initiatives towards more relationship-based procurement arrangements in many countries; and (b) related perceptions on the potential for the joint management of many construction risks. The responses to two recent questionnaire surveys are found to strongly reinforce the value and viability of this present conceptualisation, and proposed operationalization, of relationally integrated supply chains - in releasing latent energies and enabling substantial synergies in construction teams. These energies and synergies are in turn expected to contribute to considerably enhanced performance levels.

**KEYWORDS**

Enhanced performance, Joint Risk management, Procurement, Relational Contracting, Supply Chain.

**CROSS-FUNCTIONAL PRODUCT  
DEVELOPMENT TEAMS FOR  
ENHANCING THE EFFECTIVENESS OF  
SUPPLY CHAINS IN THE HOUSING  
INDUSTRY**

**Kaushik Sahu**

Associate Professor, Operations Management,  
Xavier Institute of Management, Bhubaneswar,  
India

**P. K. Das**

Faculty, Department of Civil Engineering,  
College of Engineering & Technology,  
Bhubaneswar, India

Research Scholar, South Bank University,  
London, UK

**Joe Tah**

Professor of Construction, South Bank  
University, London, UK

**ABSTRACT**

The housing industry provides enough challenges for mass customization. Our work is aimed at characterizing some supply chains that continually add value to the customers in the Housing Industry. The existence of inter-departmental barriers and the lack of inter-organizational collaboration affect customer satisfaction in this Industry. The focus, therefore, will be on the use of cross-functional teams.

We will be presenting concepts that link quality function deployment (QFD) with supply chain management (SCM). The QFD process provides a cross-functional approach that uses a planning tool called the House of Quality (HOQ) for organizing and linking the customer survey information with the product design attributes and later deploying it in stages throughout the organization. Customer feedback is used by the cross-functional team to make engineering, marketing and design decisions. These tools can be extended to support inter-organizational interactions thereby enhancing the effectiveness of collaborative product development ventures. Supply chains wanting early design involvement of key chain members can use these support systems that can deploy the voice of the customer with minimum distortion along the value chain. Effective implementation of these tools through cross-functional teams will improve concurrency and enhance mass customization capabilities.

**KEYWORDS**

Concurrent Engineering, Virtual Collocation, Mass Customization, Feedback Mechanism, Quality Function Deployment

**INTELLIGENT VIRTUAL  
CONSTRUCTION MATERIAL SUPPLY  
CHAIN ENVIRONMENT**

**Chika Udejaja**

**ABSTRACT**

The use of information technology is being encouraged increasingly for exchanging information and coordination activities among participants in a supply chain. This trend can be understood as a consequence of a new strategy of conducting business, which is the concept of virtual enterprise (VE). In the Construction Material procurement, the virtual enterprise is mostly composed of sub-contractors and suppliers having no definite relations, policies and implications. Hence, it is not difficult to perceive the degree of complexity in managing this kind of value-chain as well as coordinating the processes of the material supply chain that is distributed. This paper presents an ongoing research for developing intelligent virtual tools based on Multi-agent systems (MAS), to support the construction material supply chain environment. The MAS views the material supply chain as a virtual environment, that employs concepts from distributed artificial intelligent (DAI) field to organize and coordinate the activities of a material supply chain process. The primary goal is to examine some of the issues associated with the use of MAS within the construction industry. It further describes the potential for the use of agent technology in a collaborative and distributed environment such as the material supply chain environment and then goes on to present conceptual framework for the use of MAS technology in a virtual environment for the automated procurement of construction materials. This is intended to serve as a useful decision support system (DSS) for participants in material supply chain environment, and should allow faster, better, and more economic, collaborative procurement.

**KEYWORDS**

Supply Chain, Virtual Environment, Construction Material Procurement, Multi-Agent System

**DEVELOPMENT OF AN E-BUSINESS SOLUTION FOR THE INTEGRATION OF STEEL REINFORCEMENT SUPPLY CHAIN IN CONSTRUCTION PROJECTS**

**Daniel Castro-Lacouture**

Ph.D. Candidate, Purdue University, West Lafayette, Indiana, USA

**Mirosław J. Skibniewski**

Professor of Civil Engineering, Purdue University, West Lafayette, Indiana, USA

**ABSTRACT**

Although it is currently possible to read structural drawings and prepare concrete reinforcement schedules automatically, improvements in scheduling, cost and project delivery will not be significant if the complexities in the interactions of parties involved are not addressed. Reinforcement steel is a critical material for construction success in terms of cost, schedule and ultimate integrity of the structure. It is still common practice for rebar fabricators to accept structural design information in CAD drawing formats and then generate new drawings for the shop floor, which ultimately are presented to the contractor as blueprints. Collaborative supply chain solutions provide support for the capture and communication of customer demands, and enable these demands to automatically trigger business events and initiate process workflow. This paper presents a system that will allow the rebar industry to collaborate with construction and design firms, thus implementing a robust supply chain with dynamic marketplaces enabled by electronic business technologies.

**KEYWORDS**

Steel Reinforcement, Supply Chain Management, E-business, Extensive Markup Language (XML)

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*“Challenges and Opportunities in Management and Technology”*

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**POLICIES, PRINCIPLES AND PROCEDURES FOR CONSTRUCTION PROCUREMENT IN THE PUBLIC SECTOR OF MALAYSIA**

**Khairuddin Abdul Rashid**

Associate Professor, Kulliyyah of Architecture and Environmental Design International Islamic University Malaysia, Kuala Lumpur, Malaysia

**ABSTRACT**

The Government is the largest single client for construction in Malaysia. Using this commanding position, the Government formulated policies, principles and procedures that aim to achieve value for money. In addition, through its procurement policies the Government aims to stimulate socio-economic growth and development. The paper begins by providing a snapshot on the construction industry of Malaysia. It then outlines the Government of Malaysia's policies, principles and procedures for procurement. In the concluding section, factors that should be considered by a project manager intent on managing construction projects in the public sector of Malaysia are outlined.

**KEYWORDS**

Construction, Malaysia, Policies, Procurement, Public Sector

**INNOVATIVE METHODS FOR REDUCING CONSTRUCTION TIME OF TRANSPORTATION PROJECTS IN URBAN AREAS**

**Zohar J. Herbsman**

Professor of Civil Engineering, University of Florida, Gainesville, Florida, USA

**Cristina Cosma**

Ph.D. Candidate, University of Florida, Gainesville, Florida, USA

**ABSTRACT**

In today's highway construction industry, the

focus of work has shifted from building new transportation facilities to Rehabilitating, Resurfacing, and Restoring (3R) of those already in existence. In this type of project, traffic must be maintained with lane and shoulder restrictions while construction takes place, As a result, traffic flow is disrupted seriously and creates major inconvenience to the public. Reducing the construction time and thereby minimizing the inconvenience to the traveling public has become one of the primary missions for State Highway Agencies.

In recent years, a few innovative contracting methods have been introduced into the USA. These innovative contracting methods are not entirely new ideas but have not been used substantially in the past. These methods intend to reduce construction time and thereby minimize traffic disruptions during the construction periods. These innovative contracting methods motivate the contractor to work faster and encourage better construction planning and work management.

This paper will introduce the results of analyzing 100 projects that have been constructed in the USA using these innovative methods. The statistical analysis has shown substantial reductions in construction time (up to 50%) as compared to similar projects using conventional methods. The paper will also present the parameters affecting time reduction, such as project type, location, and other parameters.

#### **KEYWORDS**

Procurement, Time Unit Cost, Road User Cost, Bidding Methods, Transportation Projects

#### **INTEGRATION OF SUPPLY CHAINS AND CONSTRUCTION SCHEDULE ON HIGHWAY PROJECTS**

**John Sobanjo**

Department of Civil and Environmental Engineering FAMU-FSU College of Engineering, Tallahassee, Florida, USA

#### **ABSTRACT**

The supply chain methodology is a recent technology being developed and implemented

for the manufacturing industry with many reported benefits. This paper presents a conceptual framework for the application of supply chain models in highway construction projects. The highway construction process is served by hierarchical levels of suppliers: (1) the materials' plants and vendors who provide construction materials directly to the contractors; and (2) vendors who supply the "parts" or "ingredients" that these materials' plants need to produce the construction materials. This implies a multi-echelon serial supply chain. Uncertainties in these materials' characteristics (quality, cost, time, etc.), as generated at the interface of each supply chain with the construction process, will lead to uncertainties associated with the final project completion characteristics, i.e., project quality, cost, and time. The formulation of a mathematical model of the supply chains is demonstrated, along with impact of the supply chains on construction project completion.

#### **KEYWORDS**

Highway Construction, Supply Chain, Construction Materials, Probability Network Scheduling, Project Cost

#### **CONCEPTUAL FRAMEWORK FOR DEVELOPING GENERIC INTEGRATED SUPPLY CHAIN MANAGEMENT MODEL FOR CONSTRUCTION INDUSTRY**

**Tayyab Maqsood**

Department of Building and Construction, City University of Hong Kong, Hong Kong

**Akintoye Akintola**

School of Built and Natural Environment, Glasgow Caledonian University, UK

**Salman Azhar**

Doctoral Candidate, Department of Civil and Environmental Engineering Florida International University, Miami, Florida, USA

#### **ABSTRACT**

Supply chain management concept has flourished under different labels. The paper argues that after a decade use of confusing terminologies it is now possible to obtain a

consensus on supply chain management terminology and establish its problem domain. There is a need of advancing the theory and developing robust supply chain management models to put this philosophy in actual practice in its true form. The supply chain management emphasizes ‘Inter-organization cross-functional integration’. This attribute is suitable for construction industry, which is characterized by ‘fragmentation’. The paper provides a conceptualisation of supply chain management by proposing its structural make up consisting of two components; essential components like supply management and chain management and driving components like outsourcing, relationship management and power management. The research is being undertaken to theoretically advance all these components for supply chain management implementation and utilization as a management tool that may plan, monitor, control and synchronizes various business processes and activities in a supply chain from one end to other with a view to obtain waste elimination, increased efficiency and improved end customer satisfaction.

#### **KEY WORDS**

Supply Chain Management, Purchasing, Logistics, Integration, Theoretical Constructs

#### **A DYNAMIC SIMULATION MODELLING SYSTEM FOR PROCESS REENGINEERING AND OPTIMISATION**

**Hemanta Doloi**

PhD Candidate, Project Management Group,  
Dept. of Civil Engineering, The University of  
Sydney, NSW, Australia

**Ali Jaafari**

Professor of Project Management, Dept. of Civil  
Engineering, The University of Sydney, NSW,  
Australia

#### **ABSTRACT**

The challenge faced by most designers and facility planners is to determine the required size of a major facility and the associated main parts that work most effectively in a fluctuating operational environment. Process simulation, if

carried out realistically, provides clear insights into the working efficacy of a given process. The information generated can be used to reengineer the same. Reengineering is widely used along with advanced information systems to automate and or improve an existing or a planned operation. It involves establishing a digital process model of the project and subjecting the same to the operational scenarios expected during the life of a facility.

This paper puts forward a Computer-Integrated Simulation technique that will respond to the above challenges dynamically in a construction, service or production environment. The developed system, dubbed Dynamic Simulation Modeling System (**DSMS**), is unique in the sense that it provides a facility for determining project operability and process efficiency within a whole-of-life business approach. Through the definition and use of only 2 building blocks a process can be defined and then the model run to test the same. The information can be fed to an Integrated Facility Engineering (**IFE**) system for overall optimisation purposes. The system enables analysing alternative process designs reflecting the associated external uncertainties. A brief case study will be used to demonstrate and discuss the model's capabilities.

#### **KEYWORDS**

Simulation, Process Reengineering, Process Modelling

#### **IMPROVING THE VALUE GENERATION CYCLE IN THE DESIGN PROCESS OF INDUSTRIAL CONSTRUCTION PROJECTS**

**Leonardo Rischmoller**

Ph.D. Candidate, Pontificia Universidad  
Católica de Chile, Santiago, Chile

**Luis Fernando Alarcón**

Director, Production Management Program,  
Pontificia Universidad Católica de Chile,  
Santiago, Chile

**Lauri Koskela**

Senior Research Scientist, VTT Building and  
Transport, Espoo, Finland

## **ABSTRACT**

Construction can be claimed to be on the threshold of a new paradigm that will bring about major changes in performance in the 21st century. Information Technology (IT) plays a key role within this context of change. The practical application of IT has already led engineering and construction corporations to reach high levels of performance in contrast with the rest of the industry. Design of industrial process plants using **Computer** Advanced Visualization Tools (CAVT) is the most glaring example of such developments. Nevertheless, researchers in construction IT appear reluctant to embrace the issues associated with implementation and industry practice. The rhetoric and visions associated with construction IT have turned out to be alarmingly distant from reality of construction usage of IT. This paper presents results from a research about the impact of **CAVT** in the design process of industrial process plants. The research methodology considers the industry as point of departure, through a case study using the observation-participation method, and then confronts insights coming from practical issues with theoretical analysis and traditional approaches. The **TFV (Transformation-Flow-Value)** production theory is used as the conceptual framework in the analysis of engineering and construction processes. Five main principles covering the value generation cycle in the design process of industrial construction projects are identified and presented, and utilizing these principles as the conceptual framework, important changes and improvements due to the impact of **CAVT** are pinpointed.

## **KEYWORDS**

4D Simulation, Industrial Construction, Production Theory, Case Research, Evaluation

### **CREATING LEAN ENTERPRISES THROUGH PROCESS ORIENTATION - MODELS FOR NEW BUSINESS OPPORTUNITIES**

**Christian Lindfors**

Doctoral Researcher, Royal Institute of  
Technology, Stockholm, Sweden

## **Roine Leiringer**

Doctoral Researcher, Royal Institute of  
Technology, Stockholm, Sweden

## **ABSTRACT**

The construction industry is experiencing large and radical changes forced upon it by external influences such as changing social patterns, internationalisation, growing environmental awareness, rapid development of the IT sector, knowledgeable and demanding customers, as well as development within the industry itself. The need for organisations to adapt to this new set of circumstances is evident as companies face financial difficulties at a time when they need to come up with innovative solutions and increase their customer focus. One way of adapting – the one explored in this paper – is to make the organisation leaner. ‘Lean enterprises’ are resource and time efficient and agile to the point that they are able to respond to customer demands and expectations. Instead of having activities aligned according to functions, lean enterprises are organised along value chains of products or product families. This paper addresses the implementation of process thinking to the construction industry and presents a structured way of making a systematic representation of processes. It discusses initiatives, including the creation of extensive functional models that have been initiated to systematically identify processes within organisations and to create new models for more efficient enterprises. Conclusions are drawn that confirm the utility of adopting a process orientation for bringing about improvement and as a pathway towards establishing lean enterprises.

## **KEYWORDS**

Lean Thinking, Process Orientation, Customer Focus

### **INCORPORATING SAFETY INTO CONSTRUCTION SITE MANAGEMENT**

**Emad Elbeltagi**

Post-Doctoral Fellow, Civil Engineering  
Department, University of Waterloo, Waterloo,

Ontario, Canada

**Tarek Hegazy**

Associate Professor, Civil Engineering  
Department, University of Waterloo, Waterloo,  
Ontario, Canada

**ABSTRACT**

The construction industry involves many operations that can be risky, dangerous, and unhealthy. The number of injuries, accidents, and work related illnesses reported on construction sites exceed that of the manufacturing industry, thus contributing to additional costs and delays on projects. To ensure that a construction site is safe for operations, proper site management procedures have to be put in place, considering safety into account. This paper presents an effort to provide a quantitative approach that will help in maintaining safe and productive construction sites. First, safety issues on construction sites are discussed and the factors that contribute to unsafe sites are outlined. Three aspects are then considered during site planning to improve safety: (1) Defining the necessary temporary facilities needed for safety reasons on construction sites; (2) Defining proper safety zones around the construction space; and (3) Considering safety in the process of determining the optimum placement of facilities within the site. These considerations will lead to a safe site and accordingly increase productivity. A case study is presented to demonstrate the benefits of the three safety measures proposed and future extensions are outlined.

**KEYWORDS**

Safety, Site Layout, Construction Management, Environment, Accidents

**THE PERFORMANCE APPROACH TO  
CONSTRUCTION WORKER SAFETY - A  
MODEL FOR IMPLEMENTATION**

**Theo C. Haupt**

Senior Lecturer, Peninsula Technikon, Bellville,  
Western Cape, South Africa

**ABSTRACT**

A procedural model for implementing the

performance approach was developed after an extensive review of the literature on the performance approach as it applies to building construction, and approaches advocated in safety and health legislation in several countries. The model promotes the resolution of planning issues ahead of organizational ones. In this case, planning is the determination in advance of the safety objectives of the organization and deciding upon the course of action that will most effectively achieve those objectives. The model fosters a proactive approach since management and workers are involved on a participatory basis in setting the safety objectives to be achieved with respect to each activity before it is undertaken. In this paper, the procedures required to implement the performance approach to construction worker safety are presented and outlined within the framework of the model.

**KEYWORDS**

Performance Approach, Planning, Risk Assessment, Safety Objectives, Hazard Identification

**TRENCH-RELATED FATALITIES IN  
CONSTRUCTION: AN ANALYSIS OF  
FATALITY ASSESSMENT AND  
CONTROL EVALUATION (FACE)  
RECORDS**

**Carlos A. Arboleda**

Research Assistant, Purdue University, West  
Lafayette, Indiana, USA

**Dulcy M. Abraham**

Associate Professor, Purdue University, West  
Lafayette, Indiana, USA

**Reini Wirahadikusumah**

Research Engineer, Purdue University, West  
Lafayette, Indiana, USA

**Javier Irizarry**

George Washington Carver Doctoral Student,  
Purdue University, West Lafayette, Indiana,  
USA

**ABSTRACT**

Every year, there are over one hundred estimated fatalities in the U.S. associated with

excavations and trenching operations. Causes of fatalities include: cave-ins, contacts with electrical cables, equipment related accidents, and utility damages. To improve the effectiveness of accident prevention programs in trenching operations, the primary causes of trenching accidents and fatalities have to be identified. Developing a database to identify the causes of fatalities in trenching operations is the first step in the development of effective intervention strategies. This paper describes the analysis of trenching-related fatalities based on the National Institutes for Occupational Safety and Health (NIOSH) Fatality Assessment and Control Evaluation (FACE) records.

#### **KEYWORDS**

Trenching, Accident Prevention, Fatalities, Injuries

#### **PRODUCT AND PROCESS QUALITY ASPECTS OF READY-MIXED CONCRETE TECHNOLOGIES**

**Arne Ziegert**

PhD Student, AB Färdig Betong and Chalmers University of Technology, Göteborg, Sweden

**Jan Bröchner**

Professor, Chalmers University of Technology, Göteborg, Sweden

#### **ABSTRACT**

Market acceptance of new types of concrete and associated technologies that have emerged during the last decades varies. The purpose of this investigation is to identify which features of new technologies in concrete that determine adoption by construction contractors, designers and clients. For each technology, product qualities, process qualities and their mutual relations are studied. Results indicate that more widespread market acceptance of certain new technologies presupposes changes in the supply chain, implying a reallocation of tasks and risks between ready-mix concrete suppliers and construction contractors. The potential for a more responsive integration of construction design and site activities is also investigated in the light of features of individual technologies.

#### **KEYWORDS**

Ready-mixed Concrete, Innovation, Process Quality, Product Quality, Supply Chain

#### **QUALITY DEVELOPMENT IN HONG KONG PUBLIC HOUSING**

**A.P.C. Chan**

Associate Professor, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong

**F.K.W. Wong**

Associate Professor, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong

**P.T.I. Lam**

Lecturer, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong

**J.C.W. Choi**

Research Assistant, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong

#### **ABSTRACT**

Quality of public housing in Hong Kong has been under cynical criticisms. Insufficient design of space allocation, poor workmanship, faulty piling, and substandard steel structure, concrete work, and finish work have been the subjects of attack by politicians and general public. In response to these criticisms, the Hong Kong Housing Authority (HA), together with its executive arm - the Housing Department (HD), have implemented a number of improvement initiatives to enhance its quality performance in the past ten years. The main purpose of this paper is to conduct a comprehensive review of quality development in Hong Kong public housing, with particular attention to the improvement initiatives implemented by the HA and HD. It is hoped that this paper can provide the reader with a clear picture of the transformation process of quality development in Hong Kong public housing.

#### **KEYWORDS**

Public Housing, Quality, Hong Kong

#### **THE YEAR 2000 VERSION OF ISO 9000 AND THE PROCESS COST MODEL FOR MEASURING QUALITY COSTS IN**

## **CONSTRUCTION PROCESSES**

**Raymond T. Aoieong**

Lecturer, University of Macau, Macau SAR,  
China

**S.L. Tang**

Associate Professor, The Hong Kong  
Polytechnic University, Hong Kong SAR, China

### **ABSTRACT**

One of the main focuses of the Year 2000 version of the international standard ISO 9000 is continual improvement. The Standard clearly indicates that the top management of an organization should make an effort to continually improve both its quality management system and the quality of its products. In order to demonstrate compliance to this requirement, measurement of cost data showing continual improvement should be made and the cost data so obtained must be analyzed. In manufacturing and servicing industries, the measurement of quality costs has been traditionally viewed as one of the most effective tools for evaluating the success of a quality management system. Data obtained from such measurement can also be used to identify areas for improvement. However, due to the special features of construction projects, the measurement of quality costs is seldom carried out in the construction industry.

Activities in construction projects are not rarely repetitive in nature and can be grouped as different processes. An alternative approach, Process Cost Model, as described in the British Standard BS 6143, can be used to measure quality costs. In this paper, the correlation between the two standards (ISO 9000 and BS 6143) is discussed. The common point of the two standards is the Process Approach. An attempt is also made to use the Process Cost Model approach as a tool for measuring quality costs in order to fulfil the ISO 9000 latest edition's requirement of continual improvement in construction processes.

### **KEYWORDS**

ISO 9000, Process Cost Model, Cost of Quality, Construction

## **CONSTRUCTION QUALITY ASSESSMENT SYSTEM (CONQUAS): THE SINGAPORE EXPERIENCE**

**Patrick TI Lam**

Lecturer, Hong Kong Polytechnic University,  
Hong Kong

**Albert PC Chan**

Associate Professor, Hong Kong Polytechnic  
University, Hong Kong

**Wilson CY Shea**

Quantity Surveyor, Levett & Bailey, Hong Kong

### **ABSTRACT**

In the quest for quality management of construction, different countries have devised their own systems for assessing and benchmarking contractors' quality performance. In this regard, Singapore is the forerunner since the then Construction Industry Development Board (now renamed as Building Construction Authority) developed a Construction Quality Assessment System (the CONQUAS) in the 1980s and this system has become the model for others to follow. Hong Kong, for example, has drawn reference from CONQUAS to develop its own quality assessment scheme for use in the public housing sector, whilst UK is now adopting CONQUAS as her official measure for construction quality.

This paper explains the mechanics of "CONQUAS 21", which is the latest version of the quality assessment system in Singapore for the twentieth-first century. It also presents an analysis of contractors' quality performance based on this new scheme and its predecessor. This research is part of the team's efforts to investigate the efficacy of such assessment schemes.

### **KEYWORDS**

CONQUAS, Quality Assessment, Private Sector, Public Sector, Efficacy.

## **VALUE OPTIMISATION OF BUILDING COMPONENTS IN DESIGN PROCESS**

**Kai-Tak Cheung**

Instructor, Department of Building and  
Construction, City University of Hong Kong,  
Hong Kong

**Sai-On Cheung**

Assistant Professor, Department of Building and  
Construction, City University of Hong Kong,  
Hong Kong

**Derek Drew**

Associate Professor, Department of Building  
and Real Estate, Hong Kong Polytechnic  
University, Hung Hom, Hong Kong

**ABSTRACT**

Construction clients have become increasingly dissatisfied with the quality of strategic construction price forecasts provided by the professional advisors. One of the primary functions of cost planning is to optimise the expenditure of client in terms of the price allocation of different components of a building. The paper describes a new approach for building design. The suggested approach contains three activities:

(1) Market analysis, (2) Quality function deployment and (3) Cost deployment. The goal of integrating these activities to the building design process is to improve the quality, the functionality, and the innovation aspects of the design of components. This requires the matching of the value of building components with their costs.

**KEYWORDS**

Market Analysis, Quality Function Deployment (QFD), Cost Deployment

**PERFORMANCE OF INTERNATIONAL  
CONSTRUCTION JOINT VENTURES: AN  
EMPIRICAL ANALYSIS**

**Sherif Mohamed**

Senior Lecturer, Griffith University, Gold Coast,  
Queensland, Australia

**ABSTRACT**

The increasing magnitudes, complexities and risks associated with major construction projects have brought together organisations with diverse

strengths and weaknesses to form joint ventures to collectively bid for, and execute projects. Published works have focussed primarily on risk and/or success factors without relating these factors directly to the performance of international joint ventures. Moreover, those factors were grouped and ranked without examining their inter-dependence. One implication of this practice is that the role played by such factors is usually examined in isolation giving rise to inaccurate assessment or conclusion. This paper attempts to fill the noted gap by building upon the literature, empirically examining the relationships between reported risk and success factors, and relating these relationships to the performance of joint ventures.

**KEYWORDS**

Joint Ventures, Risk, Performance, Host Government, Partner Selection

**UNDERSTANDING ‘CULTURE’ IN AN  
INTERNATIONAL CONSTRUCTION  
CONTEXT**

**Vasantha Abeysekera**

Senior Lecturer, UNITEC Institute of  
Technology, Auckland, New Zealand

**Praveen Lata**

UNITEC Institute of Technology, Auckland,  
New Zealand

**ABSTRACT**

Culture has long been recognised as an issue that impacts on business success. Despite its importance there has been little attention to understanding it in a construction context. Consequently construction contractors have faced many problems when working with other cultures. Thus the aims of this study were (a) to understand the nature of culture as applied in a construction context (b) to develop a framework to further this understanding, and (c) to identify suitable examples and methods to illustrate this understanding with reference to international construction. The framework developed incorporated two key concepts of culture viz. ‘categories’ and ‘components’. The sub-

framework comprising of technological, sociological, and ideological 'components' was useful to explore further understanding; the technological component was as useful as the other two. The concept of 'cultural polarity' with its accompanying measures may be used as an early warning system for detecting and dealing with cultural issues that may otherwise lead to significant problems; there is scope for further development of this system. This study was also useful for establishing areas of construction that may have potential links with 'categories' of culture; these links could be explored further to understand the impact of culture on international construction.

#### **KEYWORDS**

Construction, Culture, Cultural Polarity, International Construction, Technology

#### **LINKING TRENDS IN THE CONSTRUCTION INDUSTRY TO GLOBALISATION AND THE TRANSITION IN SOUTH AFRICA**

**Gavin Shor**

Projects and Development Manager, Zenprop Property Holding Company (Pty) Ltd and University of the Witwatersrand, Johannesburg, South Africa

#### **ABSTRACT**

This paper highlights the trends in construction management over the last decade and relates these to the transition in South Africa (SA) and to globalisation. Directors of South African public listed construction companies, industry authorities and influential academics were interviewed. The interviews explored the reasons for the downsizing of construction companies, a possible shift from a traditional procurement system to one of management-oriented organisation, and the effect of opening up the economy to the industry. Based on the results recommendations regarding the construction industry in contemporary South Africa are made.

#### **KEYWORDS**

South Africa, Globalisation, Transition

#### **THE EGAN REPORT: AN AGENDA FOR CHANGE? THE VIEWS OF UK CONSTRUCTION DIRECTORS**

**David Proverbs**

Principal Lecturer, University of Wolverhampton, UK

**Gary Holt**

Reader, University of Wolverhampton, UK

**Hoon Yeow Cheok**

Researcher, University of Wolverhampton, UK

#### **ABSTRACT**

Sir John Egan's report *Rethinking Construction* was published in 1998 and advocated radical change for the UK construction industry. This was particularly so with respect to the way the industry functions and ultimately serves its clients. Based on a structured postal questionnaire survey of UK construction company Directors, their perceived impact, effectiveness and potential 'success' of the Egan recommendations were analysed. The survey revealed that the most successful recommendations (i.e. those with high levels of perceived impact and effectiveness) were considered to be: i) the development of long-term relationships; ii) commitment of leadership; iii) greater customer focus; iv) more and better training; and v) improved quality and fewer defects. Recommendations considered least successful include: i) the use of demonstration projects; ii) re-engineering of existing processes; and iii) the application of products/services from other industries. Respondents were generally in agreement that the Egan report may succeed in achieving its desired intentions of promoting some major industry changes, this being particularly so regarding the nature of relationships between project participants.

#### **KEYWORDS**

Egan Report, Construction Industry, Contractors, Directors

#### **CONSTRUCTION NEGOTIATION: AN EVEN SWAPS APPROACH**

**Sai-On Cheung, Kenneth Tak-Wing Yiu,  
Henry Suen**

Construction Dispute Resolution Research Unit,  
City University of Hong Kong, Hong Kong

#### **ABSTRACT**

Construction involves the coordinated efforts of a wide range of participants working together to achieve project objectives. Negotiation among these participants is common as group effort deem to involve allocation of resources and settlement of differences arising there from. This paper discusses the concept of Even Swaps, a method that facilitates systematic elimination of alternatives. Even Swaps method is first explained through an example of negotiating the terms of a construction contract. The detail application in construction negotiation is illustrated by a construction dispute involving negotiating a settlement on extension of time, loss and expenses and acceleration costs.

#### **KEYWORDS**

Construction Negotiation, Even Swaps

#### **PROBLEM RESOLUTION IN PARTNERING: A CASE STUDY**

**Heng Li**

Professor, The Hong Kong Polytechnic  
University, Hung Hom, Kowloon, Hong Kong

**Eddie W.L. Cheng**

Research Associate, The Hong Kong  
Polytechnic University, Hung Hom, Kowloon,  
Hong Kong

**Peter E.D. Love**

Associate Professor, School of Management  
Information Systems, Edith Cowan University,  
Perth, Australia

**Luke H.W. Leung**

Senior Structural Engineer, Binnie Black &  
Veatch Hong Kong Limited, Hong Kong

#### **ABSTRACT**

This paper aims at identifying the principles of problem resolution and exploring associated activities. As partnering helps to resolve conflicts and disputes and key problems in

traditional procurement methods, the paper focuses on the resolution studies in partnering. As a result, nine salient principles are identified and expected to be appropriate for the development of a problem resolution mechanism for construction projects. The paper uses a case to ascertain whether these principles are included in a local construction project that involved partnering. Six of these principles have been found in the case. The case also helps to reveal the derived activities of the principles. Organizations may apply these activities to their normal resolution practices.

#### **KEYWORDS**

Partnering, Problem resolution, Construction,  
Project, Management

#### **CURRENT LEGISLATIVE DEVELOPMENTS EFFECTING DISPUTE RESOLUTION IN THE CONSTRUCTION INDUSTRY IN NEW ZEALAND**

**David Gatley**

Senior Academic Staff Member, Faculty of  
Architecture and Design UNITEC Institute of  
Technology, Auckland, New Zealand

#### **ABSTRACT**

During recent years in New Zealand there have been several liquidations/receiverships of major commercial construction contractors, which has prompted the government to introduce legislation that affords protection of payments to contractors and subcontractors. The paper will discuss the events leading to the introduction of the Construction Contracts Bill; the changes to the Dispute Resolution processes that will eventuate as a consequence of new legislation; the potentiality for the success of the legislation; and contemplate the future role of construction industry professionals.

#### **KEYWORDS**

Dispute Resolution, Legislation, Adjudication

#### **THE RELATIONSHIP BETWEEN THE SPECIFICATION, LOW-BID PROCESS AND CONSTRUCTION**

## **NONPERFORMANCE**

### **Dean T. Kashiwagi**

Director, Performance Based Studies Research  
Group, Arizona State University, Tempe,  
Arizona, USA

### **John Savicky**

Researcher, Arizona State University, Tempe,  
Arizona, USA

Associate Professor, The Hong Kong  
Polytechnic University, Hung Hom, Kowloon,  
Hong Kong

### **P.T.I. Lam**

Lecturer, The Hong Kong Polytechnic  
University, Hung Hom, Kowloon, Hong Kong

### **D.W.M. Chan**

Research Fellow, The Hong Kong Polytechnic  
University, Hung Hom, Kowloon, Hong Kong

## **ABSTRACT**

This article identifies the Specification, Low-Bid Delivery Process as the major cause for construction nonperformance, the eroding of construction quality and craftsperson skill, and identifies the process as expensive and filled with non-value added components. The article discusses the industry structure, problems, and practices, which bring construction nonperformance. It presents an information solution, which will reduce delivery costs and litigation, and at the same time increase construction performance, craftsperson skills, and competition. The solution includes four information filters that minimize risk: an information theory (Information Measurement Theory), a self analysis and identification of performance process (Performance Information Procurement System or PIPS), and a multi-criteria decision making model that forces competition and identifies the “best value.” The impact of the process includes contractor self improvement, the understanding of construction risks by the contractors and the users, creative solutions, contractor responsibility and the minimization of construction decisions and inspection by the user’s representatives. The solution is tested out in two State of Georgia construction projects. The paper discusses the project solutions.

## **KEYWORDS**

Specifications, Construction Nonperformance,  
Performance Contracting

## **DEVELOPING A BEST PRACTICE PARTNERING FRAMEWORK IN HONG KONG**

**A.P.C. Chan**

## **ABSTRACT**

The construction industry is one of the main pillars of Hong Kong’s economy. In 1999, it accounted for 5.6% of the GDP and 40% of gross domestic fixed capital formation. 9.2% of our workforce was employed by the construction industry in that year. There are, however, a number of shortcomings in the industry’s operations and in the quality of its product. In April 2000, the Chief Executive of the Hong Kong SAR appointed the Construction Industry Review Committee to comprehensively review the current state of the industry and to recommend improvement measures. The Committee advocates, inter alia, the wider adoption of partnering arrangements in local construction so that all project participants will work as a team to achieve shared project objectives rather than in competition with one other.

A research team has been set up in the Department of Building and Real Estate of the Hong Kong Polytechnic University to evaluate the performance of project partnering and investigate ways how the industry can implement these systems successfully in the Hong Kong context. The aim of the research study is to develop a best practice framework for construction partnering. The current issues and problems of construction partnering will be addressed. A research framework combining the use of questionnaire surveys, interviews and a case study approach for the collection of information and data on partnering schemes will be proposed.

## **KEYWORDS**

Partnering Framework, Best Practice, Hong

Kong

**PARTNERING IMPACT ON CHANGE  
ORDERS FOR MID SIZE COMMERCIAL  
CONSTRUCTION PROJECTS**

**Peter Wanjoga**

Graduate Student, Construction Program,  
Southern Polytechnic State University Marietta,  
Georgia, USA

**Khalid Siddiqi**

Head Construction Program, Southern  
Polytechnic State University Marietta, Georgia,  
USA

**ABSTRACT**

Partnering, when used in execution of construction projects, generally leads to better control of over all cost growth. The study carried out determined the impact of partnering on the number and cost of change orders in mid sized construction projects. The study's focus is on projects with a contract value of less than five million dollars. In this study, Small contractors executed, essentially, all projects. Small contractors, for this study purposes, are those with an annual turnover ranging between 20 million to 50 million dollars. Both partnered and non-partnered projects of similar nature and contract value were analyzed and compared. Results from this study indicate that partnered projects have a relatively higher number of change orders but cost growth is less when compared to non-partnered projects. Lessons learned from this study would be particularly beneficial to owners, small general contractors, and professionals involved in mid sized projects.

**KEYWORDS**

Partnering, Change Order, Cost Growth, Dispute Avoidance, Contracts

*25-26 April, 2002, Miami Florida, USA*

**CONSTRUCTABILITY VERSUS  
COMMUNICATIONS**

**Graham Miller**

Associate Professor, Head of School of  
Construction, Property and Planning University

of Western Sydney, Australia

**David Risby**

Honours student, Bachelor of Building Program,  
University of Western Sydney, Australia

**ABSTRACT**

This paper reports on how the constructability of buildings can be influenced by designers, particularly architects and structural engineers. Poor communication is identified as a major cause of cost increases in construction projects in Australia and the increased costs are usually borne by the client or builder and rarely by the originator of the problem. Major problem areas are identified along with their associated cost increases. Examples are taken from case studies.

**KEYWORDS**

Constructability, Communication Problems,  
Problem Areas, Costs, Liability.

**ESTABLISHING MULTISKILLED TEAMS  
- LESSONS FROM DANISH  
CONSTRUCTION**

**Christian Koch**

Associate Professor, Department for Civil  
Engineering, Technical University of Denmark,  
Denmark

**ABSTRACT**

The paper presents experiences with multiskilled teams at building sites in Denmark. The article develop a two dimensional typology of the characteristics of multiskilled teams. One is focussing on the process of establishing the team, another focussing on the content of the new work organisation. The work organisation is characterised by the degree of autonomy, overlapping skills and redesign of supporting functions. The process of establishing the teams is characterised by project and change management, degree of involvement and inclusion, training and gaining resources. Case material from three state- funded demonstration project is used to analyse how potential barriers for reorganising was overcome in the process. The cooperation with unions, training and the design of one central team, the site and logistic

teams, proves crucial. A chief barrier in Danish construction is that working in a multiskilled manner still is a very limited general skill. But segregation of design and execution also produce problems. Moreover multiskilling is rarely used under pure market conditions, it is still an organizational innovation mainly developed with state subsidization.

#### **KEYWORDS**

Multiskilling, Planning, Organizational Change, Construction

#### **CAUSES OF CONSTRUCTION DELIVERY COMPLEXITY AND NONPERFORMANCE**

**Dean T. Kashiwagi**

Director, Performance Based Studies Research Group, Del E. Webb School of Construction Arizona State University, Tempe, Arizona, USA

**John Savicky**

Researcher, Performance Based Studies Research Group, Del E. Webb School of Construction Arizona State University, Tempe, Arizona, USA

#### **ABSTRACT**

This article proposes the hypothesis that construction complexity and litigation are caused by the processes initiated to reduce risk and litigation. It relates the lack of information, bureaucratic processes, subjective expert opinion and the tasking of the management and inspection to construction nonperformance. It identifies that the construction nonperformance problem is being enlarged by engineering technical solutions to solve a business problem, bringing non-value added segments and results to the construction industry. This paper will theoretically discuss the problem of construction non-performance; propose solutions, the testing of the solutions, the results of the testing, and the recommendations. The test that will be discussed is a \$1M design-build project delivered for the State of Hawaii Department of Transportation. The conclusion of the paper is that problems in construction delivery occur due to the difference in user's perception, expectations, and the level of information, and that construction

performance can be increased significantly by changing the level of performance information in the procurement and delivery process.

#### **KEYWORDS**

Construction Nonperformance

#### **DESIGN-BUILD COMBINED CYCLE POWER PLANT PROJECT MANAGEMENT**

**Brian Gibson**

Field Engineer, Black and Veatch, Overland Park, Kansas, USA

#### **ABSTRACT**

To successfully complete a fast track combined cycle design-build power plant project, management must maintain full awareness of all phases throughout the entire project. A successful team uses phase integration to make better technical and commercial decisions allowing them to complete required deliverables within scheduled deadlines and budget constraints. Phase integration will lead to long-term project success by optimizing resources and avoiding hidden costs later in the project.

Combined cycle power plant technology involves using combustion turbine generators to produce electric power. The exhaust from the combustion turbines is used to heat boiler water into steam in heat recovery steam generators (HRSG's). This steam is used to drive a steam turbine generator, which also produces electric power. The de-energized steam is then condensed and pumped as water back to the heat recovery steam generator.

Phase integration will require additional costs for resources and services that are not standard to a classic non design-build project. By managing these additional budgeted costs along with schedule progress, total unplanned costs due to liquidated damages; unplanned project acceleration, rework, and partner litigation can be eliminated.

#### **KEYWORDS**

Phase Integration, Design-Build, Fast Track, Coordination

## **CRITICAL SUCCESS FACTORS FOR THE CONSTRUCTION INDUSTRY**

**Gena L. Abraham**

Chief Engineer, Georgia Building Authority,  
Atlanta, Georgia, USA

**Paul Chinowsky**

Associate Professor, School of Civil and  
Environmental Engineering, Georgia Institute of  
Technology, Atlanta, Georgia, USA

### **ABSTRACT**

The traditional approach to success in the construction industry, both in academia and in industry, places great emphasis on the ability to plan and execute projects. In the past, companies completing projects in a timely manner within an established budget and meeting required quality considerations have been considered successful companies. Minimizing an emphasis on management practices and organizational stability, companies with a track record of successful project completion have been considered the construction industry's top-performers. However, the future environment of the construction industry will be significantly different from today's project-oriented environment due to technological and economic changes that are changing construction from a local and regional business to a global business. Therefore, a shift in emphasis from project success to corporate success must be examined for construction organizations to compete in an ever-changing marketplace. This paper advocates the adoption of a critical success factor (CSF) methodology to enhance construction organization success and identify elements that are essential for organizations to achieve this success. Initially adopted by the software industry, critical success factors are the limited number of areas in which results, if they are satisfactory, will ensure competitive performance of the organization. This paper addresses the adoption of the CSF methodology in construction by introducing the findings of a study of ENR Top-400 contractors to identify the current state of critical success factor implementation within the industry. The paper

addresses the data collected, the areas of strength and weakness within the industry, and the need for construction enterprises to adopt a focus on corporate success in addition to project success.

### **KEYWORDS**

Management, Strategic Planning, Organizations,  
Professional Development

## **A CONCEPTUAL FRAMEWORK FOR INTEGRATED PROGRAM AND PROJECT MANAGEMENT**

**Stephen P. Mulva**

Graduate Research Assistant, Georgia Institute  
of Technology, Atlanta, Georgia, USA

**Jorge A. Vanegas**

Associate Professor, Georgia Institute of  
Technology, Atlanta, Georgia, USA

### **ABSTRACT**

Conventional thought dictates that what cannot be measured, can not be improved. In a quest for improved operational and financial performance, Architecture, Engineering, and Construction (A/E/C) industry participants have developed numerous systems and measures to benchmark and categorize project execution. Unfortunately, their efforts have fallen short in two critical areas: applicability beyond the project boundary and ability to enable proactive decision-making. To remedy this situation, a conceptual framework was developed to create a comprehensive indicator for integrated program and project management performance. Known as ARIES (Agile Resource Information and Execution System), this framework balances the resource utilization requirements of projects and programs with the cumulative amount of time available to an owner for facility occupation. Additionally, the framework incorporates contract value to produce consistent measures that provide multiple comparisons independent of project scope or delivery system choice. Such analysis allows A/E/C enterprises to align their organizational visions and plans with their project portfolio, permitting proactive decision-making regarding future work, growth, and competency development. Eventually this

framework will allow today's disconnected delivery process to become one integral to predictable A/E/C enterprise success.

#### **KEYWORDS**

Program Management, Strategic Thinking, Performance Measurement, Resource Management

#### **CURRENT LEVEL OF SATISFACTION WITH CONSTRUCTION MATERIAL LOGISTICS TASKS**

**HyounSeung Jang**

Research Assistant, Construction Engineering and Management, University of Wisconsin, Madison, Wisconsin, USA

**Jeffrey S. Russell**

Professor, Construction Engineering and Management, University of Wisconsin, Madison, Wisconsin, USA

#### **ABSTRACT**

Construction management researchers have only recently highlighted the relationship between the contractors and the ultimate customers. To improve understanding of the significance of customer satisfaction regarding construction logistics tasks, a pilot study has been undertaken. Customer satisfaction and continuous improvement are the fundamental goals of construction logistics tasks. Therefore the logistics manager who coordinates these operations with all parties to a contract is very important to the successful completion of a construction project. This paper examines how construction logistics affects a senior project manager's level of satisfaction and also defines through the use of a survey which logistics factors correlate the most with customer satisfaction. Two hundred twenty three logistics managers provided valuable data to the study. Five important factors related to satisfaction were found by interviews with logistics managers and a literature review. Those are personnel, material flow, schedule adherence, contractor's organization and information flow. The study results suggest that material flow and information flow are worthy of the most attention.

#### **KEYWORDS**

Construction Logistics, Customer Satisfaction

#### **ASSESSMENT OF CII BEST PRACTICES IMPLEMENTATION AT THE ORGANIZATIONAL LEVEL**

**SangBum Kim**

Graduate Research Assistant, University of Texas at Austin, Austin, Texas, USA

**G. Edward Gibson Jr.**

Professor, University of Texas at Austin, Austin, Texas, USA

#### **ABSTRACT**

The construction industry has become more competitive and organizations need to be continuously improved in order to remain successful. One way of improving organizations is implementing knowledge or existing research products typically developed by various universities and research institutes such as the Construction Industry Institute (CII). Although there are many valuable research products available which have tremendous potential to improve construction project performance as well as the organization's business processes, many of them have not been implemented to a significant extent on real world projects. Despite the importance of the implementation effort, there is little research focused on the implementation of existing research products or measuring the degree of the implementation effort. CII has identified the importance of implementation and constituted the Implementation Strategy Committee (ISC) which concentrates on the implementation of CII knowledge. The traditional philosophy of construction management places great emphasis on the ability to plan and execute individual projects. In contrast, a similar emphasis on the overall ability of an organization is many times lacking in the construction industry. This paper will focus on assessing a construction organization's implementation effort at the organizational level using construction-related knowledge that CII has developed. A survey questionnaire was developed based on the information gathered from literature and inputs

from industry participants to evaluate the organizational implementation status. A pilot survey was conducted for the validation purpose and the finalized questionnaire has been distributed to 88 CII member companies including both owner and contractor organizations. This paper will describe the research process that has been followed as well as findings and recommendations of the study. Differences between owners of facilities and contractor firms will be highlighted and policy implication will be presented.

#### **KEYWORDS**

Research Implementation, Knowledge Management, CII Best Practices, Organizational Assessment

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#### **LEAN METHODS IN CONSTRUCTION**

**Lincoln H. Forbes**

Supervisor, Post Occupancy, Facilities Planning and Standards Miami-Dade County Public Schools, Miami, Florida, USA

#### **ABSTRACT**

The Construction Industry has traditionally been one of the largest in the United States; employing approximately 6.7 million people in November 2000, with a new construction value of over \$800 billion dollars. While other industries have greatly increased their levels of quality and performance, the majority of construction work is based on antiquated techniques, attended by supply-chain deficiencies and high defect rates resulting in wasted labor and materials. Estimates indicate that up to 30% of construction costs is due to inefficiencies, mistakes, delays, and poor communications. As global competitiveness increases, so will the expectation of higher levels of quality and productivity in constructed facilities, placing the U.S. construction industry at a competitive risk. This paper describes the obstacles to high performance, productivity and quality initiatives and describes how lean techniques may be applied to overcome these

shortcomings. A framework is proposed for providing technical support for lean methods application, and for continuous improvement in the associated activities.

#### **KEYWORDS**

Supply Chain Management, Lean Construction, Just-in-Time, Quality, Value Stream

#### **KNOWLEDGE, LEADERSHIP, COMPETENCIES, MINDSETS AND THE ROLE OF EDUCATIONAL AND RESEARCH INSTITUTIONS**

**Ali Jaafari**

Professor of Project Management, The University of Sydney, Sydney, NSW2006, Australia

#### **ABSTRACT**

Professional people face different career paths to those of the past. Each professional person must increasingly see his or her life career as a microbusiness and manage the same professionally. Pursuing a single discipline and aligning oneself with the functions and processes in a particular organisation or branch of industry will put a professional person at considerable disadvantage in the 21<sup>st</sup> Century networked business environment. The question is whether or not the current model of education and professional development is relevant, effective and efficient, or a new approach is needed. The author undertook research to respond to these questions. A surprising model has emerged: it can be labeled as *holistic* or a *3 dimensional model*. The holistic model has a major emphasis on the development of multiple competencies. The author has presented this model, and cited his University's PM Programme as a case study to show that universities can respond to the challenges of 21<sup>st</sup> Century provided that they are prepared to break the past century's moulds and embrace the challenges of the emerging world.

#### **KEYWORDS**

Knowledge, Leadership, Competencies, Educational Institutions, Project Management

## **EMPLOYMENT TRENDS: WOMEN IN CONSTRUCTION**

**JohnM. Dye**

Chair, Department of Construction Management, Florida International University, Miami, Florida, USA

**Syed M. Ahmed**

Assistant Professor, Department of Construction Management, Florida International University, Miami, Florida

### **ABSTRACT**

The paper builds upon an article first prepared by one of the authors in 1997 and presented at the Southeastern Section of the Associated Schools of Construction annual meeting in Atlanta, Georgia. It examines the trend of an increasing number of women employed as workers in construction. Data are presented showing current and, where possible, projected employment. An updated comparison of average wages in the construction industry with more traditional occupations for women is included. Personnel related barriers and obstacles relating to women in construction are discussed, as are the management problems associated with the change in the employment pattern.

### **KEYWORDS**

Women, Construction, Workforce, Change, Training

## **BUILDING ENGINEERS- NEW PARADIGMS FOR EDUCATION?**

**Christian Koch**

Associate Professor, Construction Management, Department for Civil Engineering Technical University of Denmark, Denmark

### **ABSTRACT**

This paper discusses tradition and renewal of the education of building engineers with specialisation in construction management. It has been argued that a shift is underway in knowledge production from discipline based teaching with strict borders between education

institutions and industry (mode 1) to interdisciplinary learning under a regime of blurred boundaries between industry and education institutions (mode 2). Using this framework critical examination of the training of Danish civil engineers with a specialisation in construction management based on courses, education material, curricula and participants observation is presented. Moreover a typology of jobs is done. The existing curriculum is described and the position is taken that it already represents a type of mode 2 education profile, since multidisciplinary, problem orientation and problem solving, using real life cases as backbone, the possibility of internship and the criteria for the master thesis all represent integration with industry. It is argued that although a shift from mode 1 to mode 2 does create a new overarching framework, construction management needs a more specific analysis differentiating and prioritising different possible elements in the curricula. Some examples of possible reforms are given.

### **KEYWORDS**

Construction Management, Engineering Education, Curriculum, New Production of Knowledge.

## **TEACHING FROM A DISTANCE WITH WEBCT**

**Brian Moore**

Assistant Professor, Construction Program, Southern Polytechnic State University, Marietta, Georgia, USA

**Arlan Toy**

Professor, Construction Program, Southern Polytechnic State University, Marietta, Georgia, USA

### **ABSTRACT**

As recent trends show increasing use of the Internet as a medium for learning, varied software tools are emerging to make the task of online course development easier for faculty. The authors discuss the use of WebCT in the broader context of distance learning. Lessons specific to WebCT are discussed. The process of selecting and using some of the tools available

in WebCT is addressed. Student use of WebCT is discussed as both a supplement to in-class instruction and as a stand-alone online course. Observations are provided from faculty currently using WebCT to teach online courses; conclusions are derived from the survey performed and faculty experience; and recommendations are proffered.

#### **KEY WORDS**

Distance Learning, Internet, Construction Education, E-learning, WebCT

### **UTILIZING GREAT BOOKS TO ENHANCE CONSTRUCTION MANAGEMENT CLASSES**

**John W. Martin**

Associate Professor and Chairman, Department of Construction Management Boise State University, Boise, Idaho, USA

#### **ABSTRACT**

Books such as Upton Sinclair's "The Jungle", Steinbeck's "In Dubious Battle, and Milhauser's "A Tale of An American Dreamer are example of books that have been recently been used in classes at Texas A&M University and at The University of Louisiana. Professors can teach Construction Project Management, Estimating, and Labor Relations and Leadership using this classic literature piece This paper discusses the merits of using literature in the construction curriculum as well as the theoretical underpinnings of the great books program. Teaching style has to be adapted to include these dynamic components in the construction courses outlined and detailed in this paper.

#### **KEYWORDS**

Construction Curriculum, classic literature, Upton Sinclair, Steinbeck

### **THE EFFECT OF THE UNIQUE CHARACTERISTICS OF THE CONSTRUCTION INDUSTRY ON INFORMATION MANAGEMENT IN CONSTRUCTION FIRMS**

**J. K. Ssegawa**

Department of Civil Engineering, University of

Botswana, Gaborone, Botswana

#### **ABSTRACT**

This paper reports findings of a study, which was carried out to investigate the effect of the unique features of the construction industry (CI), on information management (IM). It begins with a background of the IM process and a literature review of how the unique features of the CI influence IM. It then reports findings of a study carried out on some 160 construction firms (CFs) in Botswana. The study concludes that the construction environment is unique and makes the IM process a challenging task and its inefficiency or ineffectiveness on many occasions hampers the performance of CFs.

#### **KEYWORDS**

Information Management, Construction Industry, Construction Firms

### **APPLICATIONS AND EFFECTS OF EMERGING AUTOMATED AND INFORMATION TECHNOLOGY IN CONSTRUCTION**

**Amaury A. Caballero**

Department of Construction Management, Florida International University, Miami, Florida

#### **ABSTRACT**

The wide implementation of information technology in construction has proved to be a difficult task due to the characteristics of the construction industry. Field-oriented industries like construction, with frequently reconfigured operations and often-severe environmental conditions, have been slower to adopt new information and automation technology. The principal causes that promote this situation may be summarized to be, among other the complexity of building process, distinctive nature of projects, dispersion of construction activities, divided authority, work environment, and long service life. In spite of these conditions, the introduction of the new techniques is inevitable because of three characteristics that are also present in the construction work: dirty environment, hard working conditions, and dangerous working

places. The paper condenses the results from a study developed for the State of Florida Department of Education, in which the use of these new technologies is analyzed.

**KEYWORDS**

Information Technology, Construction, Computers, Robotics

**ENGINEERING AND CONSTRUCTION  
COLLABORATION USING  
INFORMATION TECHNOLOGY**

**Liang Y. Liu**

Associate Professor, Department of Civil and Environmental Engineering University of Illinois at Urbana-Champaign, USA

**Christopher Erickson**

Project Engineer, Amec Engineering and Construction, Chicago, USA

**ABSTRACT**

This paper presents potential applications of IT (information technology) for engineering and construction collaboration. Relevant information technologies, both existing and emerging, for the A/E/C (Architecture/Engineering/Construction) industry are discussed in the context of how these new developments in technology may impact engineering and construction practice, especially in the area of construction engineering and collaboration. Drawn from experiences in engineering practices and knowledge of the latest IT developments, the authors outline strategies that may help engineering and construction firms make decisions in adopting IT initiatives.

**KEYWORDS**

Information Technology, Collaboration, Technology, Computing

**ANALYZING THE APPLICATION OF  
INFORMATION AND COMMUNICATION  
TECHNOLOGY FOR CONSTRUCTION  
KMS**

**Tai Sik Lee**

Professor, Hanyang University, Ansan, Korea  
**Hee Chul Lee**

M.S., Hanyang University, Ansan, Korea

**Young Hyun Kim**

Candidate of Ph.D., Hanyang University, Ansan, Korea

**ABSTRACT**

The advance of Information and Communication Technologies is giving impetus to the knowledge and information society that knowledge and information is more important than the typical elements of product such as capital and labor. That makes much valuable knowledge spread or apply efficiently in organization. This is being realized by KMS (Knowledge Management System). However, we don't hold the studies that evaluate and analyze the application of Information and Communication Technologies used for constructing KMS. Therefore, this study wants to understand the applied Information & Communication Technologies and then know what are technologies that the application is high or low, when large enterprises of construction construct KMS. In addition, this study discusses what technologies need to be improved to materialize KMS efficiently.

**KEYWORDS**

Information and Communication Technology, Application, KMS, Knowledge, Benchmarking

**FORECASTING ORGANIZATIONAL  
PERFORMANCE UNDER FLUCTUATING  
ECONOMY**

**Stephen Ogunlana**

Associate Professor, Asian Institute of Technology, Bangkok, Thailand

**Tang Yu Hoe**

Planning Engineer, Mtrans Construction Sdn Bhd, Kuala Lumpur, Malaysia

**ABSTRACT**

The Asian financial crisis has adversely affected many of the domestic construction organizations in Malaysia, bringing some of the organizations to the brink of bankruptcy. It demonstrates that a construction organization's performance is sensitive to the prevailing economic conditions. This paper seeks to model the dynamic impact

of the economy on the performance of a publicly listed construction organization in Malaysia. Firstly, a diagrammatic model consisting of two interconnected causal loop diagrams is developed to represent the organization's capacity and its financial balance sheet. The diagrams provide a clearer understanding of the interactions between the country's economy and its financial, technical and managerial capabilities within the organization. Next, the causal loop diagrams are converted into a mathematical model using specialized software. Simulation results from the model are validated against historical time series data. Graphical plots of the simulation model and results from sensitivity analysis indicate that the model is capable of replicating the general behavior of the organization. The model will be used as a tool for predicting future organizational performance based on the expected fluctuations in the economy.

#### **KEYWORDS**

Construction Company, Performance Modeling, System Dynamics, Forecasting, Malaysia

#### **STRATEGIC IMPLEMENTATION OF IT/IS PROJECTS IN CONSTRUCTION: A CASE STUDY**

**Rodney A. Stewart**

PhD Candidate, Griffith University, Gold Coast,  
QLD, Australia

**Sherif Mohamed**

Senior Lecturer, Griffith University, Gold Coast,  
QLD, Australia

**Raul Daet**

MPhil Candidate, Griffith University, Gold  
Coast, QLD, Australia

#### **ABSTRACT**

The need for improved implementation of Information Technology (IT) and Information Systems (IS) has been emphasised in both empirical and prescriptive research studies. This paper presents a strategic implementation framework for IT/IS projects in construction. The framework builds upon recent published works and encompasses well-documented

predictors for effective IT/IS implementation. A case study with a large multi-national construction organisation is used to demonstrate the strategic implementation of a Project Management Information System (PMIS) used for the first time in the construction of a mobile phone telecommunications network in the South East of Queensland, Australia.

#### **KEYWORDS**

Information Technology; Information Systems;  
SWOT Analysis; Analytical Hierarchy Process

#### **WEB-BASED 4D VISUALIZATION FOR REAL-TIME CONSTRUCTION SIMULATION**

**Julian H. Kang**

Assistant Professor, Texas A&M University,  
College Station, Texas, USA

**Stuart D. Anderson**

Associate Professor, Texas A&M University,  
College Station, Texas, USA

**Mark J. Clayton**

Associate Professor, Texas A&M University,  
College Station, Texas, USA

#### **ABSTRACT**

Four-dimensional CAD (4D CAD) has been considered an effective tool to improve collaborative decision-making in construction scheduling. However, updating the 4D CAD model requires re-linking all activities to their corresponding CAD elements and re-distributing the revised model. If the 4D visualization of the updated schedule can be created automatically and displayed on the Web browser, the revision process of the 4D CAD model can be expedited.

A new way to build a 4D model is proposed and a Java applet is developed using Java 3D API and Java JDBC to display this 4D model on the Web browser. This Java applet allows users to retrieve the 4D model at the appropriate level of completion to create 3D computer graphics on the Web browser. Users then can navigate around 3D computer graphics. The construction schedule of the 4D model can be updated over the Internet, and the revised 4D model can be

displayed on the Web browser immediately.

### **KEYWORDS**

Web-based 4D Visualization, Web-based Project Management, 4D CAD, Construction Scheduling

### **ELECTRONIC DOCUMENTS: SAVING CONTRACTORS TIME AND MONEY**

**Kevin Miller**

Assistant Professor, Brigham Young University,  
Provo, Utah, USA

### **ABSTRACT**

This paper reports the findings of research that was conducted to evaluate whether or not takeoff viewers are developed to the point where takeoffs can be completely performed without paper documents. The findings show that software is developed enough that complete takeoffs can be performed without having the paper documents. The report identifies the features required to perform a takeoff rather than recommending one software package over another. The software features are evaluated based upon whether the features are basic requirements or advanced features. The research also included different monitor configurations and made recommendations on monitor size and screen resolution settings.

### **KEYWORDS**

Estimating, Electronic Documents, Takeoff Viewers

### **IMPACT OF WEB-BASED 4D VISUALIZATION IN CONSTRUCTION SCHEDULING**

**Julian H. Kang**

Assistant Professor, Texas A&M University,  
College Station, Texas, USA

**Stuart D. Anderson**

Associate Professor, Texas A&M University,  
College Station, Texas, USA

**Mark J. Clayton**

Associate Professor, Texas A&M University,

College Station, Texas, USA

### **ABSTRACT**

Four-dimensional CAD (4D CAD) is being utilized in the construction industry to improve collaborative decision-making in construction scheduling. Recent research has developed a Web-based 4D visualization application in order to distribute the 4D model over the Internet. This application creates 4D visualization of the updated construction schedule automatically on the Web browser and allows users to navigate around the 4D model.

In this paper, an experiment to test whether Web-based 4D visualization would help professionals understand the construction schedule and improve communication among team members is presented. For the experiment, an Internet role-playing game was developed to measure how fast or how effectively the players can detect the logic errors hidden in the construction schedule and communicate with each other using the Web-based 4D model. The results of the experiment showed that the teams that used Web-based 4D visualization detected more logic errors more effectively than the team that used the 2D drawings on the Web browser.

### **KEYWORDS**

Web-based 4D Visualization, Web-based Project Management, 4D CAD, Construction Scheduling

### **PROJECT MODELING OF LABOR INPUTS FOR AUTOMATED CONTROL IN BUILDING CONSTRUCTION**

**Rafael Sacks**

Lecturer, Faculty of Civil Engineering,  
Technion - Israel Institute of Technology,  
Haifa, Israel Currently: Research Scientist,  
College of Architecture, Georgia Institute of  
Technology, Atlanta, Georgia, USA

**Ronie Navon**

Associate Professor, Head, Construction  
Engineering & Management, and Head,  
Construction Automation Laboratory; Faculty  
of Civil Engineering, Technion - Israel  
Institute of Technology, Haifa, Israel

**Eytan Goldschmidt**

PhD. Candidate, Faculty of Civil Engineering,  
Technion - Israel Institute of Technology,  
Haifa, Israel

**ABSTRACT**

Effective control of construction projects requires reliable resource consumption data. Corrective measures can only be taken once the project manager is alerted to deviations. However, manual monitoring and reporting of resource consumption, and of labor in particular, is both expensive and inefficient. A fully automated system for controlling labor inputs is being developed at the Technion – Israel Institute of Technology. The theoretical model is complete and an experimental Global Positioning System (GPS) based data collection system has been built. A computerized Building Project Model (BPM) is a basic requirement for such a system. The BPM must contain data describing not only the physical geometry of the building, the resources active in its execution, and the planned construction activity schedule, but also additional data describing the monitoring results and supporting their automated interpretation. This paper will report on extension of a pre-existing BPM to support the control system. To date, all of the necessary data objects and relationships have been defined and implemented. Data have been collected on the job-site of a reinforced concrete building using the experimental hardware, and have been successfully represented using the extended BPM.

**KEYWORDS**

Construction Automation, Global Positioning System, Labor, Monitoring, Productivity, Project Control

**INVESTIGATING THE USE OF WEARABLE COMPUTERS IN CONSTRUCTION**

**Scott Fuller**

Assistant Professor, Building Science  
Department, Auburn University, Auburn,  
Alabama, USA

**Anoop Sattineni**

Assistant Professor Building Science  
Department, Auburn University, Auburn,  
Alabama, USA

**ABSTRACT**

In the last few months a new kind of computer has caught the attention of many industries, a ‘wearable computer’: A computer that can be worn on a human body. Its mobility has made it useful in many places where a computer could not be carried before. Xybernaut introduced the company's ‘MAV-Mobile Assistant’ wearable computer, a device that is a fully functioning, networked computer for mobile business applications. Designed with the combination of Texas Instruments digital signal processor (DSP) and the Intel Mobile Celeron 500 MHz processor, the MA V is produced by IBM Corporation. The unit incorporates a belt-worn computer, color head-mounted display, 1-pound swappable battery pack and integrated voice-recognition software. Its potential in the construction industry is investigated, to establish its usefulness for the industry. This paper will discuss the wearable computer’s design, potential and the authors’ experience using this technology. A discussion with industry partners about the potential uses of this technology is also included in this paper.

**KEYWORDS**

Xybernaut, Wearable computers, Mobile Computers

**E-COORDINATING INFRASTRUCTURE DECISIONS**

**Tamer E. El-Diraby**

Assistant Professor, Civil Engineering  
Department, University of Toronto, Canada

**ABSTRACT**

Infrastructure projects involve hundreds of participants, thousands of decisions and huge volumes of data. Centralized document-based project development schemes pose technical difficulties in addition to providing sub optimal outcomes. Distributed development environments provide an effective solution to the challenge of collaborative infrastructure

development as has been successfully shown in other sectors of the economy. This article outlines a theoretical framework for a web-based system for coordinating infrastructure decision-making using component engineering. An infrastructure decision component encapsulates all necessary elements of a decision activity in a network-based entity that references all required decision ingredients: administrative procedures, decision criteria, decision-makers, and software involved in the decision activity.

#### **KEYWORDS**

Infrastructure, Decision making, Coordination

#### **TOWARDS A CENTRALIZED CONTRACTOR REGISTRATION SYSTEM THROUGH E-REGISTRATION**

**S. Thomas Ng**

Assistant Professor, Dept. of Civil Engineering,  
The University of Hong Kong, Pokulam Road,  
Hong Kong

**Mohan M. Kumaraswamy**

Associate Professor, Dept. of Civil Engineering,  
The University of Hong Kong, Pokulam Road,  
Hong Kong

**Ekambaram Palaneeswaran**

Senior Research Assistant, Dept. of Civil  
Engineering, The University of Hong Kong,  
Pokulam Road, Hong Kong

#### **ABSTRACT**

Several influential industry reports have recommended the development of a centralized contractor registration (CCR) system to replace many current idiosyncratic contractor prequalification and performance reporting practices. Despite that, a CCR system for multi-stakeholders environment is still to be realized. A major barrier is that such a CCR system must be relatively easy to access to ensure that contractors' information is constantly updated (by contractors) for evaluation, and the latest analyzed information is available to authorized clients anytime anywhere. Being a powerful information exchange tool, the World Wide Web (when combined with available analytical tools) has a high potential for satisfying the above

requirements. This paper aims to identify how a CCR system can be established using such web-based techniques. The conceptual framework of the proposed e-Registration system is developed and presented, and the functionality of each component is explained.

#### **KEYWORDS**

Contractor Prequalification, Internet,  
Procurement, Registration, World Wide Web

#### **IT PROVIDING A PATH FROM RESEARCH TO PRACTICE – PROMOTING USE OF ENVIRONMENTALLY FRIENDLY CEMENT AND CONCRETE IN CONSTRUCTION**

**Irina Kondratova**

Research Officer, NRC Institute for Information  
Technology - e-Business, Fredericton, New  
Brunswick, Canada

**Theodore W. Bremner**

Honorary Professor of Civil Engineering,  
University of New Brunswick, Fredericton, New  
Brunswick, Canada

**Ilia Goldfarb**

Multimedia Instructor, Faculty of Education,  
University of New Brunswick, Fredericton, New  
Brunswick, Canada

#### **ABSTRACT**

Developments in IT are rapidly changing the ways in which we communicate research results to provide timely technology transfer to the construction industry. This paper presents a computer database and a Web-based information system that were developed to disseminate the results of a long-term CANMET and U.S. Army Corps of Engineers studies on the durability of marine concrete incorporating supplementary cementations materials. These information systems provide tools to visualize the results of extensive field studies and support an informed decision-making on the choice of environmentally - friendly concrete for marine projects. The paper discusses some issues associated with the design and maintenance of concrete durability information systems and the

need to develop a Web portal for Sustainable Development of Cement and Concrete that would provide collaborative environment for concrete researchers all over the world to share information on concrete durability, provide on-line training materials for construction companies, and offer professional services.

#### **KEYWORDS**

Information Technology, Web-Based Information Systems, Databases

#### **BEATING THE USE OF HEURISTICS IN CONSTRUCTION PROCESS: CAN INFORMATION TECHNOLOGY DO IT?**

**Tayyab Maqsood**

Department of Building and Construction, City University of Hong Kong, Hong Kong

**Chotchai Charoenngam**

School of Civil Engineering, Asian Institute of Technology, Thailand

**Terry Clayton**

Center for Language and Educational Technology, Asian Institute of Technology, Thailand

**Salman Azhar**

Department of Civil and Environmental Engineering, Florida International University, Miami, Florida, USA

#### **ABSTRACT**

The fast pace of on site construction processes demands site managers of early recognition of the problems and instant decision making for the solutions to exercise effective onsite monitoring and control. Various tools both in the form of informal or formal exist for the purpose. Enormous efforts have been undertaken in construction industry world wide for the formal tools development for several decades to improve construction process utilizing various modernized equipment and technology including information technology. The promised benefits still have not been perceived in construction industry as were expected. The paper argues that IT related applications or tools cannot beat the use of heuristics unless they achieve a level of

swiftness, ease of use and sophistication far better than a human mind can do. It is further argued that in the absence of such formal tools it may be possible to fix the attentions on developing and refining the tools that are natural and inevitable to use, the informal intuitive tools. The research demonstrates that cognitive guidance may be regarded as one of the means of improving the utilization of intuitive formal tools for site monitoring and control. A three level task was presented to 99 civil engineers, involving an on site construction problem coupled with three different level of cognitive guidance from none to extreme. The effect of guidance observed was in the form of an increase in the number of engineers responding to the task. The research, therefore, argues to focus efforts to utilize IT in improving natural and informal tools resulting in an appropriate use of intuition and heuristics.

#### **KEYWORDS**

Information Technology, Heuristics, Cognitive Guidance, Bias, De-biasing

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25-26 April, 2002, Miami, Florida, USA

#### **TOOLS AND TECHNIQUES FOR INTELLIGENT PROJECT MANAGEMENT INFORMATION SYSTEMS: HERALDING A NEW PROJECT MANAGEMENT PARADIGM**

**Kitsana Kit Manivong**

Postdoctoral Fellow, The University of Sydney, NSW, Australia

**Ali Jaafari**

Professor of Project Management, The University of Sydney, NSW, Australia

**David Gunaratnam**

Senior Lecturer, The University of Sydney, NSW, Australia

#### **ABSTRACT**

The focus of this paper is on presenting methodologies, tools and techniques utilized for systematic inclusion of both quantitative and

qualitative variables for holistic decision-making and optimization of project plans. These comprise neural networks (NN), fuzzy logic, multi-criteria decision analyzes and intelligent agents as well as an integrated information system environment that permit both quantitative and qualitative evaluations merged through a transformation process. The development of domain knowledge on which training of neural networks can initially take place has presented a challenge. Typically, and following the soft systems methodology, information used to develop decision models of soft nature need to be case-based. Most if not all projects are unique in terms of objectives, scope, time, business imperatives etc. What may be considered as insignificant in one project may be critical in another. In order to model this decision paradigm the authors have devised a method for capturing the domain knowledge within the road transport sector, known as the integrated hierarchical decision framework. This paper describes the procedures, tools and transformation functions utilized in this research project. It describes the major high-level variables and the respective indicators that are used to evaluate these variables through several technologies and techniques. The work presented is part of a major research project funded by the Australian Research Council over a 3-year period and is in progress at the Project Management Research Center, Department of Civil Engineering of The University of Sydney.

#### **KEYWORDS**

Hierarchical Multi-criteria Decision Model, Artificial Neural Networks, Fuzzy Logic, Intelligent Agents

#### **CONSTRUCTION MANAGEMENT INFORMATION SYSTEMS FOR LINEAR PROJECTS – APPLICATION IN THE GREEK RAILWAY CONSTRUCTION MANAGEMENT COMPANY**

**John – Paris Pantouvakis**

Assistant Professor, Department of Engineering  
Construction and Management, School of Civil  
Engineering National Technical University of  
Athens, Greece

#### **ABSTRACT**

ERGOSE S.A., the Greek railway construction management company, implementing a huge program of 5,040 MEURO, is developing an integrated system assisting in the planning, scheduling, monitoring and reporting functions of all non-construction (preparation of designs, procurement and expropriations) and construction (performed by external contractors) activities. The system integrates a commercial package's database with ERGOSE's procedures, other databases and graphical data (maps, photographs etc) in order to produce a multiplicity of graphical and text reports that relate physical constructed objects (e.g. bridges, tunnels etc) to location, time, cost, quality and procedure. It is argued that the delivered system, once completed, will assist drastically ERGOSE in realizing its ambitious program of upgrading and modernizing the Greek railway network for the 21st century.

#### **KEYWORDS**

Construction Management, Linear Projects, Railway Construction, MIS, Greece

#### **DESIGNING INFORMATION MODEL FOR THE PROJECT MANAGEMENT INFORMATION SYSTEM (PMIS): A CASE STUDY**

**Seok Heon Yun**

Researcher, Research Institute of Industrial  
Science and Technology RIST, Seoul, Korea

#### **ABSTRACT**

As of today, many construction participants have been less eager to effectively manage and use information of construction projects. By effectively managing project information, the participants will not only be able to make precise analysis and decision-making, but they can also record the information for future reference during claims and making estimates on similar projects. Currently, the efforts to apply information technology (IT) to project management process are remarkably increasing. Success or failure of PMIS application is entirely dependent upon the efficiency of its information and process model based on it.

These are important factors to consider for a useful system. By analyzing the previous information models and current work process, entities organizing model are identified and the relationships are designed. In order to confirm the possibility of its application, PMIS prototype is developed in this research.

#### **KEYWORDS**

PMIS, Project Management Information System, Information Model

#### **A CONCEPTUAL MODEL OF A PRODUCTIVITY INFORMATION MANAGEMENT SYSTEM FOR CONSTRUCTION PROJECTS**

**Jung-Ho Yu**

Ph.D Student, Seoul National University, Seoul, Korea

**Kyung-Whal Kim**

Lecturer, Busan College of Information Technology, Busan, Korea

**Hyun-Soo Lee**

Assistant Professor, Seoul National University, Seoul, Korea

#### **ABSTRACT**

Although there have been many researches on construction productivity issues, researches focused on productivity management using managing productivity information have rarely been carried out. This paper suggests a conceptual model for a productivity information management system. The characteristics of productivity information are classified and the concept of a data warehouse is applied to the proposed system. For the implementation of the system, multi-dimensional productivity data models are presented. One assumption made during the study is that legacy databases exist so that the source data for this system can be extracted. The proposed system would be useful in two respects; (1) the project management team can use this system in managing project-related productivity (2) the accumulated productivity information in this system can be used for planning future projects. Some examples of each of these cases are described. In

future, further research on the computerization of the proposed system is required.

#### **KEYWORDS**

Productivity Information, Information Management System, Data Warehouse, Data Modeling

#### **OPTIMIZATION OF READY MIXED CONCRETE PLANT OPERATIONS USING SIMULATION TECHNIQUES**

**K.C. Ying**

M.Phil. Candidate, Department of Civil and Structural Engineering, The Hong Kong Polytechnic University Hung Hom, Hong Kong SAR, China

**S.L. Tang**

Associate Professor, Department of Civil and Structural Engineering, The Hong Kong Polytechnic University Hung Hom, Hong Kong SAR, China

**M. Anson**

Chair Professor and Acting Head, Department of Building and Real Estate, The Hong Kong Polytechnic University Hung Hom, Hong Kong SAR, China

**M. Lu**

Assistant Professor, Department of Civil and Structural Engineering, The Hong Kong Polytechnic University Hung Hom, Hong Kong SAR, China

#### **ABSTRACT**

The simulation program RMCSIM, developed by the authors, is used to simulate the performance of a ready mixed concrete plant's operation. Results from the simulation reveal that the performance of the concreting operations will not be improved once the optimal truckmixer number is reached even if extra truckmixers are provided. The optimal number of truckmixers can be known from the results of the concreting operation simulation. Another observation is that the performance of the concreting operations at sites is usually worse than that at the concrete plant which

provides truckmixers to the former. Moreover, two batching bays in a plant can perform better than one bay in order to help improve the performance of the concrete plant to match the site needs.

#### **KEYWORDS**

Batching plant, Simulation, Truckmixer, Ready Mixed Concrete, RMCSIM

#### **RESOURCE OPTIMIZATION IN A DESIGN OFFICE USING GA-BASED SIMULATION**

**Tarek Hegazy**

Associate Professor, Civil Engineering  
Department, University of Waterloo, Waterloo,  
Ontario, Canada

**Moustafa Kassab**

Graduate Student, Civil Engineering  
Department, University of Waterloo, Waterloo,  
Ontario, Canada

#### **ABSTRACT**

This paper presents a new approach for resource optimization by combining a flow-chart based simulation tool with a powerful Genetic optimization procedure. The proposed approach determines the least costly and most productive amount of resources that achieve optimum profitability. To demonstrate the proposed approach, a case study of a design office was used. A simulation model of the operation in the design office was created with details related to the design projects that flow into the office, employed resources, and the tasks that take places from start to finish of design. Various optimization experiments were then conducted to reveal the consistency and good performance of the proposed approach in determining the best combination of resources that maximize the yearly revenues. Based on the results obtained, Computer Simulation and Genetic optimization proved to be an effective combination with potential for improving productivity, reducing idle time, and saving construction time and cost.

#### **KEYWORDS**

Resource Management, Organizational

Planning, Simulation, Optimization, Genetic Algorithms, and Computer Application.

#### **SIMULATION MODELING BY ENTERPRISE RESOURCES PLANNING IMPLEMENTATION IN MEDIUM SIZED CORPORATION**

**Sangyoub Lee**

Research Associate, Construction Engineering  
and Management Purdue University, West  
Lafayette, Indiana, USA

**Ahsan Ullah Arif**

Assistant Project Manager, Walsh Group,  
Arlington, Texas, USA

**Daniel W. Halpin**

Professor and Head, Construction Engineering  
and Management Purdue University, West  
Lafayette, Indiana, USA

#### **ABSTRACT**

Enterprise Resource Planning (ERP) is the systems for moving data from application to application without reentry by integration of applications as a methodology for the seamless integration of all the information flowing through the company. This study applied the ERP systems to construction materials management process and quantified the resulting benefits by the variation in productivity. This paper investigated the business processes involved in construction materials management by mapping out the whole process, and illustrated how ERP systems can increase the productivity based on simulation of two model in construction materials management systems, one non-integrated and the other ERP implemented system. The transformation from a non-automated system to an ERP implemented automated system were performed to illustrate individual task improvements through four steps in application, internal and external integration, and automation. An ERP system shortens procurement cycle through automating most of the repeated transactions and reducing manpower to perform the tasks by up to 80%.

#### **KEYWORDS**

Enterprise Resource Planning , Materials  
Management, Integration, Simulation

**SIMULATE ROAD CONSTRUCTION  
OPERATIONS USING SIMPLIFIED  
DISCRETE-EVENT SIMULATION  
APPROACH (SDESA)**

**Ming Lu**

Assistant Professor, The Hong Kong  
Polytechnic University, Hong Kong SAR, China

**ABSTRACT**

Operations simulation models for typical construction systems have been developed as electronic realistic prototypes for engineers to plan productive, efficient and economical field operations ever since the inception of CYCLONE technology. Nonetheless, operations simulation has lagged spreadsheets, databases, scheduling packages, and other types of software in acceptance and implementation in the construction industry because of the complexities and time requirements involved in constructing a model.

The Simplified Discrete-Event Simulation Approach (SDESA) has been proposed as a new attempt to make simulation methods easier for users in construction. Compared with the existing event-based and activity-based approaches, SDESA has significantly streamlined the queuing structures and resources management in simulation. SDESA has been coded into a prototype computer system using Microsoft Access, which is a relational database system with supporting VB macro programs. This paper reports two case studies of applying SDESA on real road construction projects in Hong Kong, namely, a granular base-course construction system featuring both cyclic and linear processes and an asphalt paving construction system with complicated technological/logical constraints. Comparing SDESA against the well-known CYCLONE simulation methodology in two case studies has revealed the simplicity and effectiveness of SDESA in modeling complex construction systems and achieving the preset objectives of such modeling.

**KEYWORDS**

Operations Simulation, Road Construction,  
Process Modeling, CYCLONE

**SHORING LOADS IN MULTISTORY  
STRUCTURE: AN ARTIFICIAL NEURAL  
NETWORK MODEL**

**Mohammed E. Haque**

Associate Professor, Department of Construction  
Science Texas A&M University, College  
Station, Texas, USA

**André Mund**

Graduate Research Associate, Del E. Webb  
School of Construction Arizona State  
University, Tempe, Arizona, USA

**ABSTRACT**

In the construction of a multistory structure, construction loads may exceed the design loads by an appreciable amount. Thus, shoring and reshoring must be provided for a sufficient number of floors to develop the necessary strength to support the imposed loads without excessive stress or deflection. The loads imposed on the shores and reshores as well as on the structural floors must be calculated to determine the cycle time for the erection of the structure and for the design of the shores. This paper demonstrates the feasibility of using an Artificial Neural Network (ANN)-based model to estimate loads on shores and slabs during the construction phases of a multistory structure. It also determines the number of stories above the slab with the maximum load. This model permits, in an early planning stage, to establish the minimum cycle time for the erection of stories given the number of shores and reshores to be used.

**KEYWORDS**

Construction Loads, Multistory Structure,  
Shores, Reshores, Artificial Neural Network

**COMPARATIVE STUDY ON  
FORECASTING DEMAND OF LOW COST  
HOUSE IN URBAN AREAS USING  
ARTIFICIAL NEURAL NETWORKS AND  
ARIMA MODEL**

**Muhd Zaimi Abd Majid**

Director, Construction Technology and  
Management Centre (CTMC) Universiti  
Teknologi Malaysia, Johor, Malaysia

**Khairulzan Yahya**

Faculty of Civil Engineering  
Universiti Teknologi Malaysia, Skudai, Johor,  
Malaysia

**ABSTRACT**

As a developing nation, Malaysia is experiencing a rapid growth of urbanisation due to the expansion of urban economic activities, namely industry, commerce, construction and services. Concomitant with this, the housing demand in urban areas of Malaysia has been increased year by year especially for the low-income group. An accurate prediction of the level of demand for the low cost housing is vital to forecast the future demand. This study covers districts of Gombak in the state of Selangor, Malaysia that are among the areas that experienced a high level of urbanisation. Monthly data of housing demand was collected from the office State of Selangor, Malaysia. Trend of housing demand for five years period from February, 1996 until November, 2000 has been identified and used to forecast the housing demand. Two forecasting techniques were applied to compare the accuracy of short term forecasting, that are, Artificial Neural Network (ANN) and Autoregressive Integrated Moving Average (ARIMA). The accuracy of the models is measured by using the Mean Absolute Percentage Error (MAPE). The minimal MAPE values for both models are identified to be less than 10%.

**KEYWORDS**

Forecasting, ARIMA, Artificial Neural Networks

**ACCIDENT RISK EFFECT:  
FUZZY LOGIC & SIMULATION BASED  
ANALYSIS**

**Sangyoub Lee**

Research Associate, Construction Engineering  
and Management, Purdue University, West  
Lafayette, Indiana, USA

**Daniel W. Halpin**

Professor and Head, Construction Engineering  
and Management, Purdue University, West  
Lafayette, Indiana, USA

**ABSTRACT**

The construction industry has historically had a disproportionately high rate of disabling injuries and fatalities for its size and accident statistics have played an important role as prime indicator for measuring safety performance, however the current system of statistics collection is based upon post-accident analysis, which provides only factual information with no regard to any data prior to the occurrence of the accident. This study estimates the probability of accidents due to the fuzzy-based effect of the factors affecting safety performance. And the quantitative variation in productivity is simulated to incorporate the effect of the probability of accident, which can be demonstrated as a 3-dimensional relationship between probability of accident and extra duration resulting from accident. It is found that productivity is more affected by increased extra duration than by increased probability of accident, when the probability of accident is low. It can be inferred that less frequent fatal accidents causing longer delays are more critical to productivity than more frequent non-fatal accidents that result in shorter delays.

**KEYWORDS**

Construction Safety, Fuzzy Logic, Simulation,  
Accident Risk Effect

**A GRAPHICAL/GEOMETRIC (VISUAL)  
COMMON LANGUAGE FOR THE  
PRODUCTION HOME BUILDERS**

**Yvan J. Beliveau**

Professor and Head, Department of Building  
Construction

Virginia Polytechnic Institute and State  
University, Blacksburg, Virginia, USA

**Ozgur Cakir**

Ph.D. Student and GRA in Environmental  
Design and Planning Virginia Polytechnic  
Institute and State University, Blacksburg,

Virginia, USA

### **ABSTRACT**

The architecture, engineering, construction, occupancy, and operations (AECO<sub>2</sub>) process suffers from a lack of a common language between participants. Visualization platforms such as CAVE, linear scheduling along with the use of tools, such as PDAs, barcodes, digital imaging tools and etc. provide an opportunity to structure a common information exchange between all parties.

This paper presents some thoughts, which are extensions of research, looking at how to industrialize the construction site, funded by HUD and in association with several large production homebuilders. The paper identifies the need for a client centric approach to data development, interaction and archival with additional user specific processes imbedded within and; further, identifies the need to develop a new production planning process that more specifically looks at work flow characteristics, resource consumption and assignment. This research, finally, searches for a new platform for construction planning to achieve mass customization in housing industry through development of a visual interface that may be defined as a visual common language with a web based information technology framework.

### **KEYWORDS**

Housing, Information Technology, Linear Scheduling, Mass Customization, and Visual Language

### **A MODEL FOR TESTING THE IMPACTS OF DIFFERENT PROJECT RESOURCE ORGANISATIONS ON THE CONSTRUCTION PROGRAMME**

**Saad H. Al-Jibouri**

Assistant Professor, Department of Construction Process Management University of Twente, The Netherlands

### **ABSTRACT**

This paper reports on a computer model which has been developed to realistically simulates the

progress of projects. The major part of the model is a heuristic scheduler that has been run under three types of project resource organisations. The three organisational regimes used are central management, section management with co-operation between the sections and independent section management. The resultant project duration under given resource constraints has been used in each of these project management regimes as a measure of the efficiency of the resource scheduling process. It has been found that the scheduling is more effective in the case of section management with co-operation between the sections than the other two cases.

### **KEY WORDS**

Resource Organisation, Simulation, Resource Scheduling

### **CONSTRUCTION INFORMATION MANAGEMENT SYSTEM ON THE BASIS OF THE MOBILE INTERNET**

**Tai Sik Lee**

Professor, Hanyang University, Ansan, Korea

**Sung Hyun Yi**

M.S., Hanyang University, Ansan, Korea

**Dong Wook Lee**

Ph.D. Candidate, Hanyang University, Ansan, Korea

### **ABSTRACT**

Currently, in spite of continual efforts, the information utility of the construction industry does not communicate well with other industries. This problem arose from mistaken and misguided efforts on the parts of the construction industry because it left out of consideration construction characteristics which are at the center of construction, and this information system was directly introduced and operated from outside the industry. There were also other mistakes that the existing information systems disregarded in trying to fix these problems. Therefore, this study describes a new process, which proposes to build and utilize a construction information management system

using the mobile internet concept, to solve the problems of the existing construction information management system.

#### **KEYWORDS**

Mobile Internet, Construction Information Management System, Information Technology

#### **A STUDY OF THE IMPROVEMENT IN QUALITY MANAGEMENT WITH DATABASE**

**Tai Sik Lee**

Professor, Hanyang University, Ansan, Korea

**Young Hyun Kim**

Ph.D Candidate, Hanyang University, Ansan, Korea

**Hee Chul Lee**

M.S., Hanyang University, Ansan, Korea

#### **ABSTRACT**

Digitalization or database modeling occurs in every industry but is especially important in the construction industry. So the need arises for database modeling to be studied in this industry. The construction industry includes many partners and generates enormous amounts of information during the life cycle of each project.

In each construction project, it is important that the owner's requirements in terms of quality be satisfied. The manufacturing industry can produce a repeat product and sampling but the construction industry cannot. When the quality requirements are not met, that means a loss for society or in the economy.

A digital database must be constructed for the efficient management in order to ensure a link between the quality requirements and the construction process. For this linking to work, process standardization is needed. Quality management must go side by side with scheduling, cost management, and resource management, and must be integrated into all aspects of construction. This study analyzes the relationship among quality requirements for all aspects of construction, using the standard classification system now in place at the Korea

Institute of Construction Technology..

This study explores the relationship between the Work Breakdown Structure (WBS) and quality management items in the life cycle of a construction project and models quality management database with business process re-engineering.

This study has the intention to develop a Total Quality Management System (TQMS) to function during the life cycle.

#### **KEYWORD**

TQM, Quality Control, Quality Management, Database

#### **A SURVEY OF THE IMPLEMENTATION OF KNOWLEDGE MANAGEMENT IN CONSTRUCTION ENTERPRISES IN KOREA**

**Tai Sik Lee**

Professor, Hanyang University, Ansan, Korea

**Dong Wook Lee**

Candidate for the Ph.D., Hanyang University, Ansan, Korea

**Sung Hyun Yi**

M.S., Hanyang University, Ansan, Korea

#### **ABSTRACT**

With the growing importance of intellectual capital, corporations are developing Knowledge Management Systems(KMS). The concept of knowledge management in the Korean construction industry was introduced in the mid 1990's by large enterprises. Construction enterprises are trying to develop KMS for Information Technology(IT) application. CEOs are aggressively pushing KMS in a top-down manner. These CEOs are establishing Information Strategic Planning(ISP), organizing taskforce teams, and using external consultants. The results of this paper show that top level CEOs are ambitiously developing strategic approaches to KMS and that technical IT systems exist on a high level. However, this paper identifies the absence of tools for companies to assess the status of their

knowledge management, the lack of techniques for finding and creating knowledge, and the lack of knowledge about developing processes and knowledge-sharing culture. Continued commitment by CEOs is required for knowledge management to become a common practice.

**KEYWORDS**

Knowledge Management, Knowledge Management System(KMS), Information Technology(IT)

**DATA WAREHOUSING IN CONSTRUCTION: FROM CONCEPTION TO APPLICATION**

**Irtishad Ahmad**

Associate Professor, Department of Civil and Environmental Engineering Florida International University, Miami, Florida, USA

**Salman Azhar**

Doctoral Candidate, Department of Civil and Environmental Engineering Florida International University, Miami, Florida, USA

**ABSTRACT**

Data warehousing has emerged as an effective mechanism for converting data into useful information. It is an improved approach to integrate data from multiple, often very large, distributed, heterogeneous databases and other information sources. This paper examines the possibility of using data warehousing technique in the construction industry to integrate various functional and operational databases which are usually scattered across multiple, dispersed and fragmented departments, units or project sites. The concept of data warehousing is explained with the help of several examples and an insight is provided to the reference architecture of a generic data warehouse. At the end, an example on the design of a data warehouse for building developers is provided.

**KEYWORDS**

Data Warehouse, Information Management, Information Systems, Databases, Knowledge-based Systems

**ANALYSIS OF GROUND PENETRATING RADAR SIGNALS FOR PAVEMENT CONDITION EVALUATION**

**Charles N. Nunoo**

Assistant Professor, Florida International University, Miami, Florida, USA

**Hesham Ali**

District Materials Engineer, Florida Department of Transportation, Ft. Lauderdale, USA

**Donath Mrawira**

Assistant Professor, University of New Brunswick, Fredericton, New Brunswick, Canada

**ABSTRACT**

Ground penetrating radar (GPR) technology has been used over the last two decades for a variety of applications including the assessment of pavement condition by obtaining pavement layer thickness and material properties. This paper describes the application of a system identification and analysis of radar signal (SIDARS) methodology to rapidly analyze and compute layer thickness and changes in layer properties of a pavement, using digitized images of reflected radar signals obtained from a conventional GPR. A comparison of the result obtained from a case study analysis using this methodology and that obtained from direct core measurements for the same pavement sections show that the SIDARS measurements provide reasonably accurate results in the form of comprehensive and continuous maps of the quality of compaction and the composition of the asphalt mixture. Upon validation and industry acceptance the SIDARS system can be a valuable tool for quality assurance and quality control of pavement construction. Because it permits the calculation of quantities such as total volume or total weight placed, as well as the quality of placement, it allows for computing incentive and penalty pay as prescribed by performance-based specification. With this kind of detailed information, warranty programs become practical for both the highway agency and the general contractor.

**KEYWORDS**

Pavement Construction, Quality Control, Quality Assurance, Ground Penetration Radar, SIDARS

**A MODULAR HOUSING SYSTEM: ARTI<sub>1</sub>**  
**Huseyin Kahvecioglu**

Research Assistant, Istanbul Technical  
University - Faculty of Architecture, Istanbul,  
Turkey

**Nurbin Paker-Kahvecioglu**

Research Assistant, Istanbul Technical  
University - Faculty of Architecture, Istanbul,  
Turkey

**ABSTRACT**

This paper introduces an affordable and rapid-construction housing system. While the target user group may include those from a wide range of economic and socio-cultural backgrounds, the model is primarily considered as mass housing for developing countries. The elements used to improve the model include affordability and self-development characteristics, adaptability with other construction systems and materials, and performance in varying climatic and geographical conditions. This housing model can be described as a semi-open system that is formed by basic modules that can be merged in various ways to build different types of houses.

The development of the ARTI housing system was carried out in three stages: (1) research, (2) design, (3) evaluation. First stage research concentrated on concepts of necessity and demand, cost and financing, housing typologies, construction technology, materials, energy efficiency, ecology, sustainable construction, and so on. The second stage was a design process of a modular housing system that allows the production of various alternatives and self-improvement capabilities. Adaptability and flexibility of space were also considered in the design process. The third stage was a post-design evaluation.

**KEYWORDS**

Housing, Prefabrication, Modular Houses

**CRITERIA FOR THE SELECTION OF  
DEPLOYABLE AND RAPIDLY  
ASSEMBLED STRUCTURES**

**Katherine A. Liapi**

Assistant Professor, University of Texas at  
Austin, Austin, Texas, USA

**Stephen J. Donley**

Lieutenant Commander, Civil Engineer Corps,  
United States Navy

**ABSTRACT**

In the last 20 years there has been an increased interest in building structures that change shape and form to adapt to different functional or weather conditions and respond to the continuously increasing demand for structures with reduced environmental impact. Current research in the field of Deployable and Rapidly Assembled Structures (DRAS) is focused on the classification of these structures based upon their features and properties. However, a methodology to assist a prospective user in selecting the appropriate DRAS is not available. In this paper parameters to be considered in the selection process are identified and grouped into general categories. Metrics to measure each parameter are also introduced. The usefulness of the parameters in the selection of a DRAS is demonstrated through a case study.

**KEYWORDS**

Structures, Deployable, Rapidly, Metrics

**THE SIMULATED THERMAL  
PERFORMANCE OF A TWO-STORY  
EARTH SHELTERED HOUSE WITH  
SINGLE ADULT OCCUPANCY IN A  
TEMPERATE CLIMATE**

**J.R. Littlewood**

Research Fellow, University Of Glamorgan,  
School of Technology, Environment and  
Geography, Pontypridd, UK

**A.J. Geens**

Senior Lecturer, University Of Glamorgan,  
School of Technology, Environment and  
Geography, UK

**ABSTRACT**

This paper discusses the results of a dynamic simulation study on the coldest day of the climatic test year 1985 for a semi-detached earth

sheltered house on two storeys and with three bedrooms. The earth sheltered house has no form of active space heating other than a mechanical ventilation heat recovery system and relies solely on stabilising effects of the earth, passive solar gain and heat losses from appliances and occupation from one adult. The results of the resultant internal temperatures in the ground floor lounge and first floor master bedroom are compared with the external temperature. There are seven models in the analysis split into two design groups with a common 1<sup>st</sup> floor south facing external wall configuration. The two common first floor design configurations include an insulated external wall and an insulated buffer wall combined with an insulated Trombé wall. Within each group of three models the effects of three earth covers (1500, 750 and 250 mm) on the internal temperatures are analysed. Group 1 also test the effects of zero earth cover on the internal conditions. In addition, each model analyses the effect of single adult on the internal conditions. It is seen that the greatest earth cover significantly improves the internal temperatures on both floors, but that often these temperatures do not meet CIBSE's (CIBSE 1986), recommended design temperatures for habitable rooms.

#### **KEYWORDS**

Earth Sheltered Houses, Passive Solar Design, Dynamic Simulation, Zero Heating

#### **STUDIES ON LOW-COST CONSTRUCTION SYSTEM FOR CONCRETE STRUCTURES BY USING UCAS METHOD**

**Kohei Yamaguchi**

Assistant, Kyushu University, Fukuoka, Japan

**Toshiaki Ohta**

Professor, Kyushu University, Fukuoka, Japan

**Aya Ohta**

Research Worker, Kyushu University, Fukuoka, Japan

**Hiroki Goda**

Student, Kyushu University, Fukuoka, Japan

#### **ABSTRACT**

UCAS is an abbreviation of Unresin Carbon fibers Assembly Systems. UCAS is a new construction system suited IT in applying of unresin carbon fibers cable (CF cable) or partially resin ones as reinforcement on concrete structures. These cables can be produced cheaply by using automatic arrangement reinforcement robot where preimpregnated and thermosetting processes are eliminated. And the cost of usual preimpregnated one is very expensive in comparison with their of steel bars. These defects are improved by using UCAS.

The primary objective of the research reported in this paper is to study the mechanical performance of an unresin CF reinforcing system produced by UCAS for concrete structures. The following tests are conducted: tensile test of CF cables and bending test of full-scale precast concrete slab. It was found that the unresin CF cables possessed a higher ultimate tensile strength than steel bars, and its tensile strength about 30 to 35% of tensile strength of CF strand provided by manufacturer. And the developed grid system to overcome the bonding weakness of CF cables showed good performance in order to develop a mechanical bond between CF cables and concrete. The bending behavior of the slab reinforced by unresin CF cables indicated that it may be a good alternative for steel reinforcement.

#### **KEYWORDS**

Unresin Carbon Fibers, UCAS Method, Automatic Arrangement Reinforcement Robot, Concrete Slab

#### **STEEL COMPOSITE BEAM STIFFENED WITH C-CHANNEL**

**Mahmood Md. Tahir**

Director, Steel Technology Center, Universiti Teknologi Malaysia, Skudai, Johor, Malaysia.

**Airil Yasreen Mohd Yassin**

Graduate Student, Steel Technology Center, Universiti Teknologi Malaysia, Skudai, Johor, Malaysia

#### **ABSTRACT**

Cover plate was known to be used as stiffener in composite beam to increase the bending capacity. The size of plate was cut according to

the design needs. A new method of stiffening the composite beam is introduced in this paper by means of C-channel. This paper is to discuss about experimental study on the flexural behavior of steel-concrete composite beams. Three full-scale composite beam specimens were carried out at UTM laboratory. Two of the specimens with C-channel sections where the opening part facing downward and upward act as a stiffener were welded to the lower flange of the steel beam. The stiffened length was provided at the center part of the beam, enough to the increase the bending capacity of the beam. Full shear connection was provided at the steel-concrete interface. The beams were simply supported and were loaded by two point loads. Measurements of ultimate load and maximum deflection were made in order to obtain the complete picture of the behavior of the beams. The experimental work shown that the initial flexural stiffness,  $k_i$ , for stiffened beams were about 50% higher compared to the conventional composite beam. The ultimate strength of the composite beam was improved by about 45%. It was concluded that the composite beam stiffened with C-channel contributes to the strength and stiffness of the composite section, at both elastic and ultimate condition.

#### **KEYWORDS**

C-channel, Composite beam, Moment Capacity, Stiffness

#### **MODELING EARTH MOVING WITH COMPONENT-STATE-BASED CRITERIA METHOD**

##### **D. K. H. Chua**

Associate Professor, Department of Civil Engineering, National University of Singapore, Singapore

##### **B. Tan**

Research Scholar, Department of Civil Engineering, National University of Singapore, Singapore

##### **J. K. F. Lee**

Final Year Undergraduate, Department of Civil Engineering, National University of Singapore, Singapore

#### **ABSTRACT**

This paper presents a component-state-based criteria model for construction simulation that employs a modeling methodology from the object-oriented view. The method employs a criteria object to list and check component states and other special permits (e.g. weather permit) before initiating the interaction activity. Besides the interaction activity, the component object has its inherent state changing method. This approach also employs both a components-relation diagram and the process flow diagram to facilitate the model development. Finally, the methodology of the component-state-based criteria model for simulation and its potential are illustrated with examples of earth moving applications.

#### **KEYWORDS**

Construction, Simulation, Object-oriented, Resources, Discrete-event

#### **INTERNAL PROFILE MEASUREMENT USING ROTATING LASER-BASED SYSTEM**

##### **Masahito Tanaka**

Graduate Student, Arizona State University, Tempe, Arizona, USA

##### **Bharath Leeladharan**

Graduate Student, Arizona State University, Tempe, Arizona, USA

##### **Hongtao Wu**

Post-Doctoral Fellow, Arizona State University, Tempe, Arizona, USA

##### **Ampere A. Tseng**

Professor, Arizona State University, Tempe, Arizona, USA

#### **ABSTRACT**

An automatic new system for measuring the complete inner profile of various structures has been developed. The system is compact and uses a point laser source passing through a rotating optical device fixed onto the top of the measurement device. To enhance the portability of the system, a handheld computer is selected to

control the laser source and the rotating optical device. The information provided by this system is essential to construction industries for cost estimation and production as well as to speed up the delivery of customized windowpanes, woodwork, floor-tiles and ceilings. Applications of the system for measuring windowpanes and floor plans are demonstrated. The measurement accuracy is also evaluated and analyzed. Results have indicated that measurement accuracy can be achieved within 4% for typical window designs and floor patterns.

#### **KEYWORDS**

Automation, Floor Plan, Laser Measurement, Phase Difference Method, Profile Measurement

### **THE INFORMATION SOLUTION TO HANDICAPPED ACCESS RAMP REQUIREMENTS**

#### **Dean T. Kashiwagi**

Director, Performance Based Studies Research Group, Del E. Webb School of Construction Arizona State University, Tempe, Arizona, USA

#### **Keith P. Touchet**

Researcher, Performance Based Studies Research Group, Del E. Webb School of Construction Arizona State University, Tempe, Arizona, USA

#### **ABSTRACT**

Handicapped access ramp construction standards is a relatively new technical area. Currently standards have been set for ramp width and ramp slope. However, the majority of ramp requirements are in existing sidewalks and streets. Due to the existing conditions, which include sidewalk height, existing curbs and gutter construction, reverse street slope, and obstructions such as lights, signs, and other traffic requirements, the value of existing handicapped access ramp standards is questionable. A ramp can meet standards, but yet be non-performing for handicapped access. Further complicating the issue is the difficulty of understanding performance for the handicapped, economic impact of ramp performance, and the construction quality of the ramp. As in other

construction areas, the potential solution requires excessive standards, documentation, quality control, inspection, and cost. The authors have studied the macro problem and using the technology of the Performance Information Procurement System (PIPS), have developed a process which will minimize design, construction, and risk issues, while maximizing the performance of the handicapped ramp performance and access.

#### **KEYWORDS**

Keywords: Handicapped Access Ramp Standards, Performance Based Procurement, Best Value

### **CONCRETE BORED PILES CONSTRUCTION PRODUCTIVITY INDEX**

#### **Tarek M. Zayed**

Assistant Professor at Construction Eng. and Manag. Dept., Faculty of Eng., Zagazig University, Egypt Currently Visiting Assistant Professor at Civil and Environmental Engineering Department University of Cincinnati, Cincinnati, Ohio, USA

#### **Daniel W. Halpin**

Head of Division of Construction Eng. and Management, School of Civil Engineering, Purdue University, West Lafayette, Indiana, USA

#### **ABSTRACT**

The decision-making process is a very essential part of any construction operation. Estimating the productivity of the piling process is a core step that helps decision-makers bid, plan, and organize the piling project. To schedule the piling equipment operation among different projects and within the same project, productivity analysis is a necessity. To assess productivity properly, piling process quantitative and qualitative factors have to be considered. This paper focuses on the effects of qualitative factors on productivity assessment. A Productivity Index (PI) model is developed to represent this subjective effect in refining productivity assessment using deterministic and

simulation techniques. Analytic Hierarchy Process (AHP) is used to develop the proposed PI model that relies on the actual performance of ten main piling process qualitative factors. Subjective data are collected from drilled shaft contractors considering these factors. The developed PI model implementation to piling process resulted in  $PI = 0.7$ . It has been validated using simulation model outputs.

#### **KEYWORDS**

Pile, Construction, Productivity Index, Qualitative, Analytic Hierarchy Process (AHP), Model

#### **CHALLENGES FOR CUTTING-EDGE CONSTRUCTION**

**Roger. A.F. Smook**

Faculty of Civil Engineering and Geo-Sciences,  
Delft University of Technology Delft, The  
Netherlands

**Emilia.L.C. Van Egmond – De Wilde De Ligny**

Faculty of Technology Management, Eindhoven  
University of Technology, Eindhoven, The  
Netherlands

#### **ABSTRACT**

Construction is still an activity where waste of resources of every kind is an important problem. Other economic activities are apparently more successful in being able to boost productivity and reduce waste in the production process by implementing a targeted production process redesign. Theoretical views and international comparison at the status of managerial and technological capabilities in construction can show another approach towards a more cutting edge construction (production) process.

Construction management research in Delft University could bring about a profile of the elements that can improve the overall level of productivity in the construction sector through Cutting Edge Construction Management. New types of cooperation and contracting are designed following the lines of sophisticated Supply Chain Management in a typical Continental (Dutch) business environment.

Projects are to be engineered obeying the laws of an industrial dominated production environment. Cutting Edge Construction will make this feasible by restructuring the ways of cooperation between all the building partners involved and by optimization of supporting (ICT) communication and knowledge management systems. Also other improvements of the construction process have to be studied.

This paper will formulate recommendations to be given for the improvement of the production processes in construction and civil engineering into more Cutting Edge Construction of which society will benefit.

#### **KEYWORDS**

Construction Management, Production Management, Technological Capabilities in Construction.

#### **CIRCULAR CELL COFFER DAM SHEET PILES INSTALLATION AND DESIGN: THE IRANIAN METHOD**

**Afshin Turk**

Supervisor Engineer, Ministry of Power,  
K.W.P.A , Water Unit, Ahwaz , Khuzestan , Iran

**Saeid Ebrahimzadeh**

Karon River, Head Manager, K.W.P.A, Water  
Unit, Ahwaz, Khuzestan, Iran

#### **ABSTRACT**

Use of steel sheet pile makes it perfect for shore, water engineering, dams, river dams, inaccessible land, water sea, pump stations side dam's, and installation of these piles needs more technically specialized engineering because of complex and accurate locks.

Steel sheet piles were installed first by an Iranian contractor in the south of Iran (The Persian gulf) in 1998. The original layout was designed by Soeico (Sweden Company) consulting engineering in 1975, after some years with some modification, it was approved again for installation. There is a difference between foreign and Iranian method in installation workshop. The longest sheet pile (R500J12.5) is

18 m, and Iranian method (A.TURK 2001 method) will produce comfort action of templates and cells. In this article we will describe new formulation and design method I.D.I.C (Iranian Method of Design and Installation for Circular Cell 1998).

#### **KEYWORDS**

Circular Cell Cofferdam, Sawlike, Sawing Installation, Qult Criterion, Shear Control

#### **REQUIRED CHANGES IN CONSTRUCTION BY PARADIGM SHIFT FOR SUSTAINABLE DEVELOPMENT IN THE ASIA IN 21<sup>st</sup> CENTURY**

**Keizo Baba**

*Professor, Kochi University of Technology,  
Tosayamada, Kochi Prefecture, Japan*

#### **ABSTRACT**

Before previous economic recession, construction projects in the Asia have been increased in proportion to the growth of economy. Everyone involved in construction business had been used to consider that construction business in this region, Asia, is always busy and constructed facilities are always feasible and meet requirements. Therefore, every construction had been execute without careful study of feasibility. But, this recession which may take longer period of time due to influence of the terror of New York proved that above-mentioned view has become illusion. The necessity of detailed studies become more important to evaluate feasibility of proposed construction since the previous recession started from money crisis in Thailand made many facilities unfeasible. This situation has been brought by the rapid changes of market conditions of construction by the shift of economy from old to new economy. These changes of conditions are big and many other additional changes will be expected in future. Therefore, construction projects in the future should be studied for their feasibility more carefully in the planning stage including marketing from many view-points for both sustainable construction and for broad sense of sustainability of

construction industry in the Asia under the influence of new economy.

#### **KEYWORDS**

Change, Sustainable Development, Asia, New Economy, Investment for Construction

#### **CONSTRUCTION IN THE TWENTY-FIRST CENTURY TRENDS AND OUTLOOK**

**Talal Abi-Karam**

*Senior Principal Engineer, Hazen and Sawyer,  
P.C., Hollywood, Florida, USA*

#### **ABSTRACT**

As we enter the new millennium, we move into an open global market economy. Innovative project delivery methods such as Privatization, Design/Build, and At-Risk Construction Management, are becoming common in the construction industry. The United States construction market is reacting to trends of the 1990's by reinventing itself, and emerging on the cutting edge of alternative project delivery. An outlook into the new millennium indicates megatrends such as: (a) Paradigm shift in the project delivery methods, (b) Specialization and niche marketing, (c) Increased global and local competition, (d) Emphasis on “Value” in construction goods and services, and (e) focus on project long term Life Cycle Costs and related services.

This paper will survey megatrends and sub-trends such as, mergers and acquisitions, claims and litigation, and safety in the construction industry.

#### **KEYWORDS**

Merger, Paradigm, Competition, Niche, Design/build

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*25-26 April 2002, Miami, Florida, USA*

#### **THE ROLE OF INDIGENOUS**

## **CONSTRUCTION TECHNOLOGY IN SUSTAINABLE CONSTRUCTION PRACTICES**

**Alfred Talukhaba**

Department of Construction Economics and  
Management, University of Cape Town, Cape  
Town South Africa

**Winston Shakantu**

Department of Construction Economics and  
Management, University of Cape Town, Cape  
Town South Africa

### **ABSTRACT**

Developing countries grapple with a myriad of socio-economic problems such as poverty, unemployment and poor housing conditions, among others. Past programmes to provide housing, for instance, have not achieved the desired results, as they are unsustainable. The South African government's policy of providing housing using conventional construction techniques, for example, cannot be sustained due to dwindling financial resources. On the other hand, for centuries houses and other physical facilities in rural and peri-urban areas have been constructed using indigenous construction technology. This technology utilises locally available materials and takes cognisance of the prevailing climatic conditions and imbues cultural values.

Despite its significance, this technology has not attracted much interest as it has been branded primitive, backward and unhygienic. Consequently, many governments in Africa have yet to come up with programmes and policies that can entrench indigenous construction technology in the main stream construction practices, particularly for low-cost housing provision. This is an inordinate omission in the development and promotion of sustainable construction initiatives. In addition, advances in the development of alternative technology do not have indigenous construction technology practices and its attendant aesthetic and cultural expressions incorporated.

This paper highlights the need for recognition and incorporation of indigenous construction

technology in the development of sustainable construction initiatives and its contribution to socio-economic development of poor communities. A framework for improving and promoting this mode of construction and its linkage with sustainable construction techniques is discussed.

### **KEYWORDS**

Indigenous Construction Technology, Socio-economic Development, Sustainable Construction

### **TECHNOLOGICAL CAPABILITIES FOR SUSTAINABLE CONSTRUCTION**

**Emilia.L.C. van Egmond – de Wilde de Ligny**

Senior Lecturer and Researcher, faculty of  
Technology Management, Eindhoven University  
of Technology, Eindhoven, The Netherlands

**Roger.A.F. Smook**

Professor, Faculty of Civil Engineering and  
Geo-Sciences, Delft University of Technology,  
Delft, The Netherlands

### **ABSTRACT**

Theoretical views point at the status of technological capabilities as the major factor that determines the production performance and the sustainability and competitiveness in industries. Technological capabilities refer to the total stock of technological resources in an industry that can be committed to the production processes. A methodology was developed to determine the state of art of the technological capabilities in an industry. Case studies were carried out by using the methodology . The results were useful to support the enhancement of the manufacturing and application of sustainable Construction Technologies. Empirical evidence indicated an under utilisation and a wrong utilisation of the available resources for sustainable building construction in countries. This paper describes the results of a case study that was carried out in the Costa Rican dwelling construction industry. Recommendations could be given for the enhancement of the manufacturing and application of sustainable innovative Construction Technologies.

## **KEYWORDS**

Technological Capabilities, Construction  
Technologies, Sustainability, Dwelling  
Construction

## **DEVELOPMENT AND IMPLEMENTATION OF THE SOUTH AFRICAN CONSTRUCTION EXCELLENCE MODEL (SACEM)**

### **Sihle Dlungwana**

Research Engineer, The Building and  
Technology Division, Council for Scientific and  
Industrial Research (CSIR), Pretoria, Gauteng,  
South Africa

### **Xolani H. Nxumalo**

Research Engineer, The Building and  
Technology Division, Council for Scientific and  
Industrial Research (CSIR), Pretoria, Gauteng,  
South Africa

### **Steve van Huysteen**

Project Manager, The Building and Technology  
Division, Council for Scientific and Industrial  
Research (CSIR), Pretoria, Gauteng, South  
Africa

### **Pantaleo D. Rwelamila**

Professor, The Graduate School of Business  
Leadership, University of South Africa, Pretoria,  
Gauteng, South Africa

### **Canon Noyana**

Managing Director, Noyana Management  
Consultants cc, Johannesburg, Gauteng, South  
Africa

## **ABSTRACT**

The focus of the paper is on the current progress of a research project of the Council for Scientific and Industrial Research's (CSIR) Division of Building and Construction Technology in developing a performance assessment model for contractors. The South African Construction Excellence Model (SACEM) is based on the South African Excellence Model (SAEM), an internationally recognised framework for business performance assessment.

The paper describes the some problems caused by poor performance of contractors in South Africa. The Construction Industry Development Board (CIDB), an important force driving the construction industry reforms, is described. In attempting to provide solutions to challenges facing contractors the paper introduces the South African Construction Excellence Model. The model's basic structure, function, benefits and its relationship with industry development strategy is elaborated. The promotion of "best practice" culture is advocated by the authors as a critical aspect of improving overall performance of contractors. SACEM is seen as a relevant tool, a starting point for adopting this a culture of excellence. The model's long-term objective is to contribute to the promotion of a culture of business performance excellence in the construction industry by complementing many existing, and possible future, performance improvement programmes.

## **KEY WORDS**

Construction Industry Development Strategy,  
Best Practices, Contractor Performance  
Assessment, Performance Excellence, and  
Competitiveness.

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and Opportunities in Management and  
Technology”  
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**BENCHMARKING BEST PRACTICE TO  
ACHIEVE A COMPETITIVE  
ADVANTAGE IN THE SOUTHERN  
AFRICAN CONSTRUCTION INDUSTRY  
Winston Shakantu**

Senior Lecturer, University of Cape Town, Cape  
Town, South Africa

**Alfred Talukhaba**

Senior Lecturer, University of Nairobi, Nairobi,  
Kenya

**ABSTRACT**

Recently, the South African construction Industry formulated a construction industry policy whose vision is to promote stability and international competitiveness and generate new industry capacity for development. Establishment and promotion of “best practice standards” has been identified as a key driver of work process innovation and enhancement of competitiveness.

Thus, the Southern African Construction Industry is awakening to the globalisation challenges such as technological advancement, constraints in international capital, restructuring and mergers and international competition. Consequently, the social, technical and business architecture is realigning to meet the challenges of globalisation. An e-commerce revolution coupled with paradigmatic business process re-engineering is well under way.

This paper highlights the construction industry’s initiatives that have taken place in furtherance of the policy and vision and it provides an insight into capability and capacity of the industry and its preparedness for international competition. A linkage between best practice performance and competitive advantage is established. The paper concludes that benchmarking international best practice performance can create a competitive advantage in the present globalised industry.

**KEYWORDS**

Southern Africa, Globalisation, Challenges, Benchmarking, Best Practice Standards, Competitive Advantage.

**PROTECTION TO FLORA AND FAUNA:  
THE PROBLEMS FOR CONSTRUCTION -  
A CASE STUDY OF CHIROPTERA  
IN THE UNITED KINGDOM**

**Peter Fenn**

Lecturer, UMIST, Manchester, England

**ABSTRACT**

This paper considers the problems caused to construction by the protection of flora and fauna. Recent strategies of pressure and interest groups in the United Kingdom (UK) have included the tactical use of protective legislation to prevent or halt developments and construction.

As examples case studies are presented; of the problems for construction caused by the presence of bats (Order *Chiroptera*). The paper is concerned with the micro bats (sub order *Microchiroptera*) in Europe and specifically the families *Rhinolophidae* and *Vespertilionidae* (vesper or evening bats) in the United Kingdom. The content of the paper is of general interest to construction professionals wherever bats and construction come into contact.

The paper outlines the protection afforded to bats, and their roosts, throughout the European Union and how it is brought into force in the UK. This protection causes particular problems for construction, and many everyday construction operations that disturb bats and their roosts can be illegal acts. The paper describes research to develop dynamic detectors that will collect and log bat activity, when left in-situ and in the absence of the operator.

It is proposed that as awareness of ‘environmental’ issues become more widespread there will be both opportunities and threats for construction.

**KEYWORDS**

Chiroptera, Bats, Legislation, Legal Protection; Detection

**THE MONITORING STRATEGY TO TEST  
THE ENERGY PERFORMANCE OF A UK  
DESIGNED EARTH SHELTERED  
FAMILY DWELLING**

**J.R. Littlewood**

Research Fellow, University Of Glamorgan,  
School of Technology, Environment and  
Geography, Pontypridd, UK

**A.J. Geens**

Senior Lecturer, University Of Glamorgan,  
School of Technology, Environment and  
Geography, Pontypridd, UK

**J. Harrall**

Research Student, University Of Glamorgan,  
School of Technology, Environment and  
Geography, Pontypridd, UK

**ABSTRACT**

This paper discusses how findings from a thermal simulation study of a two-storey earth sheltered house (esh unit) at the University of Glamorgan, UK, influenced in part, the design of a single-storey esh unit. The completion of the single-storey esh unit, which is being built in the Lincolnshire Fenlands, near the East Coast of the UK, is planned for completion in late Spring 2002. The paper evaluates how 55 thermocouples are being built into the structure, the surrounding earth and a number of the internal rooms, during the construction of this esh unit. These probes are being positioned to record the temperatures of the earth at specific depths around, under and on top of the esh unit. In addition, they will monitor the thermal performance of a number of design features incorporated into the esh unit and the internal comfort conditions. The thermal monitoring study is intended to last for at least three years and is part of an MPhil/PhD study programme at the University of Glamorgan, which is being undertaken by the designer/owner of the esh unit. It is hoped some of the results from the monitoring exercise will validate the results from a dynamic simulation study of the same earth sheltered house.

**KEYWORDS**

Earth Sheltered House, Thermal Monitoring, Passive Solar Design, Low Embodied Energy

**MODES OF APPLICATION OF SMART  
STRUCTURES AND SYSTEMS IN  
CONSTRUCTION**

**Tamer El-Diraby**

Assistant Professor, Department of Civil  
Engineering, University of Toronto, Toronto,  
Ontario, Canada

**Khan Falahudin Kashif**

Graduate Student, Department of Civil  
Engineering, University of Toronto, Toronto,  
Ontario, Canada

**ABSTRACT**

A smart structure is one that monitors itself and its environment in order to respond to changes in its conditions. Smart infrastructure systems is a combination of smart structures and the management systems that operate them. Although considerable research has been focussed on the structural aspect of embedding and installation of sensors and actuators in to the host or mother structure, the application of sensor-embedded materials and intelligent devices has so far been very limited in scope. This article describes the research efforts underway at the University of Toronto to establish a framework for developing deployment strategies for the utilization of smart materials and intelligent devices especially in the contest of infrastructure management. Two categories of smartness are being proposed, technical smartness and managerial smartness. Technical smartness is assessed in terms of hardware and network support needed for a given situation. The criteria used for categorizing managerial smartness are software support and the management system that an organization uses for data collection and decision making respectively. Based on the two criteria three modes of smart infrastructure systems are proposed. Given its objectives, scale, scope and human resources, any organization can delineate a roadmap for implementing different modes.

**KEYWORDS**

Infrastructure, Smart Structure, Smart System, Product Modeling, Process Modeling

## **PROMOTION OF ENERGY EFFICIENT DESIGN □ A CASE STUDY IN CHINA**

**Qi Bao**

PhD Candidate, Department of Building & Real Estate, The Hong Kong Polytechnic University, Hong Kong

**Liyin Shen**

Associate Professor, Department of Building & Real Estate, The Hong Kong Polytechnic University, Hong Kong

### **ABSTRACT**

Energy is the key to human sustainability. The efficient use of energy has become an important worldwide issue as the sustainability of the energy particularly those non-renewable energy resources is under the threats of being exhausted in meeting the process of fast economic development. Furthermore, the ever-increasing waste products due to inefficient energy consumption are causing globally environmental problems. It presents the urgency for industries to seek for energy efficient consumption measures in their economic activities. The construction industry as a major energy consumer has the liability to make contributions towards this mission. Project design is considered the most important stage in contributing to energy saving as it can determine ways of consuming energy during a construction product's life cycle. Energy efficient design in construction project is even more important in developing countries such as China where energy-use efficiency in construction products is low and at the same time great amount of construction activities remains for coming years. This paper examines the ways of applying energy efficient design in China and identifies the existing problems and the areas where energy saving improvements can be achieved. Better energy consumption measures are identified for making improvements by referring to the advanced practices of other countries.

### **KEYWORDS**

Energy Efficient Design, Energy Saving Measures, China

## **DEVELOPING ECOLOGIC HOUSING - CASE STUDIES IN CHINA**

**Dehua Wu**

PhD Candidate, Department of Building & Real Estate, The Hong Kong Polytechnic University, Hong Kong

**Liyin Shen**

Associate Professor, Department of Building & Real Estate, The Hong Kong Polytechnic University, Hong Kong

### **ABSTRACT**

Developing ecologic real estate has been promoted world-wide as an important mechanism for implementing the principles of sustainable development in construction activities. The housing industry is a major consumer of the environmental resources. This is even more obvious in developing countries such as China where the fast economic development is generating vast amount of housing activities but at the expense of environmental degradation. Construction activities particularly for housing in China will be the major economic sector for coming years, thus the implementation of environmental management in this field can contribute significantly to the mission of sustainable development. Existing research works have developed theoretical frameworks formulating the methodologies and principles of developing ecologic housing. By examining the practices of applying these methodologies in China, this paper identifies the key factors determining the application effectiveness of ecologic housing methodology. Benefits and existing problems in the application are investigated. The paper presents two case studies in applying the new methodology, and useful experience from the two cases is drawn accordingly. With the governmental determination, developing ecologic housing is the major direction of future Chinese housing industry. This presents good potential for overseas professionals who have good experience and techniques in developing ecologic housing to explore business opportunities.

### **KEYWORDS**

Sustainable Development, Environmental Management, Ecologic Housing, China

## **MODELLING WASTE FLOW PRACTICE ON CONSTRUCTION SITE**

**L.**

**. Shen**

Associate Professor, Department of Building and Real Estate, The Hong Kong Polytechnic University, Hong Kong

**Vivian W. Y. Tam**

Research Student, Department of Building and Construction, City University of Hong Kong, Hong Kong

**C. M. Tam**

Associate Professor, Department of Building and Construction, City University of Hong Kong, Hong Kong

### **ABSTRACT**

The increasing awareness of environmental impacts from construction wastes has led to the development of waste management as an important function of construction project. Various approaches and methods for managing construction wastes have been developed in the existing research works and practice, and these works can be grouped largely into three areas: waste classification, waste management strategies (avoiding waste, reducing waste, reusing waste, recycling waste, and disposing waste), and waste disposal technologies. This paper extends the existing approaches to examining the waste flow during construction on site with support from four cases selected in Hong Kong construction industry. The examination was conducted by mapping the waste management flows (WMF) is developed in those four cases. WMFs provide tools assisting in examining the adequacy and effectiveness of flow processes of dealing with various construction wastes, from the sources generating it to the destination of disposal. WMFs can serve as a vehicle to compare the waste management practice between construction sites, thus both good practice and weak areas in managing wastes can be presented. The key stages and areas of processing construction wastes can be identified, thus effective waste control methods can be

developed for application to these areas. An effective waste management flow model on construction sites will be developed in further research.

### **Y KEYWORDS**

Environmental Management, Construction Waste, Waste Management, Waste Management Flow (WMF)

## **SOIL-COOPER WASTE RESIDUE AS MINERAL ADDITIVE FOR MORTAR OR CONCRETE USED IN SUSTAINABLE CONSTRUCTION**

**Jorge Gomez Dominguez**

Professor, Monterrey TEC, Monterrey, Nuevo Leon, Mexico

**Luis Balderrama Neder**

**M.**

**Sc.,**

Hermosillo, Sonora, Mexico

### **ABSTRACT**

In this research the possibility of using soil-cooper residue (known in Mexico as Jales of cooper) as a mineral additive for producing concrete was studied. This industrial waste comes out from a plant in the state of Sonora, Mexico, here 75,000 metric tons of the waste residue accumulates daily during cooper production. Physical and chemical characteristics of the waste product were verified and compared with ASTM standards of interest. It was found that this material has pozzolanic reactivity as determined with compression tests ran in the laboratory with Portland cement mortars (strengths are better than the minimum established by ASTM C 618-91). Although some of the ASTM requirements are not fully satisfied, it is considered that this material can be useful for manufacturing mortar and concrete for non- structural purposes. Because of its pozzolanic reactivity this industrial waste can reduce the cement consumption, alleviating its dangerous accumulation while providing a sustainable resource for our construction industry.

### **KEYWORDS**

Soil-cooper Residue, Pozzolanic Reactivity, Mortar, Concrete

**TECHNIQUES TO DEVELOP NEEDS  
MODEL ON HOUSING IN URBAN AREA:  
A LITERATURE AND MALAYSIAN  
EXPERIENCE**

**Noor Yasmin Zainun**

Graduate Student, Construction Technology &  
Management Center, Faculty of Civil  
Engineering, Universiti Teknologi Malaysia,  
Skudai, Johor, Malaysia

**Muhd. Zaimi Abd. Majid**

Director, Construction Technology &  
Management Center, Faculty of Civil  
Engineering, Universiti Teknologi  
Malaysia, Skudai, Johor, Malaysia

**ABSTRACT**

The number of people who will live in urban areas is expected to double to more than five billion people between 1990 and 2025. Therefore, accurate predictions of the level of aggregate demand for housing are very important. Empirical studies have shown that accuracy performance varies according to the types of forecasting technique and the variables to be forecast. Hence, there is a need to identify different techniques, in terms of accuracy, in the prediction of needs for facilities. This paper discussed on Artificial Neural Networks (ANN) technique and comparison with other techniques in forecasting needs of housing in urban area. Investigation on previous research and literature material will be derived and compared in terms of errors in the accuracy of the technique. Through this study, it was found that the ANN model performs best overall. .

**KEYWORDS**

Urban Area, Accuracy, Artificial Neural Network, Forecasting

**MANAGERIAL SYSTEM FOR 21<sup>st</sup>  
CENTURY CONSTRUCTION OF  
AFFORDABLE HOUSES**

**Roberto Soares**

Assistant Professor, Clemson University,  
Clemson, South Carolina, USA

**ABSTRACT**

This paper presents an alternative management system for the construction of affordable houses. It is composed of 10 managerial techniques/actions (TBA) that were generated from the observation of biological cell principles in delivering services. The 10 TBAs are: 1- building code optimization, 2- constructibility, 3-systems management, 4-empowerment, 5-cost control, 6-project partnering, 7-work team organization, 8-self-help production, 9-quality, and 10-training. The system calls for interrelation and integration between the 10 sub-systems to maximize output, high correlation of people and communication, safety and quality, and to be used as a standard to evaluate performance of construction organizations dedicated to the affordable housing construction business.

**KEYWORDS**

Affordable Housing, Construction Management System, Work Team Organization

**PROMOTION OF SUSTAINABLE  
CONSTRUCTION TECHNIQUES IN  
EXISTING BUILDING ASSESSMENT  
METHODS: A COMPARATIVE  
ANALYSIS OF GBTOOL, BREEAM, LEED  
AND SBAT**

**Ewelina Kaatz**

Department of Construction Economics and  
Management, University of Cape Town, South  
Africa

**Paul Bowen**

Department of Construction Economics and  
Management, University of Cape Town, South  
Africa

**Richard Hill**

Department of Environmental and Geographical  
Science, University of Cape Town, South Africa

**ABSTRACT**

Progress towards sustainable development in construction may be partly indicated by implementation of good construction practice in building developments. The evaluation of construction practice is often conducted using building environmental assessment methods.

Assigning credits for implementation of sustainable construction measures in the building assessment is an important incentive for their implementation in the construction process. However, it is argued that the recognition of sustainable construction techniques in existing building assessment methods is not sufficient.

The purpose of this paper is to examine sustainable construction techniques that are included in building assessment frameworks, and the underlying principles that should govern the development and implementation of such techniques. Existing building assessment methods, such as GBTool, BREEAM, LEED, and SBAT, are analysed with regard to their contribution to promoting the implementation of sustainable construction techniques.

The methodology comprised an extensive literature review in the field of sustainable construction and a detailed analysis of the chosen building assessment methods.

#### **KEYWORDS**

Building Assessment Methods, Sustainable Construction, Sustainable Construction Techniques

#### **WEB-BASED TOOL IN PROJECT QUALITY MANAGEMENT**

**Donath Mrawira**

Assistant Professor, University of New Brunswick, Fredericton, New Brunswick, Canada

**Jeff Rankin**

Director, Construction Technology Centre Atlantic, Fredericton, New Brunswick, Canada

**Charles Nunoo**

Assistant Professor, Florida International University, Miami, USA

#### **ABSTRACT**

The paper presents a state of the art application of web-based technology in providing an affordable system for managing project quality information. The advantages are demonstrated through a case study of a fully implemented

quality information management system for a highway mega-project in New Brunswick Canada. The system developed addresses key needs including support for various levels of management (technical and executive), an open data structure and inter-operability, hierarchical information levels, integration with facility-wide management information, and future scalability. The developed system addresses the needs of quality information management for a private project developer but can also be adapted to other project delivery mechanisms. The tool was implemented to support the entire project team including construction field supervisors and project's senior management. The paper offers a documented analysis of a generic implementation process that can be adopted in other projects to improve efficiency in quality information management in the highway construction industry.

#### **KEYWORDS**

Web-Based Technology, Project Quality Information Management, Private-Public Partnership

#### **COMPUTER SIMULATION ANALYSIS TO REDUCE ASPHALT PAVING PROCESS DURATION**

**Yassir A. AbdelRazig**

Assistant Professor, Florida A & M University, Florida State University, Tallahassee, Florida, USA

#### **ABSTRACT**

Generally, project completion success in construction is measured in terms of time and cost efficiencies. For highway construction in particular, time efficiency is very critical, given the traffic delays and higher accidents risks associated with highway construction zones. This study is focused on studying and identifying changes at the construction process level rather than the contractual, procurement, or project scheduling aspects of highway construction management. A detailed examination of the asphalt paving process is presented. The asphalt paving process is analyzed utilizing computer simulation to identify potential improvement to reduce its

duration. A sensitivity analysis is conducted to evaluate different alternatives.

#### **KEYWORDS**

Computer Simulation, Asphalt Paving, Construction Process

### **DEVELOPMENT OF AN INTEGRATED DATABASE FOR 4D/VR CONSTRUCTION PROCESSES SIMULATION**

**Nashwan Dawood**

Centre for Construction Innovation Research,  
School of Science and Technology University of  
Teesside, Middlesbrough TS1 3BA, UK

**Eknarin Sriprasert**

Centre for Construction Innovation Research,  
School of Science and Technology University of  
Teesside, Middlesbrough TS1 3BA, UK

**Zaki Mallasi**

Centre for Construction Innovation Research,  
School of Science and Technology University of  
Teesside, Middlesbrough TS1 3BA, UK

#### **ABSTRACT**

The objective of this paper is to report on the development of an integrated database to act as an information resource base for 4D/VR construction process simulation. A comprehensive database was designed, implemented and populated with the School of Health Construction Project (A six million pounds, three story development at the university of Teesside campus). The database is composed of a core database of building components which is in turn, integrated with a CAD package (AUTOCAD 2000), a Project Management Package (MS Project) and Graphical User Interfaces.

The core database was designed using Standard Classification Methods (Uniclass). One of the benefits of using the Uniclass method, a part from providing standards for structuring building information, is that it provides a media for integrating PBS (Product Breakdown Structure) with WBS (Work Breakdown Structure). This is an important aspect for delivering a meaningful 4D model.

Integrated interfaces between MS Access Database, AutoCAD Drawings and MS Project Schedules were developed and implemented. Furthermore, the British Standards of layering convention (BS 1192-5) was adapted and implemented and justification for this is given in the part 2 of this document.

The database was populated with detailed 2D drawings (whole building and M&E), schedules of work and resources of the School of Health Project.. This paper is also addressing object definition, structuring the data, and establishing the relationships and dependencies within the data set, the WBS and building objects as well as modelling the building in 3D in order to capture the essential space- and time-critical attributes of tasks. Practical application of database throughout the construction process has been highlighted and discussed.

#### **KEYWORDS**

Integrated Database, 3D Modelling, Virtual Reality

### **CUSTOMER SATISFACTION: CONTRACTOR'S PERSPECTIVE**

**Larry D. Rigsby**

Graduate Student, Department of Construction  
Management, Florida International University,  
Miami, Florida, USA

**Željko M. Torbica**

Assist. Professor, Department of Construction  
Management, Florida International University,  
Miami, Florida, USA

#### **ABSTRACT**

One of the most effective ways for contractors to differentiate their firms from the competition is their ability and commitment to establish criteria, measure, and maintain a positive relationship with project owners by placing customer satisfaction as the priority in any project. This paper suggests the necessary steps that a contractor needs to undertake in order to initiate and maintain a successful customer satisfaction program. Topics discussed are designed around the owner/contractor relationship in general and are not pinpointed to any particular market segment.

**KEYWORDS**

Customer Satisfaction, Construction

**DESIGN BUILD PROJECT DELIVERY:  
OPPORTUNITIES AND CHALLENGES**

**Zuhair Itr**

Associate Professor, Southern Polytechnic State  
University, Marietta, Georgia

**Saeid Sadri**

Associate Professor, Georgia Institute of  
Technology, Atlanta, Georgia

**ABSTRACT**

More Owners are using the Design Build delivery methods while seeking construction services. This paper discuss the legal implication, the difference in characteristics between the Design Build and the traditional delivery methods, and the difficulties created while bidding small public construction projects under the design build delivery methods.

**KEYWORDS**

Design Build, Bidding Design Build