

Abstracts for the Proceedings of the
8th International
Conference on Construction in
the 21st Century

CITC-8

*“Changing the Field: Recent Developments
for the Future of Engineering and Construction”*

Thessaloniki, Greece

May 27-30, 2015

Editors:

Syed M. Ahmed, Yiannis Xenidis, Salman Azhar,
Norma A. Smith, Cat E. Yaris, Shaunna Campbell



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Editors

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Foreword

The construction industry is a vital contributor to worldwide economic growth and development in the 21st century. In support of the growth of modern knowledge, Construction in the 21st Century's (CITC) conference series reaches out to an outstanding international group of practitioners, researchers and educators to encourage an elaborate exchange of knowledge and ideas in an integrative fashion.

Significant knowledge is constantly generated through increasing technology and research methods. The exchange of this knowledge supports the growth of individuals as well as the construction industry as a whole. CITC plays an integral role in scrutinizing and rigorously testing research methods and techniques before implementation. The conference further provides a medium for multinational collaboration, which is crucial for the future complex global economy. Future industrial expansion relies on international teamwork and alliance.

CITC conferences have been tremendously successful thanks to the great support offered by our friends and colleagues from across the globe. Previous conferences include CITC-I in Miami of 2002, CITC-II in Hong Kong of 2003, CITC-III in Athens of 2005, CITC-IV in Gold Coast, Australia of 2007, CITC-V in Istanbul of 2009, CITC-VI in Kuala Lumpur of 2011 and CITC-VII in Bangkok, Thailand of 2013. The *Eighth International Conference on Construction in the 21st Century: Changing the Field: Recent Developments for the Future of Engineering and Construction (CITC-8, Thessaloniki)* was held between May 27-30, 2015 in Thessaloniki, Greece. In the two and a half days of the conference, participants had the opportunity to attend a large infrastructure project site visit, five workshops, and four keynote speeches from prominent colleagues in the field. They also had the chance to attend the presentations of 87 scientific papers out of the 106 papers included in the conference proceedings after a blind peer review process. The number of originally submitted papers and abstracts was 179, thus reaching a 60% publication rate for the conference.

CITC-8 brought together a diverse group of academics, professionals, individuals from government agencies and students from 26 countries (seven from Europe, six from Africa, ten from Asia, Australia, New Zealand and U.S.A.) succeeding in creating an international forum of discussion on the future of engineering and construction in the 21st century. The organizers greatly appreciate the participation and attendance of this large audience and hope that it will support future CITC conferences.

Thank you and kind regards,

The Editors

Syed M. Ahmed, Chair

Yiannis Xenidis, Co-Chair

Salman Azhar

Norma A. Smith

Cat E. Yaris

Shaunna Campbell

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The USB drive in your conference package contains full versions of all papers in PDF format. The papers can be viewed using Adobe Acrobat Reader.

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**May 2015
Greenville, North Carolina, USA**

CITC-8 Themes

- ❖ Complex Construction Projects & Mega Projects
- ❖ Construction Monitoring & Control
- ❖ Construction Safety & Quality
- ❖ Cost & Financial Management
- ❖ Information Systems
- ❖ Innovation
- ❖ International Construction Issues
- ❖ Modern & Future Trends in Construction Management
- ❖ New Tools in the Education of Construction Management
- ❖ Procurement Management
- ❖ Risk Management & Decision Making
- ❖ Soft Skills in Construction Management
- ❖ Sustainability
- ❖ Visualization Techniques

CITC-8 International Scientific Review Committee

We would like to express our sincere gratitude to the members of the International Scientific Committee, who participated in the review process for the CITC-8:

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Dr. Hamimah Adnan

Dr. Dimitris Antoniadis

Dr. Georgios Aretoulis

Dr. Ioannis Brilakis

Dr. Anita Ceric

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Dr. Zeljko M. Torbica

Dr. Dimitra Vagiona

Prof. Rizwan U. Farooqui



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Keynote Speaker

Dr. Mostafa Khattab is a professor and head of Colorado State University's Department of Construction Management. He has more than 20 years of experience as a teacher, researcher, and consultant in construction education.

Dr. Khattab is a past president of the Associated Schools of Construction (ASC), an international educational organization that supports the advancement of construction education, serving more than 115 schools across the United States. He is a member of the American Council of Construction Education (ACCE) Board of Trustees, and past chair of ACCE's national department head caucus.



He serves as an educator member of the Mechanical Contractors Association of America (MCAA) Board of Trustees, and a founding member of the Construction Management Association of America College of Fellow Academic Council. Dr., Khattab has successfully led several international initiatives with department faculty and staff sponsored by the United States Agency for International Development (USAID) and the Education for Employment Foundation (EEF). His international effort in addressing challenges facing higher education and lack of employment in the Middle East was recognized by the Fulbright Commission. Dr. Khattab was named a Fulbright Specialist.

Presenting on Thursday May 28th at 9:00 in Maistros B

“The Future of Construction Education: Challenges and Opportunities”

Abstract

Construction management programs, as a discipline in higher education, were created by construction industry members and faculty in the late 1960s in the US. The original goal was to create a new discipline that combines engineering, management, and construction to specifically prepare students for a career in the construction industry with strong communication and leadership skills. As a result, significant progress was made to support such an initiative, including the creation of the Associated Schools of Construction (ASC) and the American Council of Construction Education (ACCE) accrediting body.

Today, graduates from over 100 CM programs in the U.S. serve as leaders in the construction industry. However, the challenges facing CM as a discipline today and our ability to serve the construction industry can be summarized as follows:

The negative image of the construction industry by students, teachers, and counselors in K-12 schools and the lack of understanding of the multitude of career opportunities in the construction industry are impacting CM programs' abilities to attract the best and brightest to construction education.

The tension that exists in higher education between upper administration's desire for increased research productivity and CM programs' focus on quality undergraduate education is a threat to CM programs' ability to enhance their dynamic curriculum and retain many qualified classroom educators with strong industry experience who do not meet research expectations.

There is a great need for construction faculty with industry experience. One of our responsibilities as professional educators is to mentor the future leaders of industry. Many of the best faculties in our CM programs are those with many years of industry experience who transition to the classroom as a second career. In some institutions, it is difficult to hire a full time faculty member who doesn't have a Ph.D.

In recent years, construction projects have increased in complexity, integrated project delivery has become more prevalent, and the use of technology has skyrocketed. The construction industry has an increased need for graduates with strong soft skills, a graduate that could "hit the ground running." But, the state of higher education and accreditation today has limited CM programs' flexibility and incentives to respond through curriculum development.

Typical disciplines in higher education today have research support from national organizations and government agencies. Such support is limited for construction management. The construction industry is at risk of losing the focus on quality undergraduate education to satisfy the increased focus on research in higher education.

The above highlights a few challenges facing construction education and the ability of CM programs to serve the construction industry. However, these challenges should be seen as an opportunity to partner the leaders of the construction industry with construction educators to chart the future of construction education; a future that could position the CM discipline to become the new model of higher education.

Keynote Speaker

Dr. Lincoln Forbes is a subject matter expert in the area of lean construction, an emerging method of project delivery that draws on the success of the Toyota Production System (TPS). He is a member of the Lean Construction Institute, a non-profit organization dedicated to promoting knowledge and awareness of lean construction principles. He has lead-authored with Dr. Syed Ahmed on one of the first contemporary books on lean construction, titled "Modern Construction: Lean Project Delivery and Integrated Practices" (CRC Press 2010).



A Registered Professional Engineer (FL) and LEED® Accredited Professional, Dr. Forbes has over 30 years of experience in various aspects of facilities design, construction, and maintenance as well as quality and performance improvement. His firm, Harding Associates, Inc., specializes in helping to improve performance in design and construction projects. His presentations and service on lean construction have included such organizations as Universal Health Services, Baxter International, FedEx SmartPost, the American Institutes of Architects (Miami Chapter), the National Association of Women in Construction (Miami Chapter) and Florida Structural Engineers' Association (FSEA).

Dr. Forbes served as administrative head of several facilities-related departments in Miami-Dade Public Schools, the 4th largest school district in the U.S. These positions included in-house construction, design services, construction quality control, post occupancy evaluation, project warranty services and quality management. He also provided research and technical support on sustainability practices, commissioning, construction systems, and methods and materials. His professional memberships include the American Society for Quality (ASQ), the American Society for Healthcare Engineering (ASHE), and the Institute of Industrial Engineers (IIE). Dr. Forbes is also the founding President of IIE's Construction Division.

Dr. Forbes received his Pd.D. at the University of Miami, specializing in the improvement of quality and performance, including healthcare facilities design and construction. Previously, he obtained both his MBA and M.S. in Industrial Engineering at the University of Miami. He earned a B.Sc. in Electrical Engineering at the University of the West Indies.

He has also served as an Assistant Professor (visiting) in the Department of Construction Management at East Carolina University (ECU) in Greenville, North Carolina. He has also held adjunct appointments with the Construction Management departments at Florida International University (FIU) and ECU

Presenting on Thursday, May 28th at 13:00 in Maistros B

Leveraging Sustainability with Lean – A Call for Action

Abstract

The world has become an uncertain place. Recent events remind us that many forces are continually jockeying for power to fill leadership vacuums. This state of affairs threatens all nations, but another insidious threat looms quietly in the shadows; that is our environmental

sustainability. It does not dominate the headlines on a daily basis the way that violent events do, but the threat to our tranquility is real. The world's fossil fuels are being depleted at a rate that is unsustainable – the world demand for oil is approximately 31 billion barrels/year, and forecasted to grow at 2% per year until 2025. Greenhouse gases are generated at a similar rate, and the ozone layer is also being degraded faster than was anticipated. President Obama underscored the severity of our environmental problem last April. Speaking on Earth Day from the Florida Everglades nature preserve, he pointed out that “we do not have the time to deny the effects of climate change”. He stated that it is not just a problem for future generations, but is already a challenge for us in the present. While some political and business interests may cling to an optimistic view that climate change is not an imminent threat, there is much evidence to the contrary.

What meaning does this hold for us as creators and custodians of the built environment? We need to challenge the design and construction industry to break this negative spiral and leverage the sustainability practices that have existed for some time, but seem to have lost momentum. The built environment is rife with examples of waste in many forms. The Building SMART Alliance at the US- based National Institute for Building Sciences estimates that more than 50 percent of the cost of a building is waste; 25 to 50 percent waste in coordinating labor and in managing, moving, and installing materials.

The primary barrier to sustainable construction initiatives such as LEED is the client's widely held but mistaken belief that sustainable construction will cost more and attract a higher risk. Many projects are based on a short-term return on investment, as future benefits may not be received by the builder/developer/owner. The perceived high cost of registration is also a disincentive. A number of studies suggest that the cost of LEED compliance is in fact modest. The so-called LEED premium was noted in 2004 and 2007 studies to be an average of 1.87% for LEED Silver, 4.0% for LEED Gold, and 8.57% for LEED Platinum.

Lean construction projects have been demonstrated to lower costs and shorten schedules simultaneously, in some cases by 10 percent or more. In lean projects, constructors and designers can increase profitability even at a lower cost to the owner because of fewer mistakes, fewer delays and less waste of human and other resources. Green buildings promote and support the concept of Lean construction. While Lean construction involves the minimization of waste, green building design promote environmentally beneficial long-term operation. Overall, a combination of these approaches significantly enhances sustainability.

The reasons are unclear, but it appears that there has not been enough communication and collaboration between the two factions – those who advocate sustainable construction, and the growing constituency of lean construction practitioners. Forward thinking leaders in the construction industry are strongly encouraged to adopt a model of greater collaboration – reducing costs with lean and green initiatives also protects the environment and represents a sound business practice.

Construction Management, Architecture and Engineering programs can be an important catalyst for this transition and while we inculcate these values in our students we should also reach out to the industry!



Keynote Speaker

Dr. Zeljko Torbica is a Professor and Dean of the Leonard C. Nelson College of Engineering and Sciences at West Virginia Institute of Technology. Dr. Torbica's international experience of over 25 years includes both academic positions at several leading U.S. universities and an extensive and industry recognized background in real estate development, leadership, strategic planning and construction operations.



During the course of his career, Dr. Torbica has received a number of distinguished awards; published articles in the most selective professional journals; directed real estate development operations, with projects ranging from \$50 million to \$550 million; served on prestigious Baldrige National Quality Award Board of Examiners; and completed leadership programs at Columbia University and Harvard University.

Dr. Torbica received a Ph.D. degree from the University of Florida. Dr. Torbica is a Certified General Contractor in the state of Florida, and holds a Project Management Professional (PMP) and Quality Engineer (QE) certification

Presenting on Friday, May 29th at 10:30 in Maistros B

“Advancing Undergraduate Construction Management Education: Lessons Learned From the Engineering Education? (A U.S. Perspective)”

Abstract

Construction Management higher education in the U.S. has a relatively short history with its oldest continuing building construction program celebrating its 80th anniversary in 2015. Despite the fact that the majority of programs are less than 40 years old, Construction Management has matured significantly as an academic discipline and is constantly evolving to adapt to the changing demands of society, industry and students.

In order to encourage discussion and exchange of ideas on how to advance the Construction Management education, an overview of some of the challenges facing engineering undergraduate education, which is a more matured academic discipline, will be presented. The case will be made that the enduring discussion taking place in engineering education about the challenges and the initiatives aimed at addressing these difficulties, has relevance and potential applicability in the Construction Management education.



Keynote Speaker

John-Paris Pantouvakis, following a ten year career in industry moved to Academia and is now a Full Professor, Director of the Laboratory of Construction Equipment & Project Management and the Founder & Director of the Centre for Construction Innovation at the National Technical University of Athens (NTUA).



John-Paris is also an Adjunct Lecturer and a Postgraduate Module Coordinator at the Hellenic Open University. He has chaired the IPMA Education & Training Board since 2012 leading a team of experts pursuing innovative project, portfolio, and programme management teaching methodologies. John-Paris is also the President of PM-Greece, the Greek Association for the advancement of project management in Greece and an IPMA Member, a First Assessor for IPMA Certification in Greece and an IPMA Project Excellence Awards Lead Assessor. He has participated in IPMA award assessments in Germany, Iran and the Netherlands.

He has served as a Visiting Professor of Construction Management at Nazarbayev University, Kazakhstan and has delivered various keynote speeches at international conferences (Greece, Czech Republic, Croatia, Hungary, and the UK) and invited lectures at several universities in Europe (Italy, Czech Republic, Lithuania, Turkey, US). He co-chaired the first CITC Conference organized in Greece (CITC-III, Athens, 2005). He has also chaired the 26th IPMA World Congress in Greece (2012) along with a number of other conferences and events in Greece since 2001.

John-Paris has coordinated and participated in various EU co-funded research projects including 'nCPM' and 'profPM' aiming at the advancement of professional project management in Greece. He has also established and led the programme of practical placements for civil engineering students at NTUA (2009-2014). Professor Pantouvakis has been a Member of Technical Committees for ELOT 1429 (Gratification of Management Capability of agencies implementing public projects in Greece) and the translation of ISO 21500 (Guidance on Project Management) in Greek. He also serves as an Expert Arbitrator for technical disputes in major infrastructure projects in Greece since 2008.

Presenting on Friday, May 29th at 14:00 in Maistros B

“The Achievement of Engineering Management Competence”

Abstract

Engineering management is based on the manipulation of data with the purpose of creating value for the project stakeholders. Among recent technological developments, Building Information Management (BIM) unifies digital representations of project physical and functional characteristics in forms that can be exchanged and networked among software applications and computer platforms throughout the project life cycle. BIMs, although extremely useful, can

never replace the most important resource of all; people, who interact, collaborate, negotiate, conflict and professionally develop during project realization. Arguably, according to the forecasts, the demand for senior level staff capable of dealing with 'sensitive' matters of project realization will rise in the future. If this is true, then issues such business strategy, organizational mission and vision, appropriate project alignment and prioritization, the agile approach, exploitation of new risks and opportunities, human factors and contextual awareness will soon become of greater importance. Furthermore, the developments in technology and the globalization of the economy will allow for more dispersed and diverse project teams, greater numbers of participating contractors and consultants and finally for more projects, portfolios and programs. It is for this reason that we need, in parallel with advancing technologically, to be able to better understand the application of soft skills in engineering management (such as entrepreneurship, innovation, leadership, team formation, motivation, moderation etc.) throughout the project phases. For this purpose, the notion of Annotated Project Handbooks (APHs) is proposed. An APH is an integrated, time/project phase related document referring both to the technical data (such as those managed by a BIM) but also, and most importantly, to the related contextual and organizational framework, to the pertinent competences required and to the management challenges met during project realization. The basis for the development of an APH is a competence framework (such as that prescribed by the IPMA Competence Baseline - ICB), a project life cycle, a real or fictitious project scenario and the documentation of lessons learned in past projects. An APH is then a neutral (in the sense – no single real project related) resource with the purpose of demonstrating the application of knowledge and skills to practical problems. As such, APHs may be invaluable tools for developing the human resource beyond technical knowledge in order to achieve engineering management competence.

Workshops

Charrettes in Project Management

Wednesday, May 27th at 15:00 in Maistros B

Overview

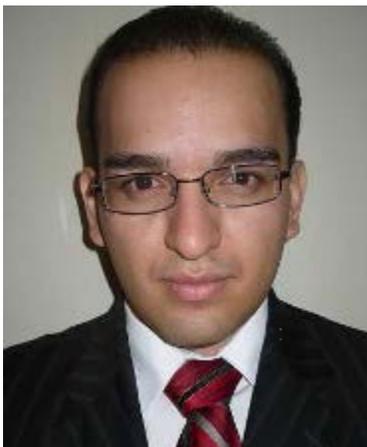
This workshop highlights the correct application of the tool Charrette, in program and project management while explaining how to plan, manage and execute a Real Estate Development program. It is explained using the successful example of Cayalá City, a Guatemalan program that has become the fastest growing city in Central America.

Hosted By Hector Rafael Leal and Victor Hugo Zamora Anderson



successful Cattle trade in Nicaragua, CA.

Hector Rafael Leal graduated as an Industrial Engineer from Lehigh University, USA and obtained his MBA-MAEX from INCAE Business School in Nicaragua, CA. He has over 10 years of experience in the field of Real Estate Development business and currently is the CEO of Grupo Cayalá, responsible for the development of Cayalá City, the first Latin American project to receive the IPMA Silver Award in the Category of Medium and Big Projects in 2014. Before working at Cayalá, Hector was responsible for initiating the largest and most



granted by GPM Global, Gold Medal in the Category of Community Service/Development (Construction), Palladio Award in the category of New Design and construction over 30,000 square feet, 2013.

Victor Hugo Zamora Anderson graduated as an Industrial Engineer and obtained his MBA degree from Francisco Marroquin University, Guatemala City. He majored in Planning and Quality Assurance and graduated with honors from Galileo University. He has a minor in Entrepreneurship obtained from Tulane University, USA. He has over 9 years of experience in Real Estate Development projects and today, he is the first project manager of Cayalá City, the first Latin American project to receive the IPMA Silver Award in the category of Medium to Big Projects in 2014 and several other international awards and recognitions such as: Project of the Year Award Recognition 2014

Visual Management for the Construction of Expo 2015 - Time Location Diagram

Wednesday, May 27th at 15:00 in Ostria

Overview

In large engineering projects it is not always easy to manage complexity and it is even more difficult to have a clear communication with stakeholders who may not have the required technical competencies, such as understanding planning tools like CPM scheduling. Visual Management is an effective way to facilitate this communication. This workshop will show the participants a practical example in the case of complex project of Expo 2015.

Hosted by Ivan Calimani



Ivan Calimani has a master's degree in Building Engineering and Architecture from Politecnico di Milano. He has been the Project Manager at Expo 2015 S.p.A., since 2009. His duties include program/project management, construction supervision and works management, master site programming and detail scheduling, project estimation, budgeting and cost control, coordination with several suppliers, partners and third-parties, institutional and media relationship, tender documents for preparation of bids, design and coordination of the main architectural projects, design and coordinator of the infrastructural system that will be the base of 100 hectares of the Exposition Site (value €270M.)

Project Stakeholders' Role for its Success or Failure

Thursday, May 28th at 13:45 in Maistros B

Overview

Dealing with project stakeholders is an art. Project stakeholders are those people, groups, or organizations that could impact or be impacted by the project. This workshop will guide managers on the successful project stakeholder management to guarantee its success and avoid its failure.

Hosted by Mohamed El Agroudy



Mohamed El Agroudy has decades of experience in construction engineering and management, a Project Management Professional (PMP), a Risk Management Professional (RMP), and an International Arbitrator. El Agroudy has his BSc in civil/construction engineering, a Masters in contracts and a PhD in risk management. He is teaching Contract/Risk Management at the American University in Cairo. He is also the Chairman of one of the leading Facility Management companies in the Middle East. With both his academic and construction industry background, he has practically trained thousands of professionals around the globe and has performed

numerous workshops and keynote speeches in many countries.

An International Workshop on Building Information Modeling (BIM)

Thursday, May 28th at 13:45 in Sirocco

Overview

This workshop will deliver state-of-the-art knowledge on BIM technology and process, its applications in construction via case studies and a demonstration of the BIM software. Specifically, this workshop will provide in-depth knowledge on BIM.

Hosted by Salman Azhar



Dr. Salman Azhar is J.E. Wilborn Endowed Associate Professor and Graduate Program Chair in the McWhorter School of Building Science at Auburn University, Auburn, Alabama. He has 20 years of research, teaching and construction industry experience by working in USA, Hong Kong, Thailand and Pakistan. Dr. Azhar has conducted research on Building Information Modeling, High performance buildings, Sustainable construction, Construction safety and Construction education. His research projects have been funded by the US Department of State, Construction Industry Institute (CII), National Electrical Contractors Association (NECA), the Alabama State Licensing Board for General Contractors, and several construction firms in the Southeast USA. He has written a monograph entitled “Data Warehousing in Construction Organizations: Concepts, Architecture and Implementation”, co-edited nine conference proceedings and published more than 100 papers in refereed journals and conferences. His two research papers received the Best Paper Award at the 48th and 49th Annual Conference of the Associated Schools of Construction held in Birmingham, UK in 2012 and Saint Luis Obispo, CA in 2013 respectively. Dr. Azhar is the Associate Editor of the *International Journal of Construction Education and Research*, USA and Editorial Board Member of *ASCE Journal of Management in Engineering*. Dr. Azhar received the Auburn University’s Outstanding Faculty award in 2012 and Building Science Outstanding Researcher Award in 2011 and 2009, and Excellence in Teaching Award in 2014. Last month, he received the Outstanding Researcher Award at the 51st Annual Conference of Associated Schools of Construction (ASC) at College Station, Texas, USA. This award was given to recognize his outstanding research and publication work within the ASC schools.

Sustainability: Systems, Students, Faculty, Education and Initiatives for the 21st Century

Thursday May 28th at 13:45 in Ostria

Overview

This workshop teaches the most current initiatives involving the USGBC, sustainability opportunities within various institutions, Global Rating systems, acquiring sustainable certifications, getting involved with sustainability at your university, and partnering with others.

Hosted by Erich Connell and Anton P.M. van Bakel



Dr. Erich Connell is an Associate Professor and licensed architect at East Carolina University in the Department of Construction Management. His interest's center on the concepts of sustainability within the built environment and techniques to bring these issues to students in various forms of learning. Dr. Connell has taught sustainability in numerous courses as well as immersive learning study abroad programs to the Netherlands, Germany and China. Prof. Connell introduced Construction Management students to sustainability by forming the inaugural student organization, the Emerging Green Builders, that later evolved into East Carolina's chapter of the USGBC (United States Green Building Council). Prof. Connell is himself a LEED-AP and a Certified Green Builder, and has various certifications from the Building Performance Institute and member of the Center of Sustainability at East Carolina University.



Dr. Anton P.M. van Bakel is a researchworker and CEO of PolySim Ltd. and PolyMetric. He has an educational background in Pedagogics, Cognitive Psychology, Media and Architectural Design and Styles in Design Reasoning. From 2004 until 2010 he has been a Dissemination Technology professor at HAN-University. For 25 years he has been involved in the use of E-Learning, ICT, virtual reality and Social Media in learning and professional processes, with Eindhoven University of Technology, Police, Air Traffic Control and TNO innovation for life in the Netherlands. Anton van Bakel is currently conducting research on sustainable curricula in design and construction management as well as working with Dr. Connell on a 25 year longitudinal research study on Strategic Styles in Architectural Designing and Construction Management.

Complex Construction Projects & Mega Projects:

(Paper 1, ID #26)

Involved Parties and Plan Formats in Equipment Planning for Mega Building Projects

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Abstract

Mega building projects are distinguished by the use of multiple tower cranes that over sail numerous shared work zones at graded heights. This paper aims to provide an answer to the following question: is the process of equipment planning for such projects similar to that of smaller projects? The answer was sought through the investigation of two measures, involvement in planning and issuance of plans, based on case studies of mega building construction sites in Europe. On-site interviews focused on three research variables: project planning stages, planning parties, and plan formats. Main findings were: (1) the number of participating parties was about twice as high as the respective numbers of involved

parties identified in previous studies of regular sites; (2) various functionalities other than the “classic” parties were important players in equipment planning for mega building projects; and (3) the number of different format types used to document the outcome of equipment planning was about six times the respective number found in previous studies for regular projects. These findings indicate that the equipment planning process for mega building projects differs significantly from that conducted for regular projects.

Keywords

Construction, Equipment planning, Mega building projects, Tower cranes

(Paper 2, ID #32)

Comparative Evaluation of Alternative Design Concepts of the “Underwater Road Artery of Thessaloniki” by Using the AHP Multi-Criteria Method

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*Professor of Marine Structures, Department
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Abstract

The large-scale project of “Thessaloniki Underwater Road Artery”, which has been under discussion since the mid-1980s, was intended to bypass the center of Thessaloniki by the side of Thermaic Gulf, and decongest the city center by receiving most of the East-West car traffic. In the present study two alternative design concepts of the above project, proposed in

different periods, are comparatively examined. The first design concept consists of an underwater tunnel across the Thermaic Gulf, whose western end will be at the port area in West Thessaloniki, while the eastern end will be close to the “Makedonia Pallas” hotel, in Central East Thessaloniki. The second concept provides a significant extension of the aforementioned underwater tunnel, combined with an additional long floating bridge which ends up in East Thessaloniki in the district of Kalamaria, functioning as a peripheral ring road. The purpose of this study is to perform a comparative evaluation of these two alternative design concepts, using multi-criteria analysis and specifically the method of Analytic Hierarchy Process (AHP). In the context of this analysis, the hierarchy of the problem is structured, while suitable criteria that concern the main impacts of large-scale road projects are considered. Depending on the extent of their correspondence with these weighted criteria, the two design concepts are evaluated in a systematic way. The design project with the highest ranking is proposed for implementation.

Keywords

Underwater Road Artery, Comparative evaluation, Multi-criteria analysis, Analytic Hierarchy Process, Decision making

(Paper 3, ID #45)

The Development of the Trans-European Transport Network in Greece: A Review and Critique

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Abstract

The construction of modern transport infrastructure in Greece was progressing at a very low pace until the 80's due to the limited availability of financing. The initiation of a large number of projects was only possible in early 90's, as a result of the European Union's decision to develop a Trans-European Transport Network (TEN-T) and to create the European financing instruments to boost it. At the same time, the European Union revitalized Public and Private Partnerships (PPPs) to enable the construction of additional projects. Nowadays, the financial crisis has led to the substantial reduction of public investments and to problems in PPPs advancement, thus limiting considerably the TEN-T progress. In this paper, the TEN-T development in Greece from 1990 to date is critically reviewed in its various aspects and phases: the formation and approval of master plans for each transport mode and the selection of priority projects included therein; the concessions awarded in order to accelerate the programme realization; the procedures employed regarding the legal consents: issuance of expropriations permits, extraction of materials from quarries and borrow pits, archaeological investigations, fauna and flora protection etc.; the project design. Suggestions are made on the way forward to TEN-T completion, taking into consideration the Greek Economy's problems and perspectives.

Keywords

Trans-European Transport Network, Planning, Concessions, Design, Legal Consents.

(Paper 4, ID #78)

Project Control Body of Strategic Knowledge for Complex Construction Projects

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Abstract

To enhance project control in the construction industry of complex projects, it is important to embed knowledge management practice in it. The research question is: The knowledge management serves in improving the management of large and complex construction projects. The objective of this paper is to identify the strategic knowledge which lies underneath the project control workflow. The exploration of the strategic knowledge, will allow focusing on the strategic areas of project control workflow and effectively changing the mechanism ensuring project success. Based on literature review and the objective of this paper, the proposition is, “Scope (value added), quality and budget are the strategic dimensions that can be mapped out in the project control process ensuring that project controllers will focus on those areas, so the project control success can be achieved.” Due to the nature of this research, the scientific ideal implemented is critical realism. This research is conducted based on qualitative method of secondary data analysis on organizational documents. The research strategy is archival research since the author analyzed manuals from two

organizations. Based on the empirical data and analysis, the author accepts that strategic knowledge can be depicted in a diagram. The specific areas in the project control workflow are identified: cost control, planning and scheduling, internal reporting, client reporting and variations/claims. It was found that knowledge management constitutes a basis for the development and management of large and complex construction projects.

Keywords

Knowledge management, Project control, Project success, Complex construction projects

(Paper 5, ID #176)

Big Data in the Construction Project Management

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Abstract

The construction and engineering industry generates vast amount of data defined by dimension and attributes. Construction projects are associated with the collection, processing, and exchange of large amounts of data among the stakeholders. The larger the size of the project, the larger the amount of data associated with the project. To generate information from the data, proper predictive analytics and data visualization tools are required – a practice that is not common. The application of big data in construction helps in decision making, resource efficiency improvements, risk management and reporting, financial and cost management and ideas generation. Big

data can be applied to every aspect of construction including project scheduling, costing and management etc. The resources required for project scheduling are derived from data. Guidelines for incorporating big data into the construction industry are also analyzed. Therefore, big data in the construction industry is a business opportunity that needs to be explored.

Keywords

Big data, Construction, Data Visualization, project management

Construction Monitoring & Control:

(Paper 6, ID #20)

Progress Monitoring of the Construction of Prefabricated Bridge with the Methods of Earned Value Analysis (EVA) and Earned Schedule Analysis (ES)

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Abstract

The methods for monitoring and evaluating the progress of the projects resulted from the need to find ways to monitor and estimate the total cost and the total duration of the project according to the actual progress of activities and not to the original design. These methods can predict the final cost and the total duration, calculating indices using the estimated and actual cost of activities. Two well-known methods for monitoring and evaluating the progress of the projects are the Earned Value Analysis (EVA) and the Earned Schedule Analysis (ES). The Earned Value Analysis, which is the oldest method, is successful in estimating the final cost and generally fails in estimating the total duration. The Earned Schedule Analysis, which is more recent, improves significantly the Earned Value Analysis in estimating the total duration. The two

methodologies are complementary. In this paper the two methods are summarized and are implemented to monitor the construction progress of the C6 Bridge of the Egnatia Motorway. The bridge is located in the section 4.1.2 Panagia-Grevena of Egnatia Motorway. The C6 Bridge is constructed with the method of prefabricated beams and is a twin split carriageway bridge. The total length of each branch is 157,4m.

Keywords

Progress monitoring of the construction, Prefabricated Bridge, Earned value analysis (EVA), Earned schedule analysis (ES)

(Paper 7, ID #22)

Study of a Construction Project in Greece Using Earned Value Analysis and Agile Project Management

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Abstract

In the present work an improvement of the Earned Value Analysis (EVA) method is introduced for the planning and management of technical projects with use of Agile Project Management (APM). Some features of the Agile Project Management and specifically regularly concretely measurements for the reliable recording of changes in the EVA as well as segregation of behavior of various sub-projects of

constructional work are used and examined for their adaptation in construction project management. The method used in this study is recording per sub-project recording of elements EVA per regular time intervals adaptation of time intervals of recording and composition of EVA per every time period. The construction project in which the method is applied is a wastewater treatment plant in Veria Greece. The project consists of the construction of four sedimentation tanks and has 3.5 months duration. The projects work breakdown structure is consisted of the construction of initial sedimentation tank, sedimentation tank and the final sedimentation tanks. EVA figures were produced following the suggested method and were compared with the traditional EVA figures. The method suggested appeared to be better than the traditional method in terms of time of completion and related cost and can be easily implemented to construction project management and is useful for quick and satisfactory results.

Keywords

Agile management, Construction Project Management, Earned Value Analysis

(Paper 8, ID #29)

Implementing IPMA Standards in Managing Small-size/Non-complex Technical Projects: A Case Study of a Photovoltaic Power Plant for a Residence

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Abstract

Two of the most common standards developed by the International Project Management Association (IPMA), one of the largest world-wide project management associations, are the IPMA Competence Baseline (ICB) and the project management baseline (pm baseline). ICB Version 3.0, the standard's last revision, focuses on the detailed presentation of the competences required from project management professionals. It chooses these competences from three ranges: the technical, the behavioral and the contextual range, requiring forty-six elements to describe the competence of a project manager. On the other hand, pm baseline 3.0, the standard's updated version, constitutes a useful manual of relevant knowledge elements, structured by definitions and process descriptions, as well as methods for managing projects, for social competence and for the management of project-oriented organizations. Integrating the above two, or many other standards, as well as common project management body of knowledge and best practices, several project management text books are published, providing instructions for the preparation of handbooks and procedures for handling simple or more complex projects. Such handbooks are used to document all the current project contents related both to the management process and to the project results. Following a similar approach, the paper proposes the structure of a simple project handbook for the design and the construction management of a relative small, low budget and non-complex photovoltaic power plant, based on the IPMA standards.

For that purpose, an actual case study of the installation of a 10 kW, roof-top, photovoltaic system, to be used for domestic exploitation is selected. At first, a brief description of the project is summarized, including general information and basic technical characteristics of the system. Next, the basic project planning documents, in the form of tables or charts, is deployed, taking into account the sequence they follow and the interrelationships between them. Finally, general conclusions and proposals regarding the whole process are stated.

Keywords

IPMA standards, IPMA Competence Baseline, project management baseline, project handbook, photovoltaic system

(Paper 9, ID #41)

Project and Construction Management of Large Warehouses Logistics

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Abstract

The objective of the subject thesis is the application of construction management principles for large logistic warehouses including a case study for the construction management of new facilities for the company “General Commercial” located in the industrial area of Sindos, Thessaloniki in Northern Greece. In modern global markets, the intense competition, forces companies to seek new and improved methods to achieve effective customer service. In recent years companies have become increasingly aware that the effectiveness of their activities

depends largely on the cooperation and coordination with their suppliers as well as with their customers. This coordination role is implemented by the logistics. Therefore, attempts are made to present the concept of logistics, of supply chain and the current trend regarding management. Based on the above, it is evident the importance and the incentives which lead in the construction of large warehouse logistics complex. The construction of a storage center must be an integral part of a comprehensive business plan with clear goals and objectives for the entire supply chain. Therefore, the engineer is called to manage properly the construction of such a project. Following are different steps that the engineer must follow in order to construct large warehouse complexes. Finally, the present thesis discusses some methodologies for monitoring and assessing the progress of works by applying as an example a case study of new facilities constructed in the Industrial Area of Sindos. It is evident that a certain methodology should be applied in order to monitor the progress of a project taking into consideration the initial cost and time estimations. The two methods applied to monitor and estimate the progress of the project which is applied here is the method Earned Value Analysis (EVA) and the method of Earned Schedule (ES).

Keywords

Logistic, supply chain, construction management, project progress, Earned Value Analysis (EVA), Earned Schedule (ES).

(Paper 10, ID #43)

**Intuitive Self-Inspection
Techniques Based on BIM for
Energy-efficient Buildings: EU
Horizon 2020 Research Project
INSITER**

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Abstract

More than 70% of all buildings in the EU nowadays are based on prefab components. The critical mass of energy-efficient buildings in Europe by 2020 can, therefore, be achieved through sustainable building industrialisation. Prefabricated architectural, structural, MEP and HVAC components nowadays are designed and manufactured according to high quality and performance standards. However, realising the targeted performance in design is hampered by critical shortcomings during on-site construction and refurbishment that cause a lower built-quality and sub-optimal energy-saving in the building lifecycle. The INSITER research project within the EU Horizon 2020 Programme aims to eliminate the gaps in quality and energy-performance between design and realisation of buildings with prefabricated components.

The key innovation of INSITER is an intuitive and cost-effective Augmented Reality (AR) system that connects the virtual model based on Building Information Model (BIM) and the physical building in real-time.

The new concept of self-inspection that is performed simultaneously with on-site processes has a strong contrast with the traditional post-inspection approach. INSITER will develop a new methodology and supporting toolset for self-instruction and self-inspection by construction workers, subcontractors, component suppliers, and other stakeholders during on-site working processes.

Keywords

Self-inspection, quality control, performance assessment, energy efficiency, Augmented Reality, Building Information Model

(Paper 11, ID #93)

**A Legal Approach to the
Fédération Internationale des
Ingénieurs Conseils (FIDIC) – The
Yellow Book case**

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Abstract

The purpose of this research paper consists in the presentation of the Transnational Organization FIDIC, headquartered in Geneva, and of the standard contracts that it has established for potential use in the technical works market on international scale. Within the construction industry, standard contract terms are used, being types of contracts that are not shaped by the parties through negotiations. They have been prepared by agencies or contractors represented by associations, for instance engineers associations. As a result, negotiations between the contracting parties are limited to only specific terms of each contract. The understanding and good knowledge of the structure and terms of the construction contract are no longer necessary for all engineers involved in the construction industry. The current paper presents, as a specific case study, the contract model of FIDIC Yellow Book, analyzing the basic concepts of the contract. It puts the stress on the crucial question whether the above-mentioned model is ruled by the contract-law fundamental principle of “bona fide”.

Keywords

Bonafide, Construction Contract, Construction Law, FIDIC, Technical Works, Yellow Book.

(Paper 12, ID #111)

Unmanned Aerial System (UAS) in Construction: Opportunities and Challenges

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Abstract

A plan-reading skill is one of the essential

competencies sought in the construction industry. Most construction management programs in the U.S. provide a blueprint-reading course, where students learn how to read and understand lines and symbols on 2-dimensional (2D) drawings. The essential objective of most blueprint-reading courses is to facilitate students to pick up the skill to read 2D drawings and figure out the look of the objects in 3-dimensional (3D) world. Figuring out the look of the objects in 3D world requires a skill to convert those lines and symbols on 2D drawings into 3D components. In spring 2015, the blueprint-reading class at Texas A&M University was taught differently to test how BIM could help students develop their plan-reading skill. This course was taught in an expedited framework, where students learn all topics in 7 weeks before the spring break started. Teaching how to use BIM tools and instruct students to pick up the plan-reading skill in 7 weeks was challenging, so the Goal Oriented Active Learning (GOAL) pedagogy was used to overcome the challenge. A class project was prepared with the sponsor, for which students read 2D drawings of a dormitory building in the campus, created its 3D model, and produced a short video presenting the configuration of the dormitory using the 3D model. All students successfully created the 3D model of the 5-story dormitory building, and then produced a short video presenting their project. This paper presents how the blueprint-reading course was designed, and how the GOAL pedagogy was working. It also presents some feedbacks from students, and a few lessons learned.

Keywords

UAS, Construction Monitoring

(Paper 13, ID #122)

Factors Causing Construction Delays in Developing Countries: A Focus on Malawi

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Abstract

Delays in the delivery of construction projects remain a major challenge facing construction project managers and the industry as a whole. Delays are also deemed counterproductive to governments' efforts in developing countries to use construction as an engine of economic growth. This paper focuses on factors causing construction delays in developing countries with Malawi as a case study. The main aim of the study was to explore significant factors that cause construction delays. A comprehensive review of relevant literature and an empirical study of public construction projects in Malawi were carried out. The latter was conducted through a cross-sectional questionnaire survey. A response rate of 50.3% was achieved from a sample of 157 potential respondents drawn from contractors, consultants and public client organizations provided by the National Construction Industry Council (NCIC). The findings indicate that the top five significant factors causing delays in Malawi are economic problems, escalation of materials' prices, delayed monthly payments, financial difficulties faced by contractors and lack of materials on the market. Furthermore, the most frequent and severe effects of

construction delay are cost escalation and time overrun. Additionally, there appears to be a skills gap among construction professionals in the management of delays.

Keywords

Construction delay, Developing countries, Malawi, Project management

(Paper 14, ID #129)

On the Use of Learning Curves for the Estimation of Construction Productivity

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Abstract

To account for the skill of construction crew, an ad-hoc coefficient is used as a multiplier of productivity estimations in most available methodologies today. However, little has been published on the determination of this coefficient and, moreover, on the way it is affected by repetition at the same working conditions. As such, research has been undertaken to associate the crew skill coefficient to the learning curve of a specific repetitive activity. Field measurements have been used as the basis to develop statistically sound datasets for subsequent use in simulation-based analysis. Field and simulation results have been compared in order to determine the most appropriate crew skill coefficient. The main conclusions are that the crew skill coefficient is better represented by an

exponential learning curve, and that the accuracy of construction productivity estimation based on learning curves as opposed to empirical ad-hoc coefficients can be improved by 10- 15%.

Keywords

Crew skill coefficient, Learning curve, Productivity, Simulation

(Paper 15, ID #155)

Defining the Key Considerations for Initiating and Implementing 4D BIM Workflows

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Abstract

During recent years, there has been a growing interest in the use of 4D Building Information Models (BIM) to help assist with planning construction projects. The integration of a 3D construction model with the element of time to create 4D models allows the construction process to be visualised, thereby highlighting conflicts and constraints before on site activities commence. Many researchers have evaluated the potential benefits and uses of 4D technologies, yet the process of planning with 4D technologies has not been accepted within the industry on a wide scale. It has been suggested that the use of 4D models is being restricted to the preconstruction phase at the expense of wider integration in projects.

This paper seeks to identify the key considerations for initiating and implementing 4D BIM workflows on a range of projects. To meet this aim, the research adopts a Modified Grounded Theory methodology incorporating long-term participant observations. The research found that 4D is currently used in practice for work winning, communication, validation and to a lesser extent, monitoring progress. Barriers to adopting 4D include a lack of understanding amongst practitioners, training, time and resistance to change.

Keywords

Building Information Modelling (BIM), 4D Technology, Planning, Visualisation, Construction Management

(Paper 16, ID #164)

Factors Impacting of Time and Cost Performance in the Zambian Construction Industry

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Abstract

This research seeks to provide an understanding of factors that contribute to the success and failure of construction projects in Zambia. In particular it focuses on factors impacting on time and cost performance. It is recognized that many studies on this subject have been undertaken focusing on specific countries recognizing the importance of national industry specific characteristics as possible contributors to the differences in the perception of factors that impact on project performance. A focus on the Zambian construction industry was there deemed appropriate as the focus of this

study. The study is based on an online questionnaire survey to construction professionals in the Zambian construction Industry. This enabled capture of required data from a large target audience. The questionnaire was developed after an extensive literature review on factors impacting on project performance. The findings suggest that all the key participants on construction projects, employers, contractors and consultants play a key role in influencing time and cost performance of construction projects in the Zambian construction industry. Factors such as employer financial difficulties, construction project and site management and unethical behavior were perceived to be significant contributors of poor time and cost performance. The study acknowledges the limited literature on the Zambian Construction Industry and in particular issues concerning the performance of projects. Of particular interest in this paper is the comparison of factors between Zambia and that reported about other countries? By taking a Zambian specific analysis of key factors time and cost contributing factors, this study adds to the list of countries which have been investigated.

Keywords

Project Performance, Critical Success Factors, Project management, Zambia.

(Paper 17, ID #180)

Reasons of Incompatibility between Design and Construction in Buildings

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Abstract

In the building construction industry, incompatibilities frequently occur between the design and construction pertaining to architectural details, structural details, materials and quality of construction. The objective of this paper is to identify the major causes of these incompatibilities and in building construction from the viewpoint of the clients, the consultants and the contractors. A questionnaire was utilized as a means of obtaining data. The final questionnaire contained sixty-five potential causes of incompatibilities that were classified into four categories including the design, tendering, construction and the overall project phases. Data were obtained by administering the questionnaire to clients, consultants and contractors and the response rate was excellent (80.6%). Collected data were analyzed, and important causes of incompatibilities were identified. The results substantiate the role of the design phase and the construction phase of a project in the creation of incompatibilities. Results indicate that the provision of incomplete data to designers, lack of interest by approving authorities to carefully check designs, and owner-proposed changes due to financial problems, are among the top three important causes of incompatibilities. The appointment of a designer as consultant, withdrawal of licenses or permits, bankrupting or black-listing of the designer and contractor, the appointment of a contractor as a consultant, and the

nationality of participants, are the least important causes of incompatibilities. This work provides a basis to minimize incompatibilities in building projects to reduce rework and delays.

Keywords

Building Construction, Design

Incompatibility, Construction

Incompatibility, Relative Importance index

Construction Safety & Quality

(Paper 18, ID #25)

Systematic Approach to Crane-Related Near-Miss Analysis

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Abstract

The use of near-miss management systems in construction is relatively new and has not been fully explored or understood. Although the issue has drawn some research attention lately, no efforts appear to have been made to investigate near misses in a systematic perspective and to propose a model that enables to analyze a given set of reported incidents. The research effort reported here suggests a systematic approach to near-miss analysis, and concentrates on tower-crane-related near-miss events. This is due to the centrality of tower cranes in nowadays construction on the one hand, and the potential of tower cranes as hazard generators on construction sites on the other hand. The study began with an extensive effort to collect stories of safety events,

including near misses and accidents. An exploratory research method was then implemented in developing a comprehensive database of crane-related accidents and near-miss events. The database classifies each event using a set of encoded variables that disclose event definition, crane status, activity, main incident factor, and more. The applicability of the database is demonstrated by providing qualified support to the notion of cause communality between accidents and near misses, an issue that has been studied in the context of other industries.

Keywords

Construction, safety, Accidents, Near misses, Tower ceanes.

(Paper 19, ID #70)

Decisions Impacting on the Quality of Low Income Houses in South Africa

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Abstract

At the advent of the democratic dispensation in South Africa, the government embarked on low income housing project to address society ills of the past. The housing project is named Reconstruction and Development Programmes (RDP) after the document that set it up. However, there are problems due to paucity of 'know-how' among contracting parties. A major issue at stake is the quality of delivered houses. Thus, this paper discusses the factors that have engendered

the quality of low income housing in a metropolitan area in South Africa. Visual inspection of housing projects is followed by semi structured interviews, which shows that small and medium sized contractors involved in such housing projects have to avoid the use of unskilled labour, and poor quality materials. It was also apparent from the study that the projects lack proper project management and there was a lack of strategy to improve the quality of houses. The conclusion drawn from the conducted interviews is that contractors must enrol with the relevant low income housing regulatory body; and the public sector client should verify that indeed the contractor is enrolled with the body in order to assure the quality of work that meet the expectations of eventual occupants. This research recommends that it is important that project managers involved in the management of RDP housing projects have the necessary skills and level of education to execute their duties. Furthermore, the Department of Human Settlements (DHS) in South Africa should ensure that relevant oversight and policy implementation, which impact on good practices and conformance to standards, take place.

Keywords

Contractors, Low income housing, Quality, South Africa

(Paper 20, ID #96)

Behavior-Based Safety Management on Construction Sites- A Field Study

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Abstract

Any Behavior-based Study is the application of science of behavioral change to real problems. It focuses on what people do, analyze why they do it, and then applies a research- supported intervention strategy to improve what people do. The national safety council reports that human behavior is the cause of 94% of all injuries and illness. Observation at site Behavior-based Safety (BBS) process depends on site observations including individual feedback, which is the most effective act in the BBS process. The observer meets the worker at site and introduces himself and the job he is performing. The objective of this paper is to document various steps of the BBS process while it is being implemented on a pilot project. Steps of a typical BBS are: (i) Study of company documents (ii) Review of safety meetings (iii) Feedback from employees (iv) Development of Critical Behavior Inventory (iv) Choice of study design (v) Intervention (vi) Safety manual (vii) Site selection (viii) Actual study implementation (ix) Data analysis and interpretation (x) Conclusion and merger into the system. The aim of this paper is to study and investigate the procedures that construction companies use to implement behavior based safety and highlight potential problems faced by them. This paper concludes that it is possible to achieve improvement in worker behaviors by using a simple safety checklist and rating system. More importantly it has demonstrated that the workers began to show better ratings after being introduced to the program and provided with feedback on their safety performance.

Keywords

Safety, Behavior Based Study

(Paper 21, ID #130)

**Construction as Biological Cells:
Can Construction Cells be similar
to Biological Cells?**

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Abstract

The premise that construction cells can be similar to biological cells is examined through a *metaphorical approach* with a view to generating new insights on how to manage construction given the amazing accuracy of the cell replication process. Evidence is presented to justify the use of the metaphorical approach. Although learning from nature has resulted in many innovations, it is noted that such applications in construction management studies seems far and few. Nevertheless, a successful exploration of chaos theory is presented as a further justification and in support of the metaphorical approach including how metaphor can be used for building theory in construction management. Biological cell properties are synthesised with the following concepts explored: the cell, the embedded design, and rate of cell proliferation providing evidence through a case study to justify the metaphorical assertion ‘construction as biological cells’. It is professed that with further work, it may be possible to lay the foundations for a theory on the management of cells in construction.

Keywords

Cell, Design, Metaphor, Rate of Build, Theory building

(Paper 22, ID #131)

**Construction as Biological Cells:
Implications of the Biological Cell
Cycle for Managing Construction**

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Abstract

The concept of a *cell* as a unit of construction is advanced exploring the notion of *construction as biological cells* metaphorically, inspired by the striking similarity of a biological cell as a building block of a multicellular organism with the hope of finding new ways of solving perennial construction problems given also that many have benefitted by learning from nature. As biological cells procreate through cell division, it follows a unique cyclic process with an astonishingly error-free cell division process despite the complexity of the process. This cyclic process consists of four phases with three checkpoints including a forced rest state. A critical incident with a quality problem was selected in order to examine the relevance of the biological cell cycle. Study finds that checkpoints at mobilisation and completion are invaluable. Results suggest there is potential for further exploration of the cell cycle to establish its value, reliability, and validity with the hope of developing a suitable cell cycle control mechanism for construction including the form and nature of the *embedded design* and *cell control checkpoints*.

Keywords

Biological cell cycle, bio mimicry, cell, cellular construction, metaphor

(Paper 23, ID #140)

Incorporating Safety in Construction Contracts- The Experience from a Developing Country

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Abstract

Construction has long been considered as a hazardous industry comprising of wide range of activities involving construction, alteration, and/or repair. During execution workers are exposed to various risks that pose health hazards and lead to several occupational injuries and diseases. Various measures have been implemented from time to time to reduce these risks in construction activities; one of these measures is the inclusion of safety related clauses in contracts. The purpose of this study is to assemble, develop and promote the effective incorporation of safety in construction contracts. The intent is to identify practices and procedures currently used in the local construction industry to fulfill the safety requirements in contract documentation. Another objective is to identify the frequency and severity of contract issues relative to worker safety on construction

sites and to work out a strategy to improve site safety conditions through contractual modifications. A questionnaire was designed and conducted from construction safety professionals and project managers from contractors' side operating in the Pakistani construction industry. After qualitative data analysis, most common contract safety issue faced by Pakistani construction industry is lack of construction safety education, and lack of understanding of the safety procedural aspects of the contract safety clauses. The authors believe that with the incorporation of relevant safety clauses of the general condition of contract, tailor fit special conditions of contract must be included in the contract, so as to legally and ethically bind all parties towards improving safety performance of their construction projects.

Keywords

Safety clauses, construction contracts, general conditions of contract, special conditions

(Paper 24, ID #177)

Security in Building Constructions: European Policies for Built Infrastructure Protection

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Abstract

The security goal is expressed in the EU Internal Security strategy in Action. Every physical asset, public or private building infrastructures are potential targets for terrorist threat and can also be damaged by accidents. Their protection starts from the resistance and robustness of the physical structure itself, so that if security measures fail, catastrophic consequences can be contained. The EU policies are strengthening the efforts for standardization and harmonization for the security in all the infrastructures. The construction sector is crucial for the European economy. Construction represents a key component in the quality of life of citizens, as they spend a considerable amount of time in buildings. Under the presence of natural and man-made hazards, citizens' welfare depends on the performance of the structures that surround them. The availability of Eurocodes and European standards in buildings infrastructures are a starting condition for risk reduction and harmonization. Although the building infrastructures are not by themselves ECI therefore constitute a key element of all the sectors and subsectors of the two main categories of ECI of the European Council Directive 2008/114/EC. The threat from terrorism and man-made hazards are usually considered as a priority for critical infrastructure, however protection of them should be based on an all-hazards approach. In support of EU efforts to protect critical infrastructures, the European Commission has launched the European Programme for Critical Infrastructure Protection (EPCIP) in order to reduce the vulnerabilities of critical infrastructures as well as the European Reference Network for Critical Infrastructure Protection (ERNICIP) in order to provide a framework within which experimental facilities and laboratories will share knowledge and expertise for

harmonizing test protocols throughout Europe, leading to better protection of critical infrastructures against all types of threats and hazards. Among others are including the issues of resistance of structures in explosive effects. The integrity of critical infrastructures and their reliable operation are vital for the well-being of the citizens and the functioning of the European economy.

Keywords

Security, Safety, Building Constructions, Critical Infrastructures Protection, natural disasters, terrorist actions, vulnerabilities, explosions, European Policies, Standardization, Harmonization, ECI, EPCIP, ERNCIP, JRC.

Cost & Financial Management

(Paper 25, ID #19)

Determining the Most Economical Formwork System, A Contractor's Perspective

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Abstract

This article discusses the steps involved when a contractor must decide the most economical formwork system for the reinforced concrete project at hand. The decision begins with a basic form design scenario and then economics are introduced that allows the contractor to make a final decision. Factors involved with the final decision are the cost of the labor and equipment for each type of form and the number of reuses that the forms will experience. Three form types will be used for this analysis. The engineering calculations will not be shared as this would take up too much precious paper space.

The costs used are from the state of California. This paper will illustrate that with temporary structures, there are often different "correct" solutions. However, without a detailed analysis, one cannot make an educated decision. Then, even the final decision cannot be validated as only one option is used. Three contractors were interviewed for the production rates and scenario circumstances. The labor production units are an average of these three companies and the names are protected.

This analysis uses a 200' x 80' concrete structure with a single center wall in the middle. The walls are 18 feet tall and all three formwork types will use the same structure and number of wall placements. This paper will only analyze the form system's material costs, labor and equipment costs, and fabrication costs. It is assumed that the placement and dry finish costs are relatively the same.

Keywords

Concrete, Formwork, Formwork Estimating, Formwork Design

(Paper 26, ID #24)

Towards the Reduction of the Construction Time and Cost of Reinforced Concrete Earthquake- Resistant Multistory Buildings

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Abstract

The purpose of the present research is the reduction of the construction time in the structural system of a tall concrete building with the higher goal of reducing the time required for the construction of the whole project. This reduction can be achieved mainly through removing the beams of a multi-story building (flat slab) and through

using modern science achievements in the field of materials (concretes with high manifestation of their strength). The time required for the construction of one floor is about 4 days. In this way it is easy to improve the economy, the functionality and the aesthetics of the final project without losing any earthquake protection. Thus, reinforcement concrete can be used in buildings' projects where the speed of the construction process is of a high priority. Steel is no more the only alternative solution in such cases. The owner and the contractor of the project can both be benefited by using these techniques for many reasons. The reduction of the construction time can affect the cost of the project by reducing it, while the earlier completion of the whole project offers important advantages.

Keywords

Reduction of the construction time, tall concrete buildings, flat slab, time management

(Paper 27, ID #35)

Preliminary Cost Estimate Model for Road Underpasses

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Abstract

In the early phases of a project, the limited availability of information increases the difficulty of reaching accurate cost estimates. Preliminary cost estimates are essential to the decision makers for go/not go decisions, budget determination and capital allocation; they eventually determine the projects' success, since they form the reference level for the actual construction cost to be compared against. Public clients aim at avoiding budget overruns in infrastructure projects, in order for them to reach high profitability rates and significant rates of return. The construction of modern high-speed motorways is constantly increasing. Underpasses present low construction cost elements when examined individually as their scale is relatively small e.g. as compared to bridges, however, each motorway includes a large number of them. As a result, their total construction cost becomes significant for the project. This paper presents a preliminary cost estimate model for underpasses exploiting limited data. The model produces quantity estimates based on preliminary design data and by applying the proper resource unit prices leads to cost estimates. Actual construction data were used to verify the credibility of the quantity estimates proving that the model produces reliable cost estimates and constitutes a valuable tool for the decision makers.

Keywords

Underpasses, Motorways, Cost Estimation, Regression Analysis

(Paper 28, ID #46)

Planning, Designing and Scheduling New Transport Infrastructure In Recession Times: The Greek Case

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Abstract

The recent financial crisis in Europe has led the economies of many countries at its periphery into recession, which results in tight budgetary constraints and large reduction of public investment in infrastructure. It is therefore imperative for the State Decision Makers and Public Clients in these countries to review their approach, attitude and policy and compromise the planning, designing and scheduling of new infrastructure projects to the stringent reality of today's and to the fuzzy future of tomorrow. In this paper, the authors discuss critically the current approach to planning, designing and scheduling of infrastructure projects in Greece, i.e. in an economy being in recession for six consecutive years. A

number of transport infrastructure projects under tendering or construction are presented and analyzed; these include urban express roads, urban development projects, cruise port, metropolitan rail and airport. The authors review the methodologies and practices implemented worldwide in similar infrastructure development to reduce the required investment, i.e. to tackle capital scarcity, and present on that basis more economical technical solutions for each of the above projects. Finally, the authors develop recommendations regarding the necessary policy and good practices that the Greek State and Public Clients should implement during recession times.

Keywords

Transport Infrastructure, Transport Planning, Infrastructure Design, Recession

(Paper 29, ID #54)

Technical and Economical Management of the Reconstruction of the Bearing Structure of an Existing Arcade in the City Centre of Thessaloniki

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Abstract

This paper deals with the economic and technical management of the construction of the bearing structure of the arcade Hirsch. Initially, the technical description of the work is presented which is of particular

interest because in this project geotechnical engineering issues, buildings' underpinning issues, conservation aspects and issues of strengthening of the bearing structure constructed by reinforced concrete and adding of floors constructed by a mixed metal body, were combined, which made the project unique. Then the estimate of quantities of work is presented and on this basis the budget of the project is calculated. The schedule of the project comes after as it was originally estimated and as it was finally formed after significant delays due primarily to the discovery of archaeological finds in the Tsimiski part during the embedment of the piles of Berliner Wall. As a result, works on the part of Tsimiski were ceased for six months. The archaeological discoveries apart from the delays they caused had as a result significant changes in the static and dynamic analysis of the project. In addition, an estimate of the machinery used is quoted. Finally, there is a presentation of the project from an architectural standpoint.

Keywords

Hirsch, technical, management, bearing, structure

(Paper 30, ID #62)

Stochastic Preliminary Budget Estimating Template for Construction Firms

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Abstract

In the construction industry, cost is proved to be one of the most important boundaries for many projects, and it is what defines their future. However, although proper estimation is crucial, it requires significant time and resources in order to be accurate. A quick preliminary estimation can be useful, mostly during the initial stages, for a company to decide whether it should go after a project, but in most cases it is based on human experience and rough assumptions. This paper presents an easy method of preliminary budget estimation which can be developed for, almost, any type of construction project, using MS Excel and @RISK. Using as the only input the area of the project, and selecting the pre-defined values expressing the intensity of the main Trades involved, we can estimate the project cost while achieving more than 80% accuracy. The main advantages of the presented template are its simplicity, flexibility, low cost and the relevant accuracy it achieves by using market prices. The paper presents step by step the development process of the template, analyzes its philosophy and discusses the main points through a real life case study from the US market.

Keywords

Stochastic Budgeting, Estimating Template, Preliminary Budget, Construction Estimating

(Paper 31, ID #63)

Cost Leader in Change Order for Franchise Hotel Construction

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Abstract

Hotel projects are often planned and constructed on very tight budgets and schedules to meet an opening date for a seasonal tourist attraction such as a town with a prominent college football team. The fast pace of development and construction usually leads to multiple change orders. Reducing the frequency of change orders enables the project to be completed on schedule and budget. This is very important since a hotel business has a high initial capital and operating costs. The hotel projects reviewed for this research have guestrooms between 60 and 95. This study collected and analyzed over 24 General Contractor (GC) pay requests of projects completed in the past 10 years to identify construction related events that led to change order. Owners, Design Professionals and Contractors will benefit from the information by focusing pre-construction planning on CSI division that is a cost leader in change order during construction of this building type. In most cases the faster pace of planning and construction required for a hotel project result in adoption of standard specifications and/or "boiler plate" detail drawings from past hotel projects which results in higher number of change order.

Keywords

Change Orders; Hotels; Construction Management

(Paper 32, ID #108)

Resource Allocation in Line-of-Balance Scheduling

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Abstract

The Line of Balance (LOB) is a scheduling technique for managing work flow in projects with repetitive characteristics. The objective of this study is to develop optimal resource allocation solutions in such projects using the LOB technique. The resource allocation process leads to a combinatorial optimization problem with multiple and partially contradictory objectives, i.e, confinement of the daily resource usage within resource availability, project completion within a given deadline (or as soon as possible), and making the resource diagram as smooth as possible. The proposed model aims to concurrently optimize all the above sub goals depending on their relative importance (multi-objective resource-constrained scheduling). Due to the size of the solution space, a genetic algorithm has been employed to perform the optimization. The model has been applied to a pipeline project and tested under several constraint and sub goal scenarios. The evaluation has indicated the ability of the model to provide reasonable and targeted solutions in response to given priorities and constraints. In conclusion, the LOB technique can be effectively used for

optimal resource allocation in repetitive projects.

Keywords

Line-of-balance, resource allocation, optimization, genetic algorithms, repetitive projects

(Paper 33, ID #112)

Cost Analysis and Material Consumption of Highway Bridge Underpasses

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Abstract

The paper presents the total cost and cost distribution for the construction of reinforced concrete bridge underpasses. The required material quantities of concrete, reinforcing steel, earthworks (excavation, soil improvement layer and backfilling), waterproofing works, joint formation and drainage system from 34 close box section and slab frame underpasses from recent highway projects in Greece, are statistically processed.

An easy to apply cost estimating procedure for underpass bridges is proposed to assist stakeholders in the bridge construction

industry when choosing the most cost effective design solution in order to reduce the risk of failure and loss of funding. In addition, accurate cost estimates give the project owner the capability to support funding applications from National and European sources.

Keywords

Bridges, Cost Estimate, Material Quantities

(Paper 34, ID #115)

Financial Analysis and Comparison of Greek Construction Enterprises and Greek Materials Procurement Enterprises

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Abstract

This paper aims to present the financial status of companies in the Greek construction industry during the economic crisis as well as their effort in tackling the emerging issues. In order for that to be achieved, a financial analysis was conducted, based on the calculation of financial ratios. The selected enterprises for examination included four from the construction industry and four from the construction materials' industry. The examined ratios included: current ratio, quick ratio, return on net worth, net profit margin, gross profit margin and ratio of owners' equity to total liabilities. The ratios

were calculated for the years 2008 to 2011 on a quarterly basis. A significant problem the construction sector faces is liquidity due to the delay in obtaining revenues regarding the construction projects. Moreover, because of the high expenditure of related projects and due to the considerable cash discounts on tender offers in auctions, the profit margins decrease. On the other hand, the upward trend of the ratio of owners' equity to total liabilities illustrates that companies try to rely on their own funds and not on loans.

Keywords

Financial Analysis, Greek Construction Companies, Financial Ratios, Construction Material Enterprises

(Paper 35, ID #153)

Are Adopting 'Modern Methods' of Construction a Suitable and Efficient Way of Delivering Client Budgets?

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Abstract

The objective for this study is to ascertain whether modern methods of construction are delivering cost effective client budgets. The study ascertains from a literature search the identification of modern methods of construction and the influence on overall project costs.

Research was undertaken; with the research methodology used being a qualitative

method utilizing structured interviews. The interviews were carried out with seven high profile United Kingdom (UK) construction professionals with ranging levels of experience to address this question.

The results of both the literature review and interviews highlighted the difficulty with classification and inclusion of construction techniques within the term 'modern methods of construction'. Construction professionals describe the reduced on-site programme as the main benefit of using modern methods with quality of the products as the second. It was apparent through the interviews the little involvement a quantity surveyor has with regard to choosing a method of construction and earlier collaboration of the architect and quantity surveyor would create more cost effective projects for clients.

Overall, the research indicated that construction costs are very project specific, with modern methods of construction seen as cost neutral compared to traditional construction methods. However larger projects and high rise buildings provide better cost incentives to use modern methods. Those interviewed felt that cost was not a reason for the perceived slow uptake of modern methods of construction in the UK, with the overriding reason for not choosing modern methods of construction being the client's familiarity, and hence preference for, traditional methods of construction.

Keywords

Modern Methods of Construction, traditional construction, project budgets, cost savings

Information Systems

(Paper 36, ID #28)

A Relational Database for Construction Delay

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Abstract

Construction projects are open to risks due to their multi-partied, environmentally dependent and complex nature. Unexpected situations generally lead to delays resulting considerable time and money losses. This makes delay and delay analysis to be the core subject matter during execution of construction projects. Therefore project participants should not only be focused on project control but also be able to clarify some project specific issues at the planning stage. At this point, past project data may be used to learn from previous projects and to take preventive actions in order to minimize delays. This study presents a relational database established to keep post project information about delays and to use the information for similar type of projects. The database may enable the user to access valuable information such as; most critical activities and parties in a specific kind of project, average cost and duration of the delay for that project, information on claim

processes for delays, probable dispute issues, etc. In the literature, there exist some notable studies related to the use of computer support in delay and claim analysis; however easily accessible and manageable nature of the created database constitutes the originality of this study.

Keywords

Construction delay, Database, Delay analysis, Learning, Relational database

(Paper 37, ID #58)

Automated Data Collection Technology Usage by UK Construction

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Abstract

Recently, Information and Communication Technology (ICT) has received a great deal of attention and some solutions have been developed to assist the management activities throughout various industries. One of the current significant issues involved with ICT is Automated Data Collection (ADC) technology that also known as Automated Data Capture; the use of which

has grown in recent years. However, little attention has been paid to the issues regarding the adoption and implementation of these technologies. This paper investigates the current state of ADC technology usage in the UK construction, and identifies reasons why construction industry in the UK is a late adopter of ADC technologies. Key factors are identified as barriers from literature review for adoption of ADC technology in construction, and validated through an online questionnaire survey. According to the results, process related factors play an essential role in adopting ADC technologies in the UK construction industry.

Keywords

Automated Data Collection (ADC) technologies, UK construction industry

(Paper 38, ID #61)

Using Building Information Modeling to Achieve Lean Principles by Improving Efficiency of Work Teams

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Abstract

Both of Building Information Modeling (BIM) and Lean construction have significant impacts on construction industry. It is widely accepted that BIM can be used as a tool to help reduce project cost, shorten project duration by optimizing the construction sequence, improving the

coordination of project teams, providing communication platform for different disciplines and so on. A further exploration can be made to find whether BIM can be used as a tool to help project team to achieve the Lean Principles. In this research, a hypothesis was developed to validate if BIM can be used as a tool to achieve the principles of Lean construction by improving the construction productivity of a project. Several metrics were investigated to measure the contributions of BIM towards project productivity. By analyzing a case study, this paper explores the connection between BIM and Lean construction, the contribution of BIM in the development of coordination and collaboration of work teams, project quality, and reduction of waste and cost.

Keywords

Building Information Modeling, Construction Management, Lean Construction

(Paper 39, ID #149)

Benchmarking of IT based Tools for Site Security, Safety and Communication on Construction Worksites in a Metropolitan City of a Developing Country

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Abstract

In this modern era of Information Technology (IT), a number of applications of IT can be found easily in almost every sector, the significance of IT also emerges in construction sector as well. Where different contractors shown their tendency to employ the latest technology as well as to equipped them efficiently; enhancing the safety, security and the process of communication on the construction worksites. Pakistan as a developing country, is trailing behind in the field of technology. This study starts with the literature review which assists in listing of key IT based tools. This research is carried out in order to assess the usage on the basis of three subject domains i.e., site safety, site security and communication on worksites. The other part of this study is targeted to assess the impact of IT tools on overall work productivity, on cost effectiveness, availability of tools on worksites and to identify the level of skill required by the workers in using IT Tools. A structured questionnaire is designed and used for data collection purpose. A total of 13 questionnaires were filled on the basis of site based interviews and site observations. A 5-point scale is used in this questionnaire to get the respondents response. This study concluded that due to the global economic competition, construction firms are beginning to adopt IT tools and explore different possible options for improving the delivery of their products and services. It is recommended to initiate programs in local sector to create awareness regarding different IT tools helping in all the three subject categories; safety, communications, site security.

Keywords

Information Technology, Tools, Site Security, Site Safety, Communication

Innovation

(Paper 40, ID #2)

Developing a Personal Cooling System (PCS) for Construction Workers – An Experimental Approach

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Abstract

Heat stress, a potential occupational hazard, can reduce work productivity, increase incident rate, and induce heat illness. Construction workers often undertake outdoor work and sometimes work in the confined working space with poor ventilation. Working in these settings during summer puts workers in a vulnerable condition and exposes them to a high risk of heat related incidents. Personal cooling systems which lessen the risk of heat related injuries are commonly used in sports and military. However, their applicability and effectiveness in the construction industry

has not yet been evaluated. This paper presents an overall research framework for developing a PCS for combating heat stress in the construction industry. The framework includes content analysis, semi-structured interview, PCS design, laboratory test, field study, and focus group meeting. Quantitative and qualitative research methods applied in conducting the research study will be discussed in this paper. Although this study applies specifically to the construction industry, similar research framework could be applied to other occupations as well which require routine exposure to extreme temperature conditions.

Keywords

Heat stress, Personal cooling systems, Construction

(Paper 41, ID #21)

Digital DIY: EDFAB project

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Abstract

The widespread availability of automated fabrication tools is rising dramatically. Entry-level CNC routers, robotics and 3D printers can be cost effective machinery for

small to medium sized enterprises to implement. The demand to reduce housing costs and to increase resilience and quality within the construction industry will lead to a dramatic change in how we build in the years to come. Today, one extreme of housing design remains defined by prefabrication, mass-produced ‘off the shelf’ materials and processes. At the other extreme, bespoke housing still requires designers to hire specialist consultants and tradespeople to calculate, engineer and manufacture custom made building elements, resulting in outcomes that are not always cost effective.

In this paper we outline EDFAB: eco – digital fabrication research project, with the aim to challenge conventional processes and relationships and propose a radically new but viable design and building alternative. To achieve these aims, the project is developing a system that introduces process and product innovation. It combines enhanced construction technologies, new attitudes towards materials and digital fabrication methods to produce distinctive, high quality, healthier and cost effective residential buildings that conform to the international housing standard. The paper discusses the specific contribution to the project from the different involved research areas – building technology, architecture and digital fabrication technologies - and presents the early results towards a ‘do it yourself’ (DIY) 10m² prototype domestic scale ‘sleep out’, designed and built using CNC routers and novel plywood construction methods that produce a kit-of-parts that are very easy to handle.

Keywords

Digital Fabrication, Prefabrication, Housing, Mass Customization

(Paper 42, ID #53)

Development of Bio-based Self-healing Concrete to Increase Durability of Structures

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Abstract

Concrete design at serviceability limit state indicates allowable crack widths for different environmental classes to ensure that functionality and durability of the structure are not affected. However, in practice these crack width limits are often exceeded and repair is needed. The innovative technology of self-healing concrete allows the concrete to be self-repaired by closing the micro-cracks and reduces the repair costs by preventing human intervention. In bio-based self-healing concrete, the alkaliphilic bacteria that are embedded in the material fill the open cracks by precipitating calcium carbonate (CaCO₃). Consequently, crack sealing is improved and the structure is less susceptible to deleterious liquids and gasses. In the current study, material

characterization tests confirm that the bio-based healing agent does not harm the properties of either fresh or hardened mortar. In addition, crack permeability tests on mortar prisms verify the material's enhanced sealing performance. Therefore, the bio-based self-healing concrete appears promising for improving crack sealing performance and decreasing durability-related risks without influencing negatively the material's properties.

Keywords

Self-healing, Bio-based mortar, Micro-cracking, Light weight aggregates, Liquid-tightness recovery

(Paper 43, ID #67)

Analysis of Flexible Pavement Materials with Image Analyzer

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Abstract

Future demand to study and understand properties of flexible pavement materials to enhance its performance and durability and to increase its life is huge. Keeping these points in mind, this study presents the work to assess the distribution of asphalt in different types of asphalt concrete using image analysis software. A total of 12 cores obtained from different area and having different composition, comprising of 48 slices and 72 images were analysed with a computer image analyser to ascertain distribution of aggregates and asphalt.

Finally study is made of variations between aggregates/ asphalt ratio with unit weight of slice to investigate a relation. There was, however no valid relation between these values which can tend to a strong conclusion except technique used for the study is easy, time saving and do not need high skill. This matter can be further investigated with computer software which can possibly analyse the images and can extract true area of different colours from images. As the result image analysis technique for different types asphalt mixes including one with vegetable oil were almost same, therefore in this work it is concluded that there will be less effect on physical properties of asphalt mixtures prepared with some amount of vegetable oil.

Keywords

Asphalt, Asphalt Concrete, Cores, Image Analysis Software, Aggregates Bitumen ratio, Unit Weight, vegetable oil.

(Paper 44, ID #106)

Composite Materials - CFRP - Applications in construction – Suggesting new applications

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Abstract

The need for better product and material performance leads to continuous improvements in the field of composite materials. Especially advanced fibers, resins and cores, as well as new methods of weaving were developed and implemented for the better production of the materials that have exceptional mechanical performance and were considered as extraordinary a few

decades ago. Those improved composite materials were used in many industry and engineering fields such as aerospace, car manufacturing, energy and construction. Their use was also expanded in general creative activities and sports industry. It is derived that where there was need for materials of very low weight and high mechanical performance, the aforementioned posed as an ideal solution. The object of the research was the categorization of reinforced polymers, emphasizing on the composite materials and the use of Carbon Fiber Reinforced Polymers in the field of construction. New uses of the CFRP were suggested on a theoretical basis as a result of the research. The goal of the research was to review these materials that are considered as one of the biggest innovations of the 20th century and moreover to suggest an innovative approach so as to restimulate their implementation in the Greek construction industry.

Keywords

Composite materials, polymers, fibers, resins, Carbon Fiber Reinforced Polymers.

(Paper 45, ID #128)

The Structural Behavior of Pozzolan-Lime Cement as a Potential Substitute to Portland Cement in Low-Strength Construction Applications

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Abstract

Construction materials constitute a significant component of construction cost. Portland cement is one of the costly materials used even in applications that do not require its high strength grades. The use of alternative materials such as pozzolan-lime cement that can substitute or supplement Portland cement to reduce the cost is hindered by limited information on their performance and cost-saving benefits. This research examined the structural behavior of natural pozzolans mixed with lime as a potential substitute to Portland cement in low-strength construction applications. The research approach was experimental. Trial mixes were prepared for different pozzolan particle sizes, and different pozzolan contents. Strength development was monitored over a period of ninety days and compressive strength tests performed at 7 days, 28 days and 90 days. The optimum pozzolan content that gave peak compressive strength development was predicted to be between 54% and 60% irrespective of the pozzolan particle size. Similarly, the most consistent effect was established with predominant pozzolan particle size of at least 125 μ m. The peak compressive strength values attained from the pozzolan-lime system are adequate for many low-strength applications but can be enhanced by addition of small quantities of Portland cement.

Keywords

Natural Pozzolan, Pozzolan-lime Cement

(Paper 46, ID #159)

Designing a Test Battery for Ergonomics of Personal Cooling Garments

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Abstract

Personal cooling garments (PCGs) are effective in helping wearers combat heat stress. However, ergonomics problems of PCGs have received little research attention so far. Along with the increasing application of personal protective devices in the construction industry, the interaction and their suitability between human and these devices have been emphasized by manufacturers and end-users. Hence, a key comprehensive ergonomic assessment of PCGs should be launched before wider application in industrial settings can be realized. As there is lacking of standard ergonomic test practice on PCGs, this study proposes a test battery for the ergonomic evaluation on PCGs. The proposed experimental design includes two major procedures: 1) identifying wearing conditions of construction workers with PCGs, and 2) executing both subjective and objective measurements on human factors. This protocol will provide solid guidelines to researchers and practitioners for the comprehensive evaluation of the ergonomic design of PCGs.

Keywords

Ergonomics, Personal cooling garment, Wearing condition, Subjective and objective assessment

International Construction **Issues**

(Paper 47, ID #5)

Women in Saudi Arabia Construction Industry: Motivations, Barriers and Perceptions

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Abstract

The economy of the Kingdom of Saudi Arabia has been relying on oil for a long period of time. However, with the recent global recession and political instability across the Middle East, the need for economic diversification has become urgent. Recently, the construction industry has been identified by policy makers and the government as a major sector for investment to minimise over reliance on oil. Interest in construction has led to a considerable number of construction projects all over the Kingdom of Saudi Arabia. This has translated into a demand in highly skilled professionals and labourers to effectively work and deliver the construction projects. Thus, the number of skilled males and male labourers who for generations have dominated the Saudi construction industry has been unable to fill the skill and labour gaps required by construction firms. The key question is: can women contribute in filling

the skill and labour gaps in the Saudi construction industry? As part of an undergraduate degree dissertation, this study investigates the challenges faced by women in a career in the construction industry in Saudi Arabia. To achieve this aim, a mixed research method consisting of exploratory, case study, qualitative and quantitative research has been used. Three main findings have emerged from this study. Firstly, parental influences are the main motivation for students to enter the construction industry. Secondly, cultural issues involving male and female stereotypes are the main challenges for women in the Saudi construction industry. Thirdly, it also emerged that a major barrier is the segregation between men and women in the society which to a certain extent discourages women to proactively seek jobs in the construction industry.

Keywords

Barriers, construction, Kingdom of Saudi Arabia, women

(Paper 48, ID #30)

The Use of Project Scheduling Techniques in the UAE Construction Industry

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Abstract

Since the 1950's, the use of project scheduling tools and techniques has grown, and continues to grow, at a rapid pace with the increasing challenges and risks each day. The construction industry is viewed as one of the largest industries in the United Arab Emirates (UAE), yet no clear statistics have traced the use of scheduling tools and techniques in UAE construction projects. The main objective of this paper is to evaluate the application of project scheduling tools and techniques in the UAE construction industry in terms of the use, benefits and barriers. The study was conducted over a sample of 45 respondents. The study shows that the mainly used technique in the UAE construction industry is the Critical Path Method (CPM). The main identified scheduling tools are Microsoft Project and Primavera P3. The results indicate that the scheduling tools and techniques are applied 50-75% of the time mainly due to company requirements and contract requirements. The main identified benefits of using project scheduling tools and techniques in the UAE construction industry include recovering cost and time overruns and meeting tight deadlines. On the other hand, the main identified barriers discouraging the proper implementation involve insufficient training for employees and lack of knowledge about the project scheduling tools and techniques.

Keywords

Project scheduling, Tools and Techniques, Construction Industry, United Arab Emirates

(Paper 49, ID #31)

External Factors Affecting the Success of International Companies in the UAE Construction Industry

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Abstract

In addition to the inherent complexity of the construction business, international projects are even more complicated due to conditions such as different political and legal matters. International projects are difficult to manage as the risks are higher and less predictable. Many international firms set their eyes on Dubai and the United Arab Emirates (UAE) as a way to mitigate the effects of the financial problems in their home countries. The UAE construction market is currently at the age of growth and prosperity. The objective of this paper is to determine, weight, and rank external factors that contribute to success of an international construction company in the UAE. Success factors can be divided into two broad groups: internal & external. Internal factors are those that are firm-specific while external factors are country specific. External success factors were identified through literature review and interviews with industry practitioners. The importance (weight) of these factors was calculated using the Analytic Hierarchy Process (AHP) based on a survey of 31 professionals. The external factors are divided into four categories including financial, economic, political and cultural & social factors. Each

category includes a set of four success factors. The results indicate that financial factors are the most important category with a weight of 0.444 followed by economic factors (0.265), political factors (0.176) and cultural & social factors (0.115). The top five factors include owners' financial strength, tax incentives, access to cheap labor, positive market characteristics and ease of import/export.

Keywords

Success factors, International Construction, United Arab Emirates

(Paper 50, ID #132)

An Experimental Investigation of the Effect of Carbonation on Properties of Plain Concrete

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Abstract

This study deals with the effect of carbonation on the mechanical properties such as compressive strength, modulus of elasticity and durability like depth of carbonation and porosity of the concrete using ordinary Portland cement over a time period of up to 120 days. To study the behavior of carbonation front of concrete in presence of varying water content, water binder ratios of 0.35, 0.50 and 0.65 are

chosen. It is observed that compressive strength, modulus of elasticity and depth of carbonation are increased with time duration.

Keywords

Compressive strength, modulus of elasticity, durability, and depth of carbonation

(Paper 51, ID #156)

Legal and Regulatory Issues Challenging the Pakistani Construction Industry

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Abstract

The Pakistani construction industry suffers many of the same pains as that of a developing country. Corrupt governmental involvement and lack of regulatory constraints allow ill-qualified consultants and contractors to structure the industry to suit their purposes. To continue leveraging on domestic opportunities and competing in the global marketplace, Pakistani construction industry players need to address these challenges. Improvements need to be implemented by all parties along the entire construction industry value chain for lasting transformation to occur. The absence of a strong regulatory environment

and authority is a problem that requires priority attention. Structurally weak legal and regulatory framework acts as a deterrent for attracting qualified consultants and contractors. To present a construction opportunity that will appeal to ethical and competent companies of both national and foreign ownership the Pakistani construction industry must provide an improved business environment.

Keywords

Business, ethics, legal, Pakistan, regulations.

(Paper 52, ID #163)

Integrated Conceptual Model on Risk Mitigation and Construction Company's Entry Decision into African Markets

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Abstract

Risks in international construction differ across markets and the impact of risks in a particular market varies due to high localization of construction services. Compared to domestic markets, international construction markets manifest more type of risks. Earlier studies on international construction evaluated and modeled risks with a view to making strategic entry decisions into international construction markets, nevertheless limited studies considered whether companies' capabilities interact with entry modes to mitigate the impact of risks in international construction markets. In addition, there is a dearth of research on risks in African construction markets. This paper therefore

examines the risks that influence construction company entry decisions into African construction markets and thereafter develops a risk quantification index and propose an integrated model that highlights the interaction between entry modes and construction company capabilities in mitigating risk impact in African construction markets. A path model of the chain-relationship of company capabilities, risk perception and entry mode which mitigates the impact of risks in international construction markets is developed. This is to establish whether perception of risk in overseas markets influences entry decision and risk perception is moderated by the magnitude of company's capabilities.

Keywords

African Construction Markets, Company Capabilities, Entry Decision, International Construction, Risk Mitigation, Risk Neutral Model

(Paper 53, ID #165)

Factors Influencing Women's Career Choices in the Construction Industry: An Exploratory Study

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Abstract

The construction industry has been challenged to increase the percentage of women it employs. Evidence suggest that while in some areas of the industry there has been a noticeable change, the industry still lags behind many other industries. This is despite initiatives that have targeted attracting women to the industry. The aim of

the study was to investigate factors that influence women's employment into the construction industry. It is considered that such an investigation is useful to highlight aspects that need to be considered in initiatives that seek to encourage women into the industry. A questionnaire survey was conducted and qualitative data collected on influences on women's career choices in the construction industry. The data collected suggests that fewer women than expected entered the industry as a result of the initiatives put in place to encourage women into the industry. The main conclusions are that there is clearly a lack of women in the industry which is a historical problem. With the need for skilled workers still pressing, encouraging women into the industry could help alleviate the skills gap.

Keywords

Women in construction; skills; construction industry; career

(Paper 54, ID #166)

Post Occupancy Evaluation of Healthcare Facilities: a Case Study of a Medical Department in the UAE

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Abstract

The process of undertaking a comprehensive evaluation of a building after it has been occupied is defined as Post Occupancy

Evaluation (POE). The purpose of such a study is to measure its users' satisfaction with its performance and determine whether or not the building fulfills its original design objectives. The main aim of the research work presented in this paper is to carry out a POE process to a single medical department/unit. The study is guided by a comprehensive literature review to identify the methods and techniques for implementing POE in general and for healthcare facility in Particular. A proposed criteria for POE is presented, which contain two main parts: technical evaluation, and occupants' perception measurement. The POE process commenced with the analysis of existing base plans, and a walkthrough observational technique to provide a closer investigation and to reveal aspects of interior design that could be further improved to serve the patients and other users better. It is expected that the result of this research project will raise awareness of integrating the concept of POE within the facility management processes of UAE healthcare projects and feed forward the positive and negative lessons learned into improving the design of current and future healthcare project in the UAE.

Keywords

Post Occupancy Evaluation (POE), Facility Management, Function Performance Specifications, Organizations, Healthcare Projects.

(Paper 55, ID #175)

Social Risks Influencing Export of Construction Services into African Markets

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adequately address the social risks identified.

Abstract

International construction studies have examined the impact of political, socio-cultural and economic/financial risks on export of construction services into overseas markets. Yet, limited studies examined international risks within African construction markets. The rationale for this paper stems from the recent social issues like outbreak of Ebola virus in West Africa and Boko Haram insurgencies within the African sub-region. This paper examines the social risks influencing export of construction services and whether there are significant social risks that influence export of construction services into African markets. The research adopted a convergence mixed method approach while stratified random sampling of 597 construction companies with work categories in civil engineering and general buildings, and listed on Grades 7 to 9 of the cidb Contractor register in South Africa was undertaken. Data collected from 58 construction companies who responded to the survey were analyzed using descriptive (mean score) and inferential (factor analysis) statistics. The social risks influencing export of construction services into African markets that emerged are threat of terrorism, difficulty of doing business, high crime rate and theft. Based on these findings, the paper concludes that there are significant social risks influencing export of construction services into African markets and that these risks can be classified into two dimensions for ease of their management. The paper recommends that there is a need for both international and South African construction companies, keen on expanding their geographical footprints across the border into Africa to put in place strategies that will

Keywords

African Construction Markets, Construction Export, Construction Services, International risks, Social Risks

Modern & Future Trends in Construction Management

(Paper 56, ID #4)

Legal and Contractual Challenges of Building Information Modeling (BIM) – Contractor’s Perspective

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Abstract

Generally, western legal systems are “individualistic” and focus on where the individual rights and responsibilities of people or parties begin and end. These types of legal systems have historically been able to handle traditional construction contracts effectively. In addition, the identifiable and quantifiable risks in such systems have enabled insurance industries to develop and offer a range of products for construction contracts. In contrast, Building Information Modeling (BIM) is “collaborative” in nature and is most effectively used when participants jointly create such models. Hence, contracts involving BIM are more challenging to put together. This challenge manifests itself in two main groups within the construction

industry, which have different perspectives; Architects on one side, and the General Contractors and Subcontractors on the other. This paper investigates the current legal and contractual challenges of BIM which the construction industry faces today. A review of contemporary papers, articles, and conference publications in addition of result from survey developed and administered to the General Contractors is presented in order to understand the general perspective on this challenge. The survey results reveal that BIM is not included in the contract documents on the majority of the projects. This is perhaps because, under existing contract laws, including BIM would upset the traditional allocation of risk among the industry participants. The Design-Bid-Build contract delivery method is still used in majority of these projects, and BIM has been included in such contracts, but only as a “co-contract”, “inferential” or “accommodation” document.

Keywords

Building Information Modeling, BIM, Model Manager, Intellectual Property Rights, Interoperability, Spearin Warranties

(Paper 57, ID #39)

Key Project Performance of the Pilot Case Study of the New Engineering Contracts (NECs) in Hong Kong

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Abstract

The New Engineering Contract (NEC) is a modern family of standard contracts which facilitates the implementation of sound project management principles and practices based on a spirit of mutual trust and co-operation. Procurement and contracting strategies are crucial to the success of every construction project as they establish the basis for co-operation between the client and the contractor. Adopting the New Engineering Contract Version 3 (NEC3), being one of the popular construction contracts worldwide, may be one of the keys to encourage more collaboration and co-operation between various parties involved in construction project management. This paper illustrates the overall project performance of the first trial construction project procured with the New Engineering Contract Version 3 - Engineering and Construction Contract (NEC3 ECC) in Hong Kong via a case study methodology. With regard to the five key performance indicators investigated, the case study project has met or even exceeded the targets established at the outset of the construction stage. The experience derived from this trial project is significant to the success of other future similar projects, and in generating useful pointers to the potential users of NEC3 ECC in the construction industry from other countries especially those where NEC3 ECC has not yet been adopted. The case study findings are envisaged to benefit both the construction academics and industrial practitioners in developing a strong basis for further research studies such as an international comparison of project performance of NEC3 ECC civil engineering works projects between the East and the West.

Keywords

New Engineering Contract, Engineering and Construction Contract, Target Cost Contract,

Case Study, Procurement Method, Hong Kong

(Paper 58, ID #51)

Adopting and Implementing New Technology in Commercial Construction

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Abstract

New technology is continuously being introduced in the construction industry and successful implementation requires a significant investment in time and resources. It is important that companies understand the challenges of adopting new technology and develop strategies to overcome them. This paper discusses the methods utilized by leading commercial construction companies in the U.S. regarding technology adoption and implementation. These results were compared against the diffusion of innovation and technology adoption models to determine if theoretical principles were being followed in the adoption and implemented processes of technology. These results demonstrate that following established theoretical principles in evaluation of new technology can provide a framework for the smoother implementation of new technology in the commercial construction industry.

Keywords

Technology, Innovation, Commercial Construction

(Paper 59, ID #69)

**Lean Construction in South Africa:
Myth or Reality**

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Abstract

After widespread use in manufacturing, lean is now embraced in the construction environment. The use of lean within the past decade has sought to address construction implementation problems for a range of reasons that focus on performance. To this end, the principles and tools of lean construction are desirable in South African construction that has always had to overcome performance problems. This paper thus reports on a study that qualitatively explored how to mainstream lean principles and methods in South Africa through implementation. The semi structured interview questions, which relied on the information obtained through a review of related literature, were used to arrive at insights, which show that contractors are open to the use of lean construction principles and techniques as it constitute a working manner that can assure efficiency and assist them to achieve stated business and project objectives. However, the proliferation of lean construction among contractors in South Africa would only appear when stakeholders shift their mind

set in relation to the construction process. The exploratory study points to a need to identify and leverage drivers that would shift the perspectives of how construction implementation processes are conceptualized and realised in South Africa.

Keywords

Contractors, Lean Construction, Performance, South Africa

(Paper 60, ID #91)

**Case-Based Decision Support
Model for the Management of
Design Related Changes in Design-
Build Construction Works**

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Abstract

Project changes constitutes to an important problem in construction projects which are unavoidable and may appear at any stage of the construction. Most of the time, project changes cause conflicts between the parties and end with change orders or claims that lead to time and money losses. Moreover, design related changes, which can be defined as variations related with the design process of the construction project, are referred as one of the most frequently seen project change types in construction projects. Especially in the design-build procurement type, design related changes lead to conflicts between design-builder and architect because of the direct relationship between design-builder and architect based

on the contract. In this research, a knowledge-based decision support model for the management of the design related project changes is proposed. The model is based on case-based reasoning approach and it will be used by the design-builder to identify the conflicts with the architect because of project changes that may occur in the design-build projects. The aim of the model is to present the design-builder possible effects of the change on time and cost, responsible party in the situation and related contract information depending on standard type of contract between design-builder and architect defined in the model. The database of the model consists of 227 architectural changes which were collected via a survey conducted with professionals of 6 large-sized housing projects in Turkey. Depending on the case-based reasoning approach, when a new situation of change is entered into the model, a result will be given by using similar cases in this database.

Keywords

Case-Based modeling, Architectural changes, Change management, Conflict, Claim management

(Paper 61, ID #154)

Lean Design Management – Waste Items of Architectural Design Process

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Abstract

Waste is standing as a major problem in the body of construction industry. Lean thinking in construction accepts any inefficiency as waste, which results with more usage of

equipment, materials, labor, time, or capital in larger quantities than those considered as necessary in the production of a building. Although poor control of the design stages has been identified as a major factor reducing the efficiency of construction projects, less attention is paid on the relationship between lean thinking and construction design process. It is essential to address the problems of an operation in order to increase the efficiency. In this respect, as the first stage, “8 Waste Categories” of “Lean Production Philosophy” and their reflections on architectural design process are examined in this study. “Waste items” of the architectural design process are investigated via semi-structured interviews conducted with senior architects performing in Turkish design industry. In the second stage, a questionnaire is developed to examine the “frequency of occurrence”, “effect over cost”, “effect over duration” and “effect over quality” for each design waste item. Main aim is to determine the inefficiencies and their impact over the value parameters of architectural design process.

Keywords

Lean thinking, 8 wastes, architectural design process, lean design, efficiency,

(Paper 62, ID #170)

Post Completion Assessment of Construction projects procured under Design and Build Method in Education Sector of Pakistan

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Abstract

Design and Build (DB) procurement method provides an innovative and flexible solution for timely completion of construction projects within the agreed cost and at the desired level of technical performance. The concept is relatively new in the construction industry of Pakistan as most of the projects in public sector are currently executed at the traditional Design Bid Build (DBB) mode. In this research work, five major projects executed in the education sector of Pakistan have been analyzed to assess the time & cost variations, quality of the projects delivered, satisfaction level of the supervisory teams and end users with questionnaire survey from the major stakeholders. The analysis of results showed that the major achievement of the DB was time gain, as the projects were completed relatively faster. There was cost variation due to change in the specification and designs at later stage. The major cost variation has been observed in the sub structure. The overall variation in cost mainly falls within the permissible limit of 15%. The end users satisfaction was observed high as the timely completion facilitated them with suitable spaces for academic and servicing spaces. Design and Build is still in embryonic stage in Pakistan and many challenges in terms of suitable Design and Build teams, their technical evaluations, cost controls and risk assessment. At the end recommendations have been made to promote the DB procurement methods in Pakistan.

Keywords

Design and build, Construction industry, Pakistan, technical performance.

New Tools in the Education of Construction Management

(Paper 63, ID #16)

Progress@NTUA: Training Engineers in Project Scheduling

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Abstract

The teaching of quantitative approaches to project management, especially the Critical Path Method and Program Evaluation and Review Technique has been included in construction management curriculums for many years. However, not many clearly educational tools to support this process exist. This paper presents the design and development of educational software, baptised Progress @NTUA that is used for supporting the teaching of CPM and PERT. Progress @ NTUA educational aid is mostly applicable as self-learning tutorial for students or as a support element in distance learning and blended courses. Its design is based on sound guidelines for educational software and interface usability. Progress @ NTUA uses common time scheduling problems in order to offer a structured reinforcement of previously learned concepts. Taking into account the probable lack of necessary experience or theoretical background, the user is guided to the desired

outcome by an interactive educational process. The needed theoretical concepts about the methods are being taught through the constructivism approach and are presented through a trial and error process that is followed by the learner. Progress @ NTUA is interacting with the student through questions and answers and gives appropriate feedback.

Keywords

Project Management, CPM, PERT,
Educational Software

(Paper 64, ID #94)

Importance of Organizational Behavior Courses In Project and Construction Management Education

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Abstract

The field of organizational behavior itself is not only vast, but also has over the years expanded from a focus on the behavior of people in organizations to encompass all aspects of organizations, including structural issues. It has influenced to a large extent by the more complex nature of construction projects arising from greater specialization, more complex clients and stakeholder activities, by the advent of partnering and other relational arrangements, by government and other reports aimed at improving the performance and reputation of the construction industry. When the complexity of the construction industry is added to the complexity of the organization behavior subject, it is easy to imagine what a complex issue the industry faces to.

Data are collected through the web pages of the construction management graduation programs of the universities all over the world. Program curriculum of the departments is analyzed through their web pages. Whether the departments have core courses or electives related to the organizational behavior issues. It is aimed to determine the proportion of the organizational behavior courses in the curriculum of the departments. This study will be discussed through a new proposal of curriculum in the area of construction management.

Keywords

Organization, Organizational behavior, Construction Project Management, Construction Industry, Construction Project Management Education

(Paper 65, ID #113)

A New Way to Teach Structural Steel to Construction Management Students

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Abstract

Structural Steel is taught in engineering, construction management (CM) and architecture programs all around the world. It has been recognized that students in these three disciplines should be taught differently so that they are able to accomplish the tasks they are assigned in their professional careers. For example, it is appropriate to teach rigorous design of beams, columns and connections to engineering students, whereas, the topics appropriate for CM

students are, (i) materials and specifications, (ii) shop drawings, (iii) basic structural concepts of beams and columns, (iv) construction loads due to equipment, (v) worker safety, (vi) trouble shooting field problems (vii) design and selection of temporary structures for construction and (viii) steel fabrication for constructability and safety etc. This paper presents the teaching aids developed by the author and other faculty members as well as AISC in the form of PowerPoint presentations, selected videos as well as Steel Sculpture used for instruction. This effort is ongoing so many revisions to the resources presented in this paper are being made. This is primarily an informational paper with the objective of helping faculty members in construction programs responsible for teaching structural steel to find construction management specific teaching materials.

Keywords

Steel beams, Columns, Base Plates, High Strength Bolts, Structural Connections.

(Paper 66, ID #125)

Sowing the Seeds of Success: The Provision of a Personalised Study Time Management Plan

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Abstract

To assist students to better manage study-time, the authors took a fresh approach in a previous study deviating from a traditionally adopted personal time management focus to

a project management focus. The framework developed in the previous study, later labelled as REST, underpinned this study. One element of this framework calls for a good understanding of the ‘scope of work’ to facilitate ‘success’. To make the scope of work more understandable and manageable, an editable, bar-chart-style personalised milestone-time-plan with scheduled assessments for all courses was provided to selected first and second year construction and civil engineering students. A questionnaire-survey was carried out to establish current practice and ascertain the suitability of the proposed time-plan with respect to its usefulness, style, adaptability, and integration. Students use calendars, diaries, and time schedules but also resort to various ad-hoc practices suggesting the need for study-time management training. The personalised bar chart was found to be more useful than the calendar provided on the online study desk. However, given that students place almost equal preference for bar charts and calendars, it is recommended that personalised time-plans be made available in both formats. It is expected that with further training students may eventually move away from the less informative and inflexible calendar format to a more useful and strategically resourceful bar chart format to effectively manage scope of work.

Keywords

Milestone plans, Scope of work, Study time, Time-plans, Time management

(Paper 67, ID #145)

Affordable Housing in Developing Countries

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Abstract

The construction of an affordable low-cost housing in developing countries can now be achieved using prefabrication process or prefab construction, considered as one of the latest technologies introduced in the last few decades, where the required structures for a prefab house are developed in a conservative environment reducing the quality issues and assembled on site. Hence, there is an annual shortfall of 600,000 houses in the developing country such as Pakistan (SMEDA, 2006) creating an opportunity for our housing construction industry to adopt the prefabricated construction process which includes innovation of new materials & advanced techniques in order to make up the backlog and meet the shortfall in the next 10-20 years. Consequently, this paper distinguishes the cost comparison analysis of prefab housing process with traditional and conventional built housing process along with the types of categories within which the customer may target and their corresponding benefits. The results indicate a significant difference in the cost comparison for the variant size houses ranging from 80 to 250 square yards.

Keywords

Prefab Construction, low-cost housing, cost comparison analysis

Procurement Management

(Paper 68, ID #48)

Public – Private Partnership (PPP) And Cultural Sponsorship Law and Deontology

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Abstract

Public-Private Partnership (PPP) is a modern variation of concession, it exemplifies the prevailed School of Thought, New Public Management, but it may cause various deontological problems. It could be promoted through another autonomous type of contract, sponsorship. This practice has been described as “*an investment in cash or in kind activity, in return for access to the exploitable commercial potential associated with that activity*”. The recommendable osmosis between the two types of contracts may be proved to be beneficial even for the cultural domain, despite its non-reciprocal nature, and is connected with the Corporate Social Responsibility tendency of both private companies and public ones.

Keywords

Public - Private Partnership (PPP), New Public Management (NPM), Cultural sponsorship, Contracting out, Business Deontology, Law, Ethics, Corporate Social Responsibility

(Paper 69, ID #109)

Derivation of Utility Values of Project Procurement Systems against Selection Criteria for Major Highway Construction Projects

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Abstract

In the project management process for the realization of major highway projects, the choice of Project Procurement System (PPS) is central to success as the relevant social environments are numerous and with interdependent interfaces. An extensive literature review showed significant research into PPS selections models for building projects. The PPSs investigated are Traditional, Traditional Fast Track, Design and Build (D&B), Private Public Partnership (PPP), Construction Management (CM), Management Contracts and Partnering. Based on this literature review, the most common Selection Criteria (SC) considered when choosing a PPS were derived. A questionnaire was developed and distributed to experts in highway authorities in Europe and abroad to rate each PPS against these SC in order to determine their Utility Values (UV) to be employed in the Multi-Attribute Utility Analysis (MAUA)

decision making methodology. The UV's are in effect a relative measurement of the suitability of a certain CT for a given criterion.

The purpose of this paper is to present the resulting UV of each PPS against each SC from the analysis of the collected data using SPSS 18 PASW software. The selected techniques employed include: estimation of the sample population mean, mode and standard deviation. In addition Pearson chi-square and Analysis of Variance (ANOVA) tests were carried out for inferential analysis between respondent's characteristics and their ratings in order to determine any significant tendency towards specific responses. The results of these analyses are presented and discussed.

Keywords

Procurement, highway projects, questionnaire survey,

(Paper 70, ID #123)

Wither Monetary Retentions for Subcontract Work? A Theoretical Framework for Rationalising the Use of Retentions

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Abstract

Despite advocacy for and against monetary retentions, it continues to be used unabatedly clouded by paradoxes, problems, and pitfalls. In order to lay the foundation to rationalise its use for subcontract work, a model was developed using three concepts, namely, mortgaging future payments, factoring current progress, and generating a level of safety for contractors. Labelled as the LOS model, it supplements and clarifies

the notion of retentions and lays the foundation for a framework for rationalising the use of retentions by focussing on three fundamental issues that need to be understood and resolved, namely,
1. Intrinsic issues focusing on 'do we need retentions for subcontract work?'
2. Quantum issues focusing on the 'level of safety' or comfort available for contractors quantified in dollar terms with retentions rates serving as a threshold level, and
3. Operational issues focussing on implementation. It is expected that this framework labelled as IQO will assist in building theory on monetary retentions in the future furthering our understanding on this seemingly simple yet complex construct.

Keywords

Factoring performance, Retentions, Monetary retentions, Mortgaging payments, Subcontracts

(Paper 71, ID #138)

Public Private Partnerships in the Transportation Sector: An Overview and Case Studies in the United States

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Abstract

Constraints on traditional funding, concurrent with the need to invest in public infrastructure, has led many U.S. public agencies to explore public private partnerships, also known as PPP or P3, for

the construction, and in some cases operation, of public infrastructure such as roads, bridges, and airports. Many attribute the initiation of modern P3 to Europe, where it has been used since the early 1990s.

Thirty-three states, the District of Columbia and Puerto Rico have enacted legislation to support the use of P3 for highway projects, and P3 have been successfully used in other sectors such as water and wastewater, the power industry, building construction, and technology. P3 may be used for 1) new facilities such as design build, design build operate and maintain, and design build finance and operate, 2) existing facilities, such as long term leases, and operation and maintenance concessions, and 3) hybrid models, which may incorporate a long term lease for operation and expansion. This paper reviews the current framework for P3 in the United States, including enabling legislation, trends, and case studies of transportation projects in the roadway and airport sectors. In many PPP cases, the required demand and projected revenue did not materialize, and the private entity could not meet their obligations and make a profit. An analysis of the factors that will affect successful implementation given the current trends and challenges of P3 is provided to ensure successful infrastructure construction projects in the future.

Keywords

Public, private, partnerships, PPP, transportation infrastructure, construction, roads, airports

(Paper 72, ID #141)

Managing the Design Process in Design-Build Projects-The South Florida Experience

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Abstract

Design-Build (DB) approach requires an explicit determination of the roles and responsibilities of the DB team. Over the years studies have been conducted to view the DB approach to construction, of which it has been getting a more favorable response. In comparison of DB versus the traditional design-bid-build (DBB) it has been found to have almost no delays; in addition, has a higher average of speed per square feet of construction per month. For this study, understanding of the management approaches being used nationally, internationally and locally was first developed through existing literature. Building upon the understanding, a questionnaire survey was conducted from South Florida DB companies in an effort to assess how clear the team members are of their roles and responsibilities. The survey was also designed to assess their management approaches and to see how they assess and protect their companies from the possible risks resulting from this particular delivery method. From the analysis of the responses received, it can be asserted that most South Florida survey of DB companies is knowledgeable of the design management approaches being implemented nationally and internationally. Another positive finding is that DB companies working on public and private projects are relatively small to medium size companies, some with their own A/E, some

not; their design management approach is established at the onset of projects and continues throughout.

Keywords

Design-Build (DB) approach, design-bid-build (DBB), delivery method, roles and responsibilities

(Paper 73, ID #169)

A Conceptual Process Framework for the Development of Briefs in Public Private Partnership Projects

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Abstract

The use of Public Private Partnerships (PPPs) as a strategy for developing infrastructure projects has been well-practiced internationally. Briefing is considered one of the important stages in any PPP project development. The briefing process is the process by which the client's needs are investigated, developed, crystallized, and communicated to all stakeholders of the PPP project. A review of the literature reveals that there are very limited numbers of studies focusing on the process of developing of briefs for PPP infrastructure projects. The aim of the research presented in this paper is to develop a framework for the conceptual process of such development. The study is guided by a

comprehensive literature on PPP briefing and a comparative analysis of the briefing processes in the top three countries of the PPP Market Maturity chart. The developed process framework is broken down into three key phases: the Strategic, Feasibility and Procurement phases, with 13 main sub-processes covering the most common sub-processes within the PPP briefing stage. The developed framework is developed further through a case study analysis and interview sessions with practitioners and experts from the PPP environment in the UAE in order to develop and validate a strategic model for developing PPP briefs with special reference to the PPP environment in the UAE.

Keywords

Public Private Partnerships (PPPs); Briefing; PPP maturity; Process Framework; PPP Market Maturity

(Paper 74, ID #172)

The Impacts of Variation Orders on South Africa Public Sector Construction Projects

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Abstract

The complexity, uncertainty, long-duration and the involvement of the sequential tasks and relationships of participants in/of the construction projects render this category of projects prone to variations along their progress. Variations create extra work, time, and money for the construction projects and they vary from one project to another. This paper investigates the impacts of variation orders on public sector projects in South Africa. To achieve the objectives of the study, a critical review of literature was done coupled with questionnaire survey to collect information on possible impacts of variations on the public projects in SA. Through the review of literature 7 major possible impacts of variation orders were identified which provided the basis for the formulation of the questionnaire. The questionnaire was distributed to professionals who work for companies that undertake public construction projects in South Africa. Targeted number of respondents was 50; however a total number of 70 questionnaires were sent out to make up for the cases where respondents did not return questionnaires. Overall, 50 questionnaires were returned and after a careful examination of the received questionnaires only 39 were usable. These formed the basis of the analysis for the study, since it accounts for 78% of the initial sample. Findings revealed that variation orders have major impact on i) time overruns, ii) cost overruns, iii) quality standard enhanced, iv) disputes amongst parties to the contract, and v) productivity degradation, iv) complaints of one or more parties to the contract. It was further noted from the results that variation orders rarely affected health and safety aspect of the public construction projects since all the factors relating to health and safety were the lowest ranked; health and safety

degradation, additional health and safety officials, additional health and safety equipment. However, this results are in disagreement with the results on the critical determinants of variation orders on SA public sector construction projects because health and safety conditions was ranked the highest reason for variation orders under other related reasons for variation orders. What these findings mean is that safety considerations may be the reason to cause variation orders but variation orders do not affect health and safety on the construction project.

Keywords

South Africa, variation order, prevalence, public construction projects

(Paper 75, ID #173)

How the Early Contractor Involvement Principles are traced in Different Procurement Routes

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Abstract

Early Contractor Involvement (ECI) is seen as one of the relationship-based procurement (RBP) methods and contracting arrangements that adopted for big and complex projects in Australia. To date, the majority of the infrastructure projects valued at \$20 Million or more is procured under the ECI or one of the collaborative approaches with the concept of ECI embedded.

Furthermore, there are a few local governments who have published a number of documents in an attempt to standardize the ECI contract as practiced in Australia. Despite the evident documents indicating the ECI as a form of binding contract, many academic and industrial professionals use the term as a concept too. From their perspective, ECI refers to engagement of the contractor at the early stage of project development and can happen through a wide range of methods. This paper, therefore, studies different delivery systems that incorporate the concept of ECI into their implementation process through a literary analysis on the existing scholars and contractual documents

Keywords: Early Contractor Involvement, ECI, Relationship-based procurement systems, Relational contracting

Risk Management & Decision Making

(Paper 76, ID #47)

Quantitative Risk Assessment: A Pragmatic Approach

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Abstract

Risk has been defined and characterized qualitatively by many researchers, but quantitative assessments methods are rarely discussed in publication. Quantitative risk assessment lacks a concise approach and all research reviewed struggled to recommend definitive methods to measure this important concept.

In recent years, there has been a desire to adopt a quantitative methodological approach in decision-making, in addition to qualitative management approaches in various business disciplines. Decision-making processes, which rely largely on quantitative assessment, are becoming more computers automated. The algorithms for such automated decisions are written first in quantitative formats to model human decisions, increasing the appeal of quantitative risk assessment. This paper provides an example of a simple and pragmatic approach for quantitative measure of risk. It is consistent with the current ISO 31000 and the widely cited Kaplan and Garrick qualitative definitions. In addition, it leads to a much more vivid understanding of the term risk. The paper stipulates that a suitable methodology based on scientific

concepts provides an acceptable tool in increasing understanding of risk assessment; prioritization and allocation of resources; and to facilitate the decision on comparative risk assessments.

Keywords

Risk, Expected Value, Mean, Variance

(Paper 77, ID #52)

Human Resource Challenges in the United States Commercial Construction Industry

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Abstract

In the commercial construction industry, the professionals who handle the Human Resource (HR) departments face many challenges that are unique to the construction industry. Decentralized work sites, mobile workforces and transient workers need the attention of HR professionals as well as executive company managers to provide strategic operational support for the company. Human Resource Management will continue to be a pressing issue in construction company management as new laws and trends in employment continue to change and evolve. Construction's unique challenges in HR have been explored and outlined in this paper to help company managers know what they may face. Commercial construction companies around the United States were visited to determine the most common challenges and concerns facing HR departments. The results of these visits found that there were commonalities in the challenges that commercial construction companies in the United States face in regards to HR. The main findings relating to

the HR challenges that will be discussed in this paper include: finding skilled and experienced workers, equal employment opportunity issues, the mobile nature of construction projects, training, layoffs and termination, compensation, retention, harassment and new trends emerging in construction companies relating to HR. The findings of this study will help construction companies better understand the unique issues of HR in the construction industry and have the information to better handle them.

Keywords

Human Resource Management,
Commercial, Construction

(Paper 78, ID #59)

Application of DSM (Design Structure Matrix) Principles to Project Risk Management of Thessaloniki Metro Construction Project

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Abstract

The process of project risk management is strongly connected to the successful completion of a project. Most of the methodologies used for this purpose analyse and manage individual risks independently, without taking into account the relations and

dependencies among risks. Design Structure Matrix is a tool that visualizes and analyses relations and dependencies among objects. In this paper, an application of DSM principles to project risk management of Thessaloniki Metro construction project is presented. The purpose of this application is to indicate how these techniques can assist and improve the risk management processes of a large and complex civil engineering project. Particularly the model structured is based on the methodology introduced by Marle & Vidal, 2008. At first risks are identified and then a binary DSM is defined to represent the project risks and their interactions. After that the numerical DSM is defined using the multi-criteria decision making method AHP, to calculate its values. Then, clustering analysis of the above matrices is implemented in order to cluster risks according to their interactions. The clustering results combined with the implementation of usual techniques can lead to a more effective risk management plan for Metro construction project.

Keywords

DSM (Design Structure Matrix), Risk Management, Metro Construction Project, AHP (Analytic Hierarchy Process), Risk Clustering

(Paper 79, ID #71)

Combined use of simulation and optimization models for the optimal design of harbor breakwaters: Application at the port of Thessaloniki.

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Abstract

The optimal design of the dimensions of a harbor breakwater is a very complex matter. The length of the breakwater must be long enough to protect the harbor but at the same time, small enough to reduce its cost. The approach presented in this paper includes the combined use of a simulation and an optimization model. The simulation model is used to determine the variation of the wave height in crucial areas of the port under different extensions in two directions, of the breakwater. The wave heights were produced using steady-length extensions of the breakwater in the two directions investigated. The optimization model, formulated in a linear programming form, aims to determine the minimum extension in these two directions that satisfies the operational constraints that was set concerning the acceptable wave heights. The two models are connected through a response matrix. This matrix is formulated by the results of the simulation model and is used to describe the constraints of the optimization model. The proposed methodology can be used and applied in a series of similarly structured construction design projects.

Keywords

Optimization, decision making, harbor design, wave models

(Paper 80, ID #72)

Optimal Construction Design Using the Harmony Search Algorithm as an Optimization Tool

Abstract

The determination of the optimal values of the numerous parameters involved in the design of complex construction elements has always been a challenge for engineers. The use of optimization approaches and techniques has gradually replaced the practice of empirical determination of crucial design parameters. The quest for more robust but at the same time user-friendly optimization techniques is nowadays more intense than ever. This need to develop and apply new optimization techniques in order to achieve more efficient and effective solutions in complex management and design problems, has led to the introduction of a series of interesting new methods. The meta-heuristic method of music-based Harmony Search Algorithm (HSA) is one of the leading optimization techniques nowadays with applications covering a wide range of scientific fields. In this paper, the main features of this method are presented along with a specific construction design application. This application is performed using specially-designed computer software programmed in MATLAB environment. The created software includes a user-friendly GUI (Graphical User Interface) that allows the user to easily interact with the optimization tool.

Keywords

Optimization, metaheuristics, decision making, structural design, harmony search algorithm

(Paper 81, ID #110)

Effect of Stakeholders' Risk Attitude on the Application of Project Risk Management

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Abstract

Project stakeholders are those people, groups, or organizations that could impact or be impacted by the project. Successful stakeholder management includes identifying potential stakeholder, analyzing their expectations and their impact on the project and developing appropriate management strategies for effectively engaging them in project decisions and execution. A wide range of factors influence risk attitude including: the scale of the project within the range of stakeholders' overall activities, the strength of public commitments made about the performance of the project, and the stakeholders' sensitivity to issues such as environmental impacts, industrial relations and satisfaction degree of all potential stakeholders. Risk management processes include planning, identification, qualitative and quantitative analysis, response and monitor and control. Understanding stakeholders' attitudes toward risk is an important component of risk management planning that precedes risk identification and analysis, in order to optimize both project success and stakeholder satisfaction with the project's results. This paper will spot the lights on stakeholder identification and analysis, their impact on the project through Salience Model, their different attitudes towards project risks and how these factors will

count during risk management application in the construction industry. A questionnaire survey was conducted to a sample representing different parties of construction industry consisting of two parts: the first part of the questionnaire addresses factors affecting stakeholders' risk attitude, while the second part analyzes different categories of stakeholders according to Salience Model and their tendency to behave in different risk attitude, namely: risk averter, risk seeker and risk neutral.

Keywords

Project Stakeholders, Risk Management Processes, and Risk attitudes.

(Paper 82, ID #157)

Managing Risks in Public-Private Partnership Projects: The Case of Izmit Bay Suspension Bridge

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Abstract

Public-Private Partnerships (PPPs) is one of the most widely used means of financing large-scale public projects. PPP agreements involve public and private sector whereby resources and risks are appropriately allocated. There has been a vast amount of research on the PPPs recently focusing on different aspects including the financing, critical success factors, risks, and concession periods. PPPs bring a number of benefits such as efficient use of resources, reduction in project costs and durations, and increase in the quality of public services. However, depending on the complexity of the projects and the procurement process, PPPs inherit a high number of risks. For a successful PPP

project, risks should be managed carefully. The major objective of this research is to investigate the risk management process in a PPP project. PPPs have been increasingly used in Turkey for the last decade. In this respect, Izmit Bay Suspension Bridge linking the Turkish cities of Izmir and Istanbul is selected as a case study. Upon its completion, it will be the world's fourth longest suspension bridge. The paper first identifies the risks in this project, then presents the risk analysis, and finally mentions the risk response strategies. The paper provides recommendations on how to better allocate risks among the participants of a PPP scheme. The findings of the study suggest that the most significant risks are the political, legal and regulatory, financial, and construction risks.

Keywords

Public-Private Partnerships, Risk Management, Izmit Bay Suspension Bridge Project

(Paper 83, ID #160)

Survival of Construction Companies in Crises through Process-Based Management

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Abstract

Crises are among the most important reasons in completing life cycles of construction companies. Crisis management starts with the introduction of crisis signals, continues with an effective struggle during the crisis, and ends with recovery studies after the crisis to turn to the former position. Most of micro and macro crises produce significant signals before they occur. Especially large-scale construction companies can overcome crises with a minimum financial loss by catching these alarming signals, by improving policies to defeat them with a minimal damage, and by developing immediate renovation works. Construction companies which can overcome crises with zero damage will likely have a competitive advantage over their current rivals and expand their market shares largely. Considering these issues, in the present study, process-based practical applications that should be performed by construction companies to survive before, during, and after crises were presented in a detailed manner. This can contribute to the creative management of construction companies under potential crises in micro and macro levels. Overall, this study attempted to reveal how construction companies can successfully manage crises throughout them and turn to their former positions in a short period of time.

Keywords

Company, Construction, Crisis, Crisis management, Crisis processes

Soft Skills in Construction Management

(Paper 84, ID #14)

The Role of Inclusion on the Career Experiences of Professional Women in Construction

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Abstract

Much of the research on women in construction has indicated that they are often not well integrated within their organizations, with their lack of advancement related to exclusionary organizational tactics and discriminatory practices. An inclusive environment, characterized by a culture which supports positive relationships and fewer stereotypes, should provide an ideal environment for women to utilize their skills effectively, as well as balance their work and family lives. A questionnaire examined the perceptions of a sample of 456 professional women from the Australian construction industry. Inclusion was operationalized through a composite measure using standardized variables and two groups formed using a zero-zero split. Contrary to expectations, comparisons using independent t-tests found the career advancement of the two groups of women were not statistically different. Career satisfaction was significantly higher in the group with high inclusion; however work-family conflict and turnover intent were statistically lower in the same group. These findings indicate inclusion is an important organizational attribute. Some explanations for its lack of effect on women's advancement are discussed.

Keywords

Construction, women, inclusion, career, career success, organizational culture

(Paper 85, ID #15)

The Development of a Scale to Measure Gender Equity in Construction

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Abstract

Women's under achievement in construction has been strongly linked to gender inequity issues within organizational practices. However, few measures of this inequity have been developed nor used within construction research. This study both developed and validated such a measure and the process is described within two separate papers. This first paper discusses how the measure was modified and developed. A second companion paper outlines the validation of the scale and presents the final measure. Bergman and Hallberg's 30-item measure, developed using a grounded theory study, was used as a starting point. It needed modification due to some validity and reliability issues. In an iterative process, involving an expert group of three academics and seven reviewers, the scale was modified to suit the construction context, with gender bias removed to broaden its application to a male and female sample. The resultant 20-item trial measure is presented. The research involved many important research lessons which are outlined in greater detail within the companion paper, as these issues mostly arose during the validation process. It is hoped this study will be useful to other

construction researchers contemplating scale development.

Keywords

Construction, scale development, gender inequity, sexual discrimination

(Paper 86, ID #65)

Line Balancing for Work Scheduling on a Construction Project

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Abstract

The Japanese construction industry has witnessed rapid development of many construction methods and equipment in building construction in recent years. However the efficient application of such methods have been found wanting. From the standpoint that building construction embodies numerous types of activity that require deliberate management, therefore a comprehensive organizational and management technique is crucial and instrumental to site productivity. The aim of the present study is to establish a work scheduling and management tool for optimum construction and practical use. The authors were involved in a number of actual

construction projects for the purpose of this study and demonstrated the application of MAC (Multi-Activity Chart) as a tool for work scheduling and management. The fundamental concept of this management tool is to organize several work teams with fixed members and to repeat the same work cycle constantly and to eliminate or reduce idle time. The necessity and significance of MAC as an onsite management tool is demonstrated in relation to the learning curve effect on a building construction project. A discussion of the outcome of the application of MAC on the project was undertaken.

Keywords

Line balancing, Building construction project, Multi-Activity Chart, Learning curve effect

(Paper 87, ID #116)

Analysis of Personal Characteristics and Cognitive Abilities of Project Managers

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Abstract

The role of a project Manager is of special importance to the economic prosperity and viability of construction enterprises. This research is aiming at defining the Greek project Managers' dominant cognitive

abilities and personality characteristics. An effort is made to identify key attributes associated with successful project manager performance and career development. A new survey was conducted using a structured questionnaire, which was based on Aretoulis et al. (2014). The questionnaire was based on international literature and extensive interviews with Greek project engineers. The study statistically analyzes and identifies the most significant attributes. The outcome of the study creates a profile of the competent project manager, and would be important for career orientation of future engineers and at the same time provides insight for academic study courses.

Keywords

Project Manager, Cognitive Abilities, Personality Characteristics, Statistical Analysis

(Paper 88, ID #117)

Enhancing Cognitive Readiness of Construction Project Teams

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Abstract

Construction challenges require rapid decisions to be made by project teams. These decisions interact with the complex,

dynamic and sometimes ambiguous project environment and affect the overall project outcome. Cognitive readiness in this context is the mental, emotional and interpersonal skills that relate to the way project teams perceive, remember, think, speak and solve problems encountered in project situations. Project teams, on top of technical and contextual competences, should possess the required cognitive readiness to address real-world problems and take rapidly the appropriate decisions. The investigation of cognitive enablers and barriers as well as their prioritization, adaptation and implementation in real-world situations is the subject of this paper. Methods assessing and procedures improving and monitoring individual and team cognitive readiness are also described. The main conclusion that can be derived from this work is that cognitive readiness of project teams relates mainly to the leadership style applied, to succinct and well defined team roles, to communication strategies and to procedures employed enabling lateral thinking, stimulation, assertiveness building, adaptability and automaticity of action.

Keywords

Project, Management, communication, competence, cognitive readiness

(Paper 89, ID #158)

Emotional Intelligence in Construction Contract Administration

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Abstract

Emotional intelligence is the thread that ties the disparate functions of construction and the management of the construction team

together. The construction contract administrator (CCA) has a different function than the construction manager. The construction manager is directly in control of the project schedule, costs, and quality of work. The CCA is responsible for the interpretation of the contract documents and providing information to the construction manager and the owner. Each team member--the owner, the construction manager, and the CCA—has his or her own knowledge, skills, and abilities (KSAs). During the construction of the project, their KSAs are vital to the timely and accurate completion of the project. Emotional intelligence must be integrated for effective and impartial administration of the construction contract. This paper discusses the relationship between emotional intelligence and the key project roles, specifically the CCA and the construction manager.

Keywords

Emotional intelligence, Construction management, Construction administration, Leadership

(Paper 90, ID #167)

The Validation of a Sexual Discrimination Measure for Construction

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Abstract

Research in construction field indicates women's lack of career achievement is related to exclusionary and discriminatory practices within their organizations. However, few measures of this gender equity have been developed, with most

typically assuming a strong gender bias. This study developed and validated a new measure for professional men and women in construction which has been described within two separate papers. The first paper (Francis, 2015) presented the development of a new 20-item trial measure using an iterative process and the assistance of a ten person expert panel. This paper is the second and describes the final part of the study presenting the validation of the new measure. Nine items, including two relating to sexual harassment, had to be removed as they could not be considered as continuous or were non parametric. Because of the exclusion of the sexual harassment items the final scale was a measure of sexual discrimination. To establish which of the 11-items should be retained, an Exploratory Factor Analysis (EFA) was conducted using a sample of 217 professional women in construction. The final scale included 5-items and was verified using a Confirmatory Factor Analysis (CFA) using a sample of 239 construction women. The Cronbach Alpha for the scale was found to be .81, indicating a relatively high level of reliability. The research involved important research lessons relating to issues such as the response format, impact of increasing gender neutrality and the reverse scoring of items. It is hoped this study will be useful to other construction researchers contemplating scale development.

Keywords

Construction, scale development, gender inequity, sexual discrimination

Sustainability

(Paper 91, ID #36)

Towards The Development of a Life-Cycle Assessment Framework for Bridge Management: A Literature Survey

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Abstract

The world is driven towards sustainable construction and there is increasing need for incorporating environmental considerations into asset management tools, models and frameworks. Structures such as bridges are subjected to deterioration due to increasingly demanding environmental conditions. In order to minimise deterioration and enable the selection of sustainable actions numerous maintenance and management approaches have been developed. However, there is limited consideration of environmental impact in Life-Cycle Assessment (LCA) during the decision making process. A life-cycle assessment can provide a detailed evaluation of environmental impacts of various

maintenance options to allow the most sustainable method to be selected. The purpose of this study is to provide an overview of up-to-date literature on the implementation of LCA for bridge assessment. The review focuses on the LCA approach and methods adopted, life-cycle inventories considered for analysis, implemented framework developed and conclusions. Findings reveal that LCA for bridge infrastructure has concentrated on life cycle phases of the structure alone, without paying much attention to the available maintenance options. Literature has also revealed that most LCA studies have not clearly identified whether they have taken attributional or consequential approaches to LCA. Finally, considerations of benefits and barriers are also proposed for newly developed LCA frameworks before implementation.

Keywords

Bridge, life cycle assessment, maintenance and sustainability

(Paper 92, ID #38)

The Adoption Building Information Modeling in Construction Industry in Libya: a Developing Country Context

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Abstract

Buildings and associated processes are now becoming increasingly required to be

delivered and implemented in a sustainable manner. Information Technology (IT) has revolutionized the building design and the adoption of advanced modeling technologies in building design. One of the latest technologies is building information modeling (BIM). This study identifies through literature review the key factors affecting BIM adoption. This study aims to propose a model that examines these factors that affecting the level of adoption and concerning the details involved in BIM for design construction in Libya; and validates the model for construction organizations in Libya using questionnaire survey. This model will be tested using structural equation modeling (SEM). This model is expected to give guidelines for engineers, designers, developers and practitioners.

Keywords:

Adoption, building information modeling, design, Libya

(Paper 93, ID #44)

Review of LEED Certified Construction Projects in Turkey

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Abstract

There has been an increasing demand for a sustainable built environment all around the world. The current building stock is responsible for a huge portion of greenhouse emissions. Green buildings are considered to be a solution to global warming and its adverse impacts. The energy efficiency level of those buildings is certified by a number of global and local rating systems. Turkey is among the countries where sustainable

construction has been recently encouraged through environmental policies. The major objective of this study is to review the current status of green buildings in Turkey. In this respect, data concerning a total of 80 LEED-certified buildings is collected and analyzed. The analysis is based on the building type and size, certificate type and rating system, and credits received for each LEED category. The findings of the study suggest that the majority of the buildings achieved gold certification for New Construction. The buildings are found to receive higher scores in “water efficiency”, “sustainable sites”, and “innovation in design”, whereas “materials and resources” is found to be the weakest category. The paper discusses the reasons for high and low performance in certain categories and how the low-scored categories could be improved. The findings of this research are expected to provide a better understanding of energy efficiency and also help construction teams effectively employ LEED certification.

Keywords

Green buildings, energy efficiency, LEED, Turkey

(Paper 94, ID #50)

Internalizing the Concept of Sustainability – A Critical Review of Curriculum in Building Construction

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Abstract

Environmental consequences of contemporary construction practices have been scientifically established through several studies. Construction activities alone contribute about 40% to the global CO₂ emissions. The seriousness of the issue has given rise to promotion of sustainable and green construction technologies worldwide. It is imperative on the architecture schools across the world to examine their curriculum contents in subject 'Building Construction and Materials' critically to ensure that the issues of sustainability are adequately addressed. The consumption pattern of building materials and construction technologies employed on execution of building projects are largely influenced by the choices made by architects. The coursework in building construction must help internalizing the concept of sustainability in architecture profession. Sensitizing the future generation of architects towards environment friendly construction practices would go a long way in mitigating the adverse impacts of construction on environment and ecology. This would also be a right step in realizing the objectives as envisaged in Agenda 21 for sustainable construction. This paper is an attempt to examine the course contents in the subject 'Building Construction and Materials' adopted at undergraduate programmes in architecture at some of the premier architecture schools in India, in context of sustainability.

Keywords

Sustainability, Construction, Building Materials, Environmental Impact, Course Contents

A Decision-Making Model Synthesis for Sustainable Building Development

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Abstract

Life Cycle Costing (LCC) is a decades old practice, yet its implication for building sector is relatively new. While ground is getting ready to accept Life Cycle Analysis (LCA), Life Cycle Cost Analysis (LCCA) and Life Cycle Inventory (LCI) Analysis for building projects, there is a need to embrace these analysis types to realize sustainable construction of building projects. While considering Sustainable development as outcome of sustainability in economic, social as well as environmental dimension, a Decision-Making Model for sustainable building development is synthesized. This is achieved by using LCC Analysis, LCI analysis and social sustainability parameters as respective indicators of economic, environmental and social sustainability dimensions. Building Information Model (BIM) as a comprehensive model including plenty of building project information will assist overall sustainability analysis of construction projects during design phase. The Decision-Making Model applied on two proposals for a community center building

has provided decisive sustainability values in all three dimensions. Based on results, a rational decision can be made to select the proposal with higher cumulative sustainability value. Owing to increasing requirement of holistic assessment of sustainability in building sector, the Decision-Making Model will help mature the participatory role of economic, social and environmental sustainability dimensions.

Keywords

Life Cycle Cost Analysis (LCCA), Life Cycle Analysis (LCA), Life Cycle Inventory Analysis (LCI), Building Information Model (BIM), Sustainability

(Paper 96, ID #84)

Turning Brownfields into Goldfish

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Abstract

The novelty of a structure is not only the result of modern engineering by creating new forms, but also the recovery of construction inheritance. Such structures are the postindustrial spaces (brownfields) that create dead zones and discontinuities in space. Their restoration and reuse is considered an important design policy of sustainability (economy, society and environment) and aesthetic upgrade of the cityscape. This trend includes recycling, preservation and restoration to life. The aim of this research is to show the plans of restoring industrial sites, concerning the uses, design trends and materials used. The industrial spaces show significant advantages and dynamic. Located at strategic places, near city centers or in port areas, and, because of their proximity to

infrastructure, they are the only land available for urban development. Also, they are major places, net-shaped, with a flexible plan. Moreover, because of variation in size and type, the selected use and design strategy, ranges from clean maintenance that includes static and sustainable design to large differences in shell and structure or a combination of new and old construction. Some popular examples are Tate Modern or the Emscher Park. In conclusion, the exploitation of such spaces seeks benefits at ecological, social and economic terms. The restoration will give employment to the construction sector in the future, as engineers will have to deal with an "aged" and densely built environment. However, the limitations one faces in existing structures are a different kind of creative energy. Therefore, we turn brownfields into goldfish.

Keywords

Sustainability, brownfields, industrial, restoration, urban development

(Paper 97, ID #88)

Current Trends and the Future for Intelligent Facades: A Review

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Abstract

Buildings play a significant role in shaping the lives of people around the world and research on how to make them healthy, comfortable and sustainable is central to scientific research in the past decades. Driven by recent evidence about climate change and the global energy crisis, buildings are identified as an important consumer of energy and resources

worldwide. In this context intelligent buildings have been put forward as an alternative to introduce high efficiency and effective use of resources, by making use of the latest technological developments, collaborative design and organizational conceptual methods. This paper focuses on intelligent building facades as the main multifunctional element of the building filtering light, heat, air, water, and offering connectivity, adaptation and aesthetical pleasure from the inside and the outside. The latest trends in intelligent façade design worldwide are presented through a series of built example buildings, including kinetic adaptive façades, interactive facades, and bio-facades. The issues addressed are the role of nature in design, the use of renewable resources, the methods of adaptation and interaction between buildings, occupants and the environment. Opportunities and challenges related to the future development of intelligent facades are analyzed and a direction for future research is proposed.

Keywords

Intelligent facades, Adaptive, Interactive, Kinetic, Bio facades

(Paper 98, ID #92)

The Relationship between Building Shape and Energy Cost

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Abstract

In the design phase, decisions regarding building shape have a considerable effect on building energy cost. Therefore, this study will analyse the extent to which changes in building shape affect energy cost, and

thereby provide pre-design information for future reference for residential buildings with less energy consumption and less environmental pollution. This study investigates the relationship between building shape and energy cost by taking into account thermophysical properties and orientations of external wall alternatives. Building shape is evaluated with external envelope area to the building's gross volume (A/V) ratio and external wall area/floor area (EWA/FA) ratio. 4 building shapes with different external wall area are selected for this study. The maximum and minimum energy costs of each building shapes are calculated on the basis of 14 different envelope and 4 different orientation alternatives taking into consideration the solar gain. The relationship between external wall area/floor area ratio, A/V ratio and building energy cost are determined for separately maximum and minimum energy costs. The increase in energy cost due to changes in building shape reaches up to 24.40%. EWA/FA and A/V ratio of buildings have significant impact on the energy cost.

Keywords

Building shape, Energy cost, Envelope design, Energy efficiency

(Paper 99, ID #102)

Environmental Impact Assessment of Various Projects Using the Environmental Performance Value

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Abstract

The Environmental Impact Assessment (EIA) is a procedural tool which has as goal

to assess and evaluate possible environmental effects of a proposed project or action. The main aim of EIA is to reduce the environmental impact of a project at the earliest possible stage during the project cycle. The evaluation of impact significance is widely considered as one of the most difficult and least understood elements of the process. In this paper, 30 environmental impact assessment studies covering projects of different types and groups have been examined. Five assessment criteria (nature, magnitude, permanence, reversibility and confrontability) as well as several environmental components, covering all aspects of abiotic, natural and anthropogenic environment are used. Furthermore, two environmental conditions (existing and potential) and two basic phases of a project life cycle (construction and operation phase) are considered in order to calculate the Environmental Performance Values (EPV) of each project. The results fluctuate in a range band from -108 to 36 (major negative to major positive impacts) and EPV can contribute to the implementation of environmental and social accepted projects and consequently to the sustainable development of regions.

Keywords

Environmental impact assessment, environmental performance values, sustainability

(Paper 100, ID #139)

Methodologies for Measuring Sustainability in the Construction of Transportation Infrastructure

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Abstract

Sustainability has become increasingly important to the public and to decision makers. Much of the attention given to sustainable construction has focused on buildings, with high profile LEED projects taking center stage. Although less visible to the public, sustainability is becoming increasingly important in other projects such as transportation infrastructure projects, which are very important to the public but generally have a much lower profile than vertical construction. Sustainable infrastructure construction will play an increasingly important role both in the U.S., where much of the infrastructure is in substandard condition and requires reconstruction, and worldwide, as countries such as China and India expand their infrastructure to meet the demands of a developing economy. The purpose of this paper is to provide an overview of sustainability rating systems for infrastructure construction, specifically airports and roadways, as well as provide insight into how sustainable construction practices can be supported by agencies and leveraged across transportation modes. Specific projects that highlight both proven and innovative sustainable practices are also included.

Keywords

Sustainable construction, transportation infrastructure, LEED, Envision, airports, roadways

(Paper 101, ID #144)

Benchmarking Energy Efficient Design Practices in Pakistani Construction Industry

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Abstract

Energy saving is a high-priority around the globe due to depleting sources of energy production. Pakistan is amongst one of the major victim of Energy crisis. It is the matter of substantial fact that most of the buildings in Pakistan are not designed by keeping in mind the energy efficient principles. For this reason, energy-efficient measures are being increasingly implemented in all sectors. The building sector is responsible for an important part of the energy consumption in the world. Most of this energy is used in heating, cooling, and artificial ventilation Systems. But there are lots of parameters, if taken into account while designing buildings can significantly reduce energy consumption. A survey conducted indicates that the architects in Pakistani Construction industry somehow take into consideration different energy efficient parameters while designing buildings.

Keywords

Energy Efficient Design, Reduce Energy Consumption, Energy Efficient Parameters.

(Paper 102, ID #161)

Turning BIM into a Holistic Sustainability Assessment Tool

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Abstract

Sustainability assessment can prove to be highly effective when performed in early design phase of building projects. Currently, Building Information Model (BIM) applications are responsive towards environmental sustainability assessment. However, same is not true about economic and social sustainability dimensions. Requirements of including social and economic sustainability assessment in BIM based design process as well as continuously enriching geospatial information in 3D city modeling (3DCM) form has led towards the model design idea for BIM application plugin. Besides the growing understanding of social and economic significance in sustainability issues, design consultants still lack comprehensive tools that can holistically assist sustainable design process. The plugin application is to provide information relevant to economic and social sustainability parameters for different localities in urban environment. While making BIM based sustainability analysis inclusive of social and economic sustainability, this plugin will also play a positive role in design process for building projects by consolidating building development bylaws information at a common platform. The plugin is intended to help make comparative sustainability assessments of multiple design proposals for a project in different neighborhoods inclusive in terms of all sustainability dimensions and it will also help BIM

applications to mature in terms of business related with building projects.

Keywords

Real estate plugin, social sustainability, economic sustainability, Building Information Model (BIM), development bylaws

(Paper 103, ID #162)

A Preliminary Study of Reclaimed Water Infrastructure Systems

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Abstract

Traditionally, fresh water has been considered a human right and its consumption went unregulated, thus some regions have nearly exhausted this natural resource. As a result, governments around the world have begun to increasingly regulate the allowable consumptive use of its freshwater resources. Meanwhile, reclaimed water systems have been built more and more as fresh water supplies have been placed under increased pressure as a result of growing human populations and environmental pressures. This has forced the utility infrastructure owners/operators to limit their consumption through conservation and use of reclaimed water. This research will attempt to document why reclaimed water infrastructure systems in use today, identify the systems' benefits to the communities, and develop a list of challenges of the construction of the systems.

Keywords

Construction, Infrastructure Systems, Potable Water, Reclaimed Water

(Paper 104, ID #171)

An Investigation of Leadership Characteristics of Project and Construction Managers in the South African Construction Industry

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Abstract

The construction industry is different from other industries due to its unique characteristics. Moreover, construction projects involve different individuals and organizations which are all gathered to achieve a specific task at a specific time. However, South African construction projects sometimes face challenges relating to quality and cost overruns. These challenges can also be attributed to ineffective leadership in the South African construction industry. Therefore, it is important to evaluate leadership in the South African construction industry. Effective leadership can improve construction productivity, where its outcomes include effectiveness, satisfaction, and project success. The main objective of the study is to identify leading characteristics of

construction and project managers in the South African construction industry which influence the success of construction projects. The data used in this research were derived from both primary and secondary sources. The secondary data was collected via a detailed review of related literature. The primary data was collected through a well-structured questionnaire aimed at 150 projects and construction managers in the South African construction industry, 110 questionnaires were received (73% response rate). Data was analysis using statkon SPSS software, whereby frequencies and descriptive was attained. Findings from the study indicate that the main leading characteristics which influence the success of construction projects include monitoring for results, problem solving and informed judgment, team building, initiative, influencing, communication, visioning, planning and goal setting, time management, sense of responsibility, empowerment, discipline, ethics, positive expectations, conceptualization, and conflict resolution. Based on the outcomes of this study it is clear that leadership characteristics of a project and construction manager are important, to establish success from a construction project.

Keywords

Construction industry, construction managers, leadership, management, project managers, success.

(Paper 105, ID #178)

Bond Strength between Steel Slag Aggregate and Cement Paste – A Micro-level Examination

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Abstract

There has been an increasing use of steel slags as supplementary cementing materials (SCMs) and as aggregates in concrete production. While the utility of these industrial wastes has been highly recognized in sustainable construction, their effect on the wide range of mechanical and chemical properties of concrete is still being investigated. Micro-hardness as well as the bond between steel slag aggregate and hardened cement paste are presented in this paper. The interfacial zone between steel slag and hardened cement paste appears to be enhanced. Bond tests have shown that steel slag and cement paste exhibits higher interfacial bond splitting strength than natural aggregate and cement paste. Micro-hardness tests have shown that hardened cement paste is consolidated within about 60 μm from the aggregate particle. It is suggested that this is the result of a chemical reaction between the steel slag and cement paste coupled with mechanical interlock due to the texture of the steel slag.

Keywords

Cement, Slag, Bonding, Hardness, Concrete

(Paper 106, ID #179)

Leveraging Sustainable Construction with Lean and Integrated Project Delivery – A Socially Responsible and Smart Business Practice

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Abstract

This paper provides a review of sustainability in the built environment and examines its intersection with the emerging practice of Lean/Integrated Project Delivery

(Lean/IPD) to forestall the growing threat to climactic conditions worldwide. A review of the literature on a number of projects addressed the potential impact of lean construction practices and sustainability practices in LEED-compliant projects on both initial costs and life cycle costs. It was noted that the adoption of LEED certification in projects is frequently inhibited by exaggerated estimates of the cost of compliance. Lean projects were observed to experience savings in the range of 5% to 20% below market prices. The so-called LEED premium was noted to be an average of 1.87% for LEED Silver, 4.0% for LEED Gold, and 8.57% for LEED Platinum (Matthiessen and Morris, 2004). In principle, a LEED Gold facility built through Lean/IPD could be built for a net cost no greater than a traditional non-sustainable project. Ongoing operating costs would be reduced as well. The construction industry is strongly encouraged to adopt this model. It represents a smart business practice and helps to protect the environment at the same time. Construction Management programs could be an

important catalyst for this transition. It represents a smart business practice and helps to protect the environment at the same time.

Keywords

Lean construction, Integrated Project Delivery, Sustainability, LEED standards.

Appreciation

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

Mrs. Brenda Battle-Simms

Mrs. Amy Taylor

Ms. Kelly Reburn

Ms. Megan Lowery

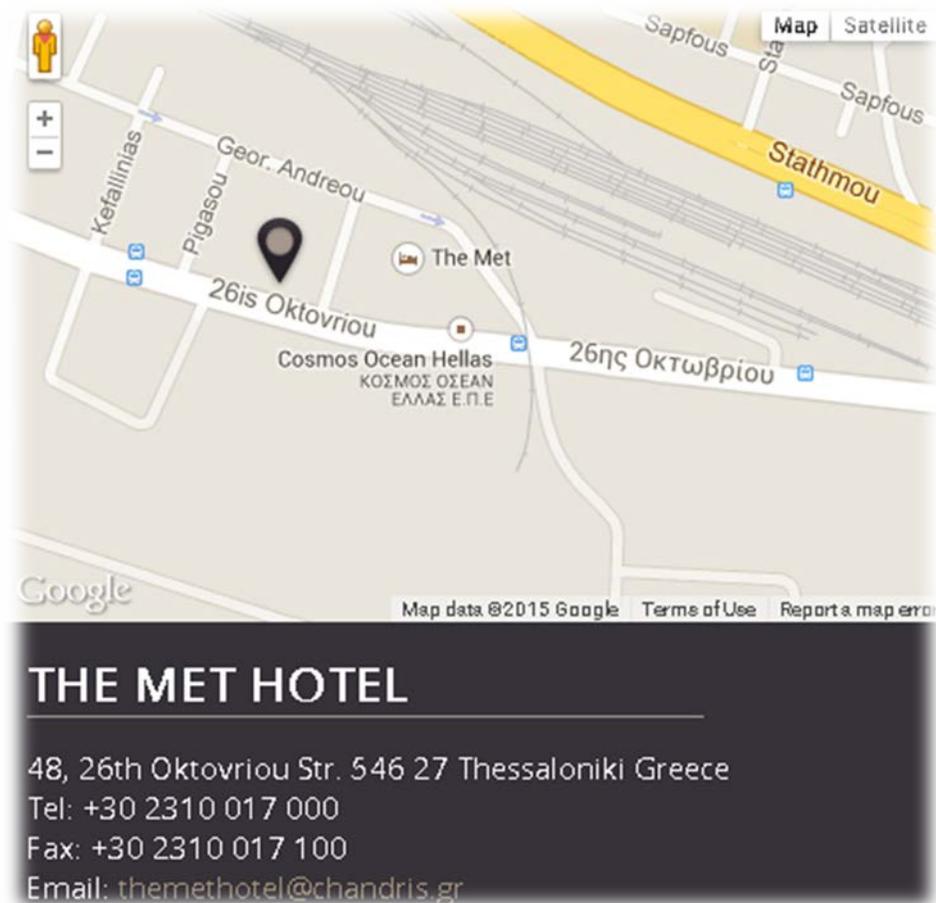
As well as those who assisted in the paper review process:

Dr. Donna Hollar

Dr. Jodi Farrington

Dr. Kamallesh Panthi

Hotel Information



The Met Hotel, located on the harbor of Thessaloniki, is the elegant venue of CITC's 8th international conference. The new harbor area of Thessaloniki is the western entrance to the city welcoming travelers with numerous nightlife venues, including "Mylos," a well-known entertainment complex providing galleries, theaters, restaurants and live shows. The Met is conveniently located near the city center and is an outstanding location for sightseeing and shopping. The hotel offers a free shuttle to the new One Salonica Outlet Mall; a perfect place to purchase souvenirs. Just three miles away from The Met is the Seafront of Thessaloniki. It is perhaps the city's most frequented place featuring not only the beautifully reconstructed shoreline and the City Port, but also a number of historical and modern buildings, monuments, sculptures and fountain such as the White Tower of Thessaloniki. Immerse yourself in the culture surrounding the hotel, or join us on May 30th for our social program where we will spend a whole day touring historic attractions such as the archaeological site of Vergina, Dion, and Litochoro.



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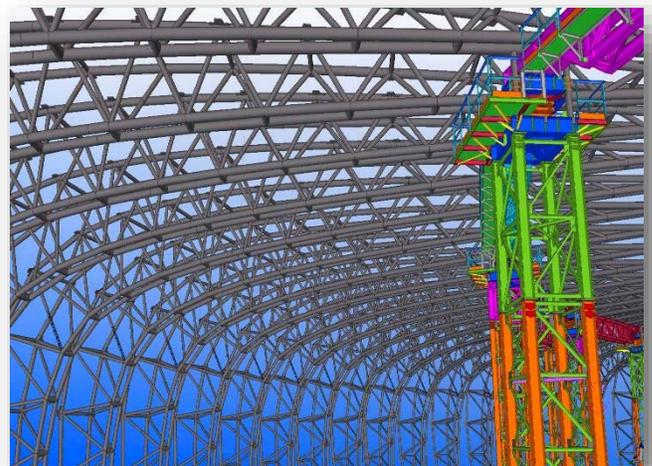


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Wednesday, 27 May 2015

09:00-10:30	Registration (Foyer)	
10:30-14:00	Metro Site Visit	
14:30-18:00	Registration (Foyer)	
15:00-16:30	Workshops:	
	MAISTROS B	OSTRIA
	<i>“Charrettes in Project Management”</i> Hector Rafael Leal and Victor Hugo Zamora Anderson	<i>“Visual Management for the Construction of Expo 2015 - Time Location Diagram”</i> Ivan Calimani
16:30-16:45	Afternoon Coffee/Tea (Foyer)	
19:00-21:00	Welcome Reception (Skybar)	

Thursday, 28 May 2015

7:30-8:30	Registration (Foyer)		
8:30-9:00	Welcome Ceremony with CITC-8 Chair, Dr. Syed M. Ahmed, AUTH Rector, Dr. Pericles Mitkas, Dean of the Faculty in Engineering, Dr. Konstantinos-Vasileios E. Katsampalos, Chair of the Department of Civil Engineering, Dr. Christos Anagnostopoulos, CITC-8 Co-Chair, Dr. Yiannis Xenidis		
9:00-9:45	Keynote Speech (MAISTROS B): <i>“The Future of Construction Education: Challenges and Opportunities”</i> - Dr. Mostafa Khattab		
9:45-10:00	Morning Coffee/Tea Break (Foyer)		
10:00-11:45	MAISTROS B	SIROCCO	OSTRIA
	Parallel Session 1 Chair: Abid Nadeem	Parallel Session 1 Chair: Odysseas Manoliadis	Parallel Session 1 Chair: Georgios Aretoulis
	<i>Lean Design Management- Waste Items of Architectural Design Process</i> S. Kaan Mazlum, M. Koray Pekerli*	<i>Construction as Biological Cells: Can Construction Cells be similar to Biological Cells?</i> Vasantha Abeysekera*, Mayur Shelke*	<i>The Role Of Inclusion on the Career Experiences of Professional Women in Construction</i> Valerie Francis*
	<i>Case-Based Decision Support Model for the Management of Design Related Changes in Design-Build Construction Works</i> Aydin Özgüneş, Ali Murat Tanyer*	<i>Lean Construction in South Africa: Myth or Reality</i> Fidelis Emuze*, Christiaan van der Linde	<i>Factors influencing women’s career choices in the construction Industry: An Exploratory Study</i> Elie Keighley, Sam Zulu*
	<i>Effect of Stakeholders' Risk Attitude on the Application of Project Risk Management</i> Mohamed El Agroudy*	<i>Study of a Construction Project in Greece Using Earned Value Analysis and Agile Project Management</i> Odysseas Manoliadis*, Lazaros Minasidis, Demetrios Oustadakis	<i>Women in Saudi Arabia Construction Industry: Motivations, Barriers and Perceptions</i> Alaa Naqadi*, Henry Abanda
	<i>Integrated Conceptual Model on Risk Mitigation and Construction Company’s Entry Decision into African Construction Markets</i> Sunday Odediran*, Abimbola Windapo	<i>Construction as Biological Cells: Managing Quality</i> Vasantha Abeysekera*, Mayur Shelke*	<i>Human Resource Challenges in the United States Commercial Construction Industry</i> Justin Weidman*

	<i>Quantitative Risk Assessment: A Pragmatic Approach</i> Albert Owusu*	<i>Are Adopting 'Modern Methods' Of Construction A Suitable And Efficient Way Of Delivering Client Budgets?</i> Paul Hampton*	<i>Analysis of Personal Characteristics and Cognitive Abilities of Project Managers</i> Dimitrios Ntaliaris, Georgios Aretoulis, Panagiotis Papaioannou, Glykeria Kalfakakou*
	<i>Application of DSM (Design Structure Matrix) Principles to Project Risk Management of Thessaloniki Metro Construction Project</i> Zoi Kazantzidou*, Stefanos Katsavounis	<i>Project Control Body of Strategic Knowledge for Complex Construction Projects</i> Nikolaos Kalyviotis*	<i>An Investigation Of Leadership Characteristics Of Project And Construction Managers In The South African Construction Industry</i> Murendeni Liphadzi, Clinton Aigbavboa*, Wellington Thwala
11:45-13:00	Lunch (Avenue 48), Presentation by TEKLA, a Trimble Company		
13:00-13:45	Keynote Speech (MAISTROS B): "Leveraging Sustainability with Lean – A Call for Action" - Dr. Lincoln Forbes		
	Workshops:		
	MAISTROS B	SIROCCO	OSTRIA
13:45-15:15	<i>"Project Stakeholders' Role for its Success or Failure"</i> Mohamed El Agroudy	<i>"An International Workshop on Building Information Modeling (BIM)"</i> Salman Azhar	<i>"Sustainability: Systems, Students, Faculty, Education and Initiatives for the 21st Century"</i> Erich Connell – Anton van Bakel
15:15-15:30	Afternoon Coffee/Tea (Foyer)		
	MAISTROS B	SIROCCO	OSTRIA
	Parallel Session 2 Chair: Dimitra Vagiona	Parallel Session 2 Chair: Athanasios Chassiakos	Parallel Session 2 Chair: Valerie Francis
	<i>Environmental Impact Assessment of various projects using the Environmental Performance Value</i> Dimitra Vagiona*	<i>Towards The Development Of A Life-Cycle Assessment Framework For Bridge Management: A Literature Survey</i> Teslim Balogun*, Adrienn Tomor, Colin Booth	<i>Importance of Organizational Behaviour Courses in Project and Construction Management Education</i> Esin Kasapoğlu*
15:30-17:15	<i>Optimal Construction Design Using The Harmony Search Algorithm As An Optimization Tool</i> Nikolaos Theodossiou*, Diamantis Karakatsanis	<i>Progress Monitoring of the Construction of Prefabricated Bridge with the Methods of Earned Value Analysis (EVA) and Earned Schedule Analysis (ES)</i> Ioannis Papaefthymiou*, Ioannis Tegos	<i>A New Way to Teach Structural Steel to Construction Management Students</i> Ajay Shanker*
	<i>Combined Use Of Simulation And Optimization Models For The Optimal Design Of Harbor Breakwaters. Application At The Port Of Thessaloniki.</i> Vasiliki Kralli, Nikolaos Theodossiou*, Theofanis Karambas	<i>Cost Analysis and Material Consumption of Highway Bridge Under Passes</i> Fani Antoniou, Dimitrios Konstantinidis, Georgios Aretoulis*	<i>Turning Brownfields into Goldfish</i> Effimia Tsocha*

15:30-17:15	<i>The Relation Between Building Shape and Energy Cost</i> Esra Bostancioglu*	<i>Technical and Economical Management of The Reconstruction of The Bearing Structure of an Existing Arcade in the City Centre Of Thessaloniki</i> Dafni Argyropoulou, Georgios Penelis, Ioannis Tegos*	<i>Adopting and Implementing New Technology in Commercial Construction</i> Justin Weidman*, Clinton Farnsworth, Melinda Mower
	<i>Factors impacting of time and cost performance in the Zambian Construction Industry</i> Sam Zulu*	<i>Sowing the Seeds of Success (SOW): The Provision of a Personalized Study Time Management Plan</i> Vasantha Abeysekera*, Ashoka Abeysekera	<i>Review of Leed Certified Construction Projects in Turkey</i> Beliz Ozorhon, Hasan Altun*
	<i>Digital DIY: EDFAB project</i> Yusuf Patel*, Dermott McMeel, John Chapman	<i>Implementing IPMA Standards In Managing Small-size/Non-complex Technical Projects: A Case Study Of A Photovoltaic Power Plant For A Residence</i> Paschalis Petridis, Alexandros Hatzigeorgiou, Odysseas Manoliadis*	<i>Progress @ NTUA: Training Engineers in Project Scheduling</i> Konstantinos Chatzoglou*, Elena Rokou, Konstantinos Kirytopoulos
19:30-22:30	Gala Dinner (Aldebaran M2 – Thessaloniki Concert Hall)		

Friday, 29 May 2015

	MAISTROS B	SIROCCO	OSTRIA
	Parallel Session 3 Chair: Mohamed El Agroudy	Parallel Session 3 Chair: Sameh El-Sayegh	Parallel Session 3 Chair: Aviad Shapira
8:30-10:15	<i>Automated Data Collection Technology Usage by UK Construction</i> Javad Majrouhi Sardroud*, Amir Hooshang Fakhimi, Mojtaba Abbasi	<i>A Relational Database for Construction Delay</i> Gozde Bilgin*, Gorkem Eken*, Irem Dikmen, Talat Birgonul	<i>Unmanned Aerial System (UAS) in Construction: Opportunities and Challenges</i> Julian Kang*
	<i>Analysis of Flexible Pavement Materials With Image Analyzer</i> Tariq Umar*, Sam Chris Wamuziri	<i>Resource Allocation in Line-of-Balance Scheduling</i> Athanasios Chassiakos*, Stavroula-Panayota Deligianni	<i>Security in Building Constructions: European Policies for Built Infrastructure Protection</i> Aikaterini Poustourli*, David Ward, Angelos Zachariadis
	<i>Intuitive Self-Inspection Techniques based on BIM for Energy-efficient Buildings: EU Horizon 2020 Research Project INSITER</i> Rizal Sebastian, Ton Damen, André van Delft, Gian Marco Revel, Antonio D'Antuono*, Milena Martarelli	<i>Line Balancing For Work Scheduling on a Construction Project</i> Naoto Mine*, Shinji Matsumoto, Yoshitsugu Uchiyama	<i>Systematic Approach to Crane-Related Near-Miss Analysis</i> Gabriel Raviv*, Aviad Shapira, Barak Fishbain
	<i>Defining the key considerations for initiating and implementing 4D BIM workflows</i> Aneesa Mulla, Andrew King*	<i>On the Use of Learning Curves for the Estimation of Construction Productivity</i> Antonis Panas*, John-Paris Pantouvakis	<i>Behavior-Based Safety Management On Construction Sites- A Field Study</i> Rizwan Farooqui*, Raja Shahmir Nizam
	<i>Legal and Contractual Challenges of BIM - Contractor's Perspective</i> Arjun Pandey*, Farzad Shahbodaghlou*, John Burger	<i>Factors Causing Construction Delays In Developing Countries - A Focus On Malawi</i> Robert Seyara*, Michael Tong	<i>Designing A Test Battery For Ergonomics of Personal Cooling Garments</i> Y. Yang*, Albert P.C. Chan

	<i>Using Building Information Modeling To Achieve Lean Principles by Improving Efficiency of Work Teams</i> Xun Zhang, Salman Azhar, Abid Nadeem*	<i>The Use of Project Scheduling Techniques in the UAE Construction Industry</i> Rami El Haj, Sameh El-Sayegh*, Rana El Haj	<i>Developing a Personal Cooling System for Construction Workers – An Experimental Approach</i> Albert P.C. Chan, W. Yi, Y. Zhao, Y. Yang*, Francis K.W. Wong, Michael C.H. Yam, Daniel W.M. Chan, Edmond W.M. Lam, Y. Li, Y. Guo
10:15-10:30	Morning Coffee/Tea Break (Foyer)		
10:30-11:15	Keynote Speech (MAISTROS B): “ <i>Advancing Undergraduate Construction Management Education: Lessons Learned From the Engineering Education? (A U.S. Perspective)</i> ” - Dr. ZeljkoTorbica		
11:15-11:20	Short Break for Setup		
11:20-13:00	MAISTROS B	SIROCCO	OSTRIA
	Parallel Session 4 Chair: Chris Souder	Parallel Session 4 Chair: KleopatraPetroutsatou	Parallel Session 4 Chair: Julian Kang
	<i>Determining the Most Economical Formwork System, A Contractor’s Perspective</i> Chris Souder*	<i>The Development of the Trans-European Transport Network in Greece: A Review and Critique</i> Marina Marinelli, Nikolaos Fragkakis, Sergios Lambropoulos*	<i>Towards the Reduction of the Construction Time and Cost of Reinforced Concrete Earthquake-Resistant Multistory Buildings</i> Michail Papadopoulos, Konstantinos Psarras*, Ioannis Tegos
	<i>Stochastic Preliminary Budget Estimating Template for Construction Firms</i> Eleftherios Stavrakas*, Yiannis Xenidis	<i>Methodologies for Measuring Sustainability in the Construction of Transportation Infrastructure</i> Sarah Hubbard*	<i>The Structural Behavior of Pozzolan-Lime Cement as a Potential Substitute to Portland Cement in Low-Strength Construction Applications</i> Dans Naturinda*, Anthony Kerali, Dan Tindiwensi
	<i>An Experimental Investigation Of the Effect of Carbonation On Properties Of Plain Concrete</i> Shaik Hussain, Dipendu Bhunia*, S.B. Singh	<i>Comparative Evaluation of Alternative Design Concepts of the “Underwater Road Artery of Thessaloniki” by Using The AHP Multi-Criteria Method</i> Nikolaos Tegos*, Demos Angelides	<i>Cost Leader in Change Order for Franchise Hotel Construction</i> Khalid Siddiqi*, Alexander Adekanmbi*
	<i>The Impacts Of Variation Orders On South Africa Public Sector Construction Projects</i> Ngwepe Lusca, Clinton Aigbavboa*, Wellington Thwala	<i>Derivation Of Utility Values Of Project Procurement Systems Against Selection Criteria For Major Highway Construction Projects</i> Fani Antoniou, Dimitrios Konstantinidis, Georgios Aretoulis*	<i>Development of Bio-Based Self-Healing Concrete to Increase Durability of Structures</i> Eirini Tziviloglou*, Virginie Wiktor, Henk M. Jonkers, Erik Schlangen
	<i>A Conceptual Process Framework for the Development of Briefs in Public Private Partnership Projects</i> Rauda Al Saadi*, Alaa Abdou	<i>Preliminary Cost Estimate Model For Road Underpasses</i> Nikolaos Fragkakis, Kleopatra Petroutsatou*, Marina Marinelli	<i>Composite Materials - CFRP - Applications in Construction – Suggesting new applications</i> Nikoleta-Maria Christopoulou*, Michael Malindretos

	<i>Project and Construction Management of Large Warehouses Logistics</i> Eleni Ioannidou, Ioannis Tegos*	<i>Financial Analysis and Comparison of Greek Construction Enterprises and Greek Materials Procurement Enterprises</i> Evangelia Manola, Fotios Katsaros, Georgios Aretoulis, Glykeria Kalfakakou*	<i>Current Trends and the Future for Intelligent Facades: A Review</i> Maria Tsemani*
13:00-14:00	Lunch(Avenue 48), Sponsor Presentation		
14:00-14:45	Keynote Speech (MAISTROS B): “ <i>The Achievement of Engineering Management Competence</i> ” - Prof. Dr. John-Paris Pantouvakis		
14:45-16:30	MAISTROS B	SIROCCO	OSTRIA
	Parallel Session 5 Chair: Vasantha Abeysekera	Parallel Session 5 Chair: Sergios Lambropoulos	Parallel Session 5 Chair: Saied Sadri
	<i>Wither Monetary Retentions for Subcontract Work? A Theoretical Framework for Rationalizing the Use of Retentions</i> Vasantha Abeysekera*	<i>Planning, Designing and Scheduling New Transport Infrastructure in Recession Times: The Greek Case</i> Marina Marinelli, Kleopatra Petroutsatou, Sergios Lambropoulos*	<i>Enhancing Cognitive Readiness of Construction Project Teams</i> Chinwi Mgbere, John-Paris Pantouvakis, Saied Sadri*
	<i>Public-Private-Partnership (PPP) And Cultural Sponsorship Law and Deontology</i> Antonios Maniatis*, Ioannis Meleas	<i>Public Private Partnerships in the Transportation Sector: An Overview and Case Studies in the United States</i> Sarah Hubbard*, Bryan Hubbard	<i>Involved Parties and Plan Formats in Equipment Planning for Mega Building Projects</i> Aviad Shapira, Albert Ben-David*, Steffen Philipp
	<i>Managing Risks in Public-Private Partnership Projects: The Case of Izmit Bay Suspension Bridge</i> Beliz Ozorhon, Sevilyay Demirkesen*	<i>Survival of Construction Companies in Crises through Process-Based Management</i> Serdar Ulubeyli*, Selim Sahin, Aynur Kazaz, Talat Birgonul	<i>Social Risks Influencing Export of Construction Services into African Markets</i> Sunday Odediran*, Abimbola Windapo
	<i>Emotional Intelligence in Construction Contract Administration</i> Gordon Vincent*	<i>Post Occupancy Evaluation of Healthcare Facilities: a Case Study of a Medical Department in the UAE</i> Alaa Abdou*, Haya Jamil Bin Rafea	<i>External Factors Affecting the Success of International Companies in the UAE Construction Industry</i> Sameh El-Sayegh*, Atefah Saleh
	<i>A legal approach to the Fédération Internationale des Ingénieurs Conseils (FIDIC) – The Yellow Bookcase</i> Antonios Maniatis*, Vasiliki Tsouvala, Evi Batra	<i>Post Completion Assessment Of Construction Projects Procured Under Design And Build Method In Education Sector Of Pakistan</i> Attallah Shah*, Ehsan Qazi	<i>Decisions Impacting on the Quality of Low Income Houses in South Africa</i> Fidelis Emuze*, Zandile Majola
16:30-17:00	Closing Ceremony and Afternoon Coffee / Tea (MAISTROS B)		

Saturday, 30 May**Social Program**

08:00	Departure from Hotel
20:30	Arrival in Thessaloniki

Conference Rooms (MAISTROS B – OSTRIA – SIROCCO)



Program at a Glance

Wednesday, 27 May

- 09:30-10:30 Registration (Foyer)
10:30-14:00 Metro Site Visit
14:30-18:00 Registration (Foyer)
15:00-16:30 Workshops:

“Charrettes in Project Management” (MAISTROS B) and “Visual Management for the Construction of Expo 2015 - Time Location Diagram” (OSTRIA)

- 16:30-16:45 Afternoon Coffee/Tea break (Foyer)
19:00-21:00 Welcome Reception (Skybar)

Thursday, 28 May

- 07:30-08:30 Registration (Foyer)
08:30-09:00 Welcome Ceremony (MAISTROS B)
09:00-09:45 Keynote Speech: Dr. Mostafa Khattab (MAISTROS B)
09:45-10:00 Morning Coffee/Tea break (Foyer)
10:00-11:45 *Parallel Session 1*
11:45-13:00 Lunch (Avenue 48), Presentation by TECKLA, a Trimble Company
13:00-13:45 Keynote Speech: Dr. Lincoln Forbes - (MAISTROS B)
13:45-15:15 Workshops:

“Project Stakeholders' Role for its Success or Failure,” “Building Information Modeling: Basic Concepts and Incorporation into the AEC Curriculum” and “Sustainability: Systems, Students, Faculty, Education and Initiatives for the 21st Century”

- 15:15-15:30 Afternoon Coffee/Tea break (Foyer)
15:30-17:15 *Parallel Session 2*
19:30-22:30 Gala Dinner

Friday, 29 May

- 08:30-10:15 *Parallel Session 3*
10:15-10:30 Morning Coffee/Tea Break (Foyer)
10:30-11:15 Keynote Speech: Dr. Zeljko Torbica (MAISTROS B)
11:15-11:20 Short Break for Setup
11:20-13:00 *Parallel Session 4*
13:00-14:00 Lunch (Avenue 48), Sponsor Presentation
14:00-14:45 Keynote Speech: Prof. Dr. John-Paris Pantouvakis (MAISTROS B)
14:45-16:30 *Parallel Session 5*
16:30-17:00 Closing Ceremony and Afternoon Coffee / Tea (Foyer)

Saturday, 30 May

- 08:00-20:30 Social Program