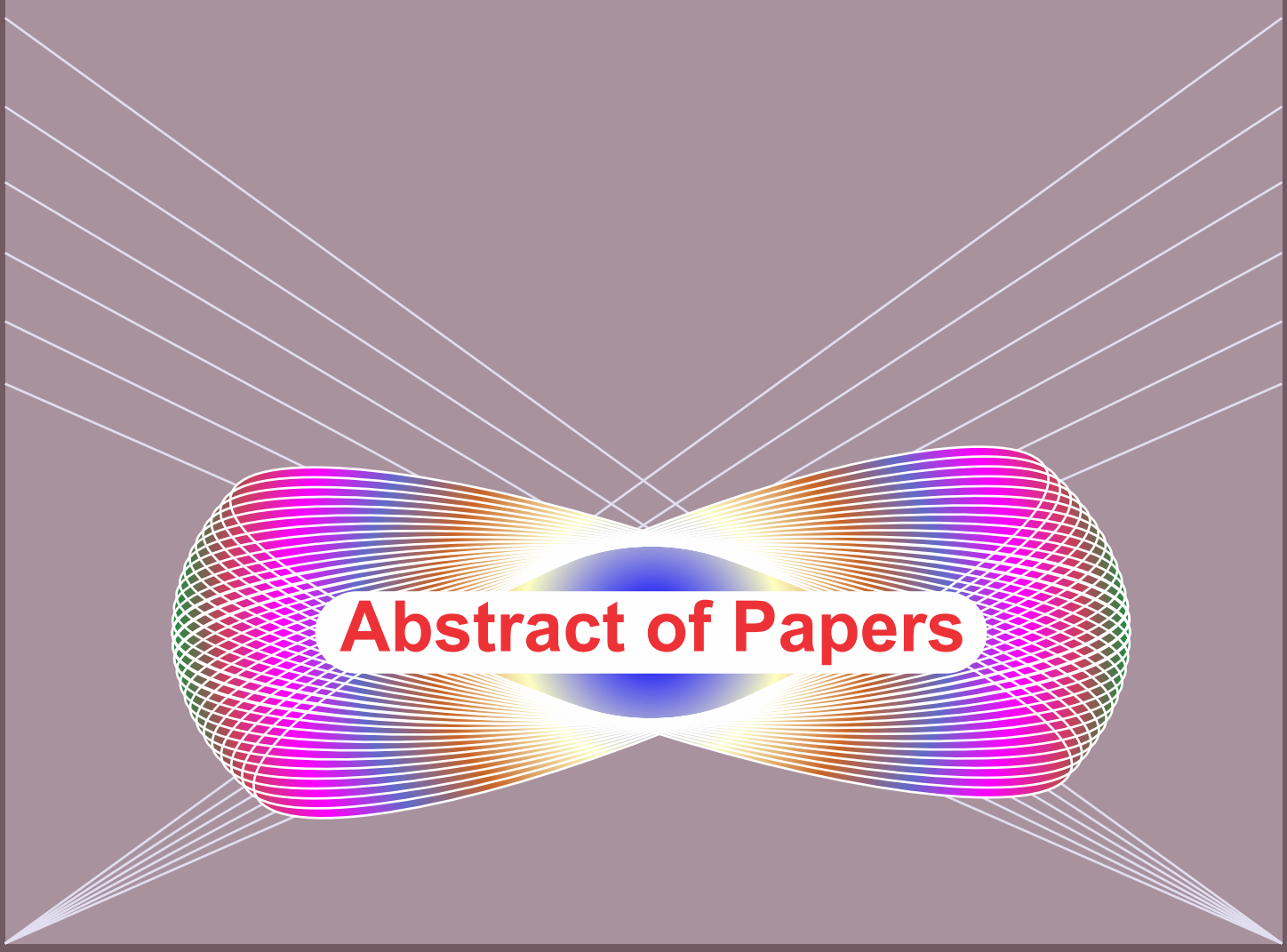
3rd International Conference

Construction, Real Estate, Infrastructure And Project (CRIP) Management



Organised by

NICMAR

National Institute of Construction Management and Research

Pune, India

November 23 - 25, 2018

About the National Institute of Construction Management and Research (NICMAR)

The National Institute of Construction Management and Research (NICMAR), has been constituted as a not for profit organisation with the express objective of engaging in activities for the promotion of education, training, research, professionalism and skill formation at all levels of the Construction Management, Real Estate Management, Infrastructure Management, and Project Management (CRIP). Besides this, NICMAR's objectives include undertaking special projects, collaboration with other organisations, dissemination of knowledge through seminars/conferences, etc; publishing literature, undertaking consultancy and taking necessary actions conducive to fulfilment of the objects of the Society. Under the Bombay Public Trust Act, 1950, NICMAR was registered as a Public Trust in 1982. The NICMAR Society was constituted in 1984, registered under the Societies' Registration Act, 1860. The Board of Trustees, the Board of Governors and the Director General, referred in the Memorandum of Association as the 'Chief Executive' of the Society, are responsible for all the decisions and actions related to NICMAR. At the Institute level, there is an Academic Council chaired by Director General which is responsible for all academic decisions. There is also a 'Research Advisory Board', an 'Academic Advisory Council' and a 'PGP Executive Committee' to provide advisory support in these areas. There is a well-developed internal organisational structure with well-defined roles and responsibilities for regular administration and management of the Institute. NICMAR takes pride in being a unique, specialised institute in the country dedicated to provide post graduate education, training, research and consultancy in Construction, Real Estate, Infrastructure and Project (CRIP) Management and allied areas in the country. Its educational programmes primarily involve imparting/acquiring particular knowledge and skills specifically needed for professionals in construction and allied industries such as real estate, projects and infrastructure. NICMAR received UNDP grant which enabled the Institute to involve eminent academicians from Massachusetts Institute of Technology, USA; University of Michigan, USA; University of Loughborough, UK; International Labour Organisation, Geneva; Indian Institute of Management, Ahmedabad and other institutes in India, and eminent practitioners from India in development of the first full-fledged curriculum for a two year Post Graduate Programme in Advanced Construction Management in the late eighties. NICMAR places strong emphasis on research and industrial consultancy. NICMAR faculty have published and presented a large number of research papers in national/international journals and conferences. NICMAR faculty members have been invited speakers at several conferences and won medals for their paper presentations. The Institute's work in research has led to its recognition as Scientific and Industrial Research Organisation (SIRO) by Department of Scientific and Industrial Research, Government of India consistently since 1990. NICMAR has undertaken sponsored research studies for various organisations including Government of Maharashtra, Govt. of India, organisations in public and private sectors, professional associations. The Institute faculty members publish/present over 250 papers in a year. The Institute has also successfully carried out many consulting studies for several organisations. In order to ensure that the Institute's educational programmes substantially benefit from research and consulting studies, there is strong emphasis on case writing by faculty members. As of now, faculty members have registered over 365 cases and teaching notes. Thus education, research, industrial problem solving and training efforts are all directed to make available a professionally competent human resource to carry out the many challenging jobs that need to be effectively performed in the Institute's chosen areas of concentration.

Abstract of Papers
3rd International Conference

On

Construction, Real Estate, Infrastructure and Project (CRIP) Management

November 23 - 25, 2018

Chief Editor : **Dr. Mangesh G. Korgaonker**
Editor : **Dr. Jonardan Koner**

Organised by
NICMAR
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Pune, India

Convener's Message

On behalf of the organizing committee, I welcome you to the 3rd International Conference on Construction, Real Estate, Infrastructure and Project (CRIP) Management (ICCRIP 2018), November 23–25, 2018, at National Institute of Construction Management and Research (NICMAR), Pune, India. This conference is a conglomeration of Academicians, Researchers, Industry Practitioners and Engineering/Architecture/Planning students with the aim to stimulate research and discussions across the broad spectrum of CRIP management.

We have received numerous research papers from eminent academicians, practitioners and students from India and abroad. The papers are based on a variety of themes relevant to the areas like Construction Management, Project Management, Real Estate Development and Management, Infrastructure Development and Management, General Management, Sustainable Development, Smart City Development and Management, Lean Construction and Critical Chain Project Management, Technological Transformation and Digitalization in Construction Industry and Advances in Transportation Technology and Systems. The papers selected for presentation in this conference have gone through the 'Blind Review Process' and we are confident that the selected papers will provide significant insights into a broad range of CRIP sector advances and issues across the globe. I am convinced that these two days of the conference will provide you with an intellectual feast and it will indeed be an enriching experience for all our participants. You will be able to listen to our highly distinguished chief guest, the guests of honor and the chief patron of ICCRIP 2018 during the inaugural function. Furthermore, there are plenary addresses by our eminent keynote speakers. During the valedictory function of ICCRIP 2018, there will be addresses by the leading experts from industry and eminent academicians. It is our belief that ICCRIP 2018 will serve as a good forum for disseminating and enhancing knowledge, furthering the cause of research & publications in the CRIP domain and networking among the leaders from industry, educational institutions and the participants.

I hope like our previous international conferences, this conference will also achieve its objectives and make a valuable contribution to the CRIP sector.

Dr. Jonardan Koner
Professor and Dean – Admissions, Research & Publications,
NICMAR

Acknowledgement

As the Convener of ICCRIP 2018, I wish to acknowledge all those individuals without whose support, guidance and incessant efforts, the conference would not have seen such an astounding success. At the outset, I express my heartfelt gratitude to the Chief Patron, Dr. Mangesh G. Korgaonker, Director General, NICMAR, for his constant support, guidance and encouragement. I am grateful to the Chief Guest, Honorable Shri. Tathagata Roy - Governor of Meghalaya and Mr. S. C. Dixit - Executive Director, Shapoorji Pallonji & Co. Ltd., Mumbai and Guest of Honour Shri. Kiran Gitte, I.A.S. - Metropolitan Commissioner and CEO, PMRDA, Pune and Dr. Brijesh Dixit - Managing Director - Maha Metro Ltd., Nagpur, for cordially accepting our invitation and gracing the conference with their esteemed presence.

I thank the Keynote Speakers, Dr. Eldho T. I. - Institute Chair Professor & Head, Department of Civil Engineering, Indian Institute of Technology Bombay, Mr. Kaustuv Ghosh - Head of Technical Services - Residential and Factory Business, Larsen & Toubro Ltd., Mumbai, Mr. Uday Dharmadhikari - Chairman - Advisory Committee, Indus Strategy Financial Advisors, Mumbai, Dr. Anoop Sattineni - William A Hunt Associate Professor, McWhorter School of Building Science, AUBURN University, USA, Prof. Alan Bugg - Assistant Professor, McWhorter School of Building Science, AUBURN University, USA, Prof. Charles Egbu - Dean, School of The Built Environment and Architecture, London South Bank University, UK, Mr. Tridip Luson Sarma - General Manager (HR), Patel Engineering Ltd., Mumbai and Mr. M. P. Naidu - Project Director, Larsen & Toubro Metro Rail (Hyderabad) Ltd., Hyderabad, for accepting our request to share their words of wisdom and enlightening the participants with their valuable insights.

I acknowledge the support and cooperation from our sponsors, Platinum Sponsor is Shapoorji Pallonji & Co. Ltd.; Gold Sponsors are L & T Construction and A.P. Hospitality Services; Silver Sponsors are HDFC Credila Financial Services Pvt. Ltd. and ICICI Bank; Co-sponsors are Bank of Maharashtra, Canara Bank, Janata Sahakari Bank Ltd., Andhra Bank, Saraswat Co-operative Bank Ltd., M/s. Avaya Construction Company, HDFC Ltd. and Bank of Baroda without whom the conference would not have been a reality.

I extend a special word of appreciation to the ‘Reviewers’ for reviewing the papers within the strict deadlines and giving quality feedback.

I owe special thanks to the ‘Advisory Committee’ Dr. Milind Phadtare, Dean – PGP, NICMAR, Dr. Chandrakant S. Gokhale, Dean – SOCM, NICMAR Pune, Dr. J. C. Edison, Dean – SOGM,

NICMAR Pune, Dr. Seshadri Tirumala, Dean – NICMAR Hyderabad at Shamirpet, Dr. Indrasen Singh, Dean – NICMAR Goa at Farmagudi and Dr. Rajesh Goyal, Dean – NICMAR Delhi NCR at Bahadurgarh for their guidance.

I appreciate the unwavering zeal and commendable effort of the 'Conference Organizing Committee', comprising Dr. Sudhir Ambekar, Dr. Amit Hiray, Dr. Dipayan Roy, Dr. Rahul Deshpande, Dr. Tushar Jadhav, Prof. Priyanka Bendigiri, Dr. Kirti Rajhans, Dr. Avinash Purandare, Dr. Amol Pawar, Dr. Milind Jagtap and Dr. Soumi Rai, NICMAR, Pune for their active cooperation in organising this conference.

I am thankful to the 'Co-Editors' Dr. Kirti Rajhans, Dr. Rahul Deshpande, Dr. Amol Pawar, Dr. Sudhir Ambekar, Dr. Amit Hiray, Dr. Tushar Jadhav, Dr. Dipayan Roy, Dr. Smita Patil and Prof. Priyanka Bendigiri for finalising this book and arranging the poster presentations.

I am grateful to the paper presenters, research scholars from different universities and institutes, who have submitted their research papers / poster papers and contributed in a meaningful manner to add value to this conference.

Lastly, I would like to extend my gratitude to all the participants, organizers, faculty, staff of NICMAR for all their effort and support.

Dr. Jonardan Koner
Conference Convener, ICCRIP – 2018
Professor and Dean – Admissions, Research & Publications,
NICMAR

Content

Design and Construction Aspects of Floating Dry Dock Gate

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Abstract

Dry dock is one of the most important infrastructure facilities for ship repair. Dry dock as the name suggests is a dry enclosed area in continuation of sea, where the vessel can float and reach when its gate is open and then gate is closed and water is pumped out to make it dry working area. The major components of a typical dry dock are dry dock floors and allied facilities, dry dock walls with provision for other amenities, dry dock gates and dry dock equipments. Dry dock gate is one of the most important and critical element of a dry dock. These gates are highly variable in type, principle and design, the choice being governed by the different features which may be required and the different conditions under which the gates must operate. The paper presents the design, fabrication, construction and installation aspects of a floating type dry dock gate along with its foundation for a slipway-cum-dry dock for a ship building and ship repair yard in Goa.

Keywords: *Dry-Dock; Floating Gate; Ship Repair; Shipyard; Slipway*

Planning Slum Rehabilitation/Redevelopment Projects: Evaluation and Learning from Mumbai

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Abstract

India is on an accelerated path of urbanisation but several Indian cities face the challenge of housing their growing population, especially the urban poor. Much of the population is forced to living in slum settlements, especially in large cities like Mumbai. Undertaking slum rehabilitation/redevelopment schemes (SRS) becomes essential for cities to improve housing conditions of the urban poor. However, the planning of such rehabilitation/ redevelopment schemes tends to focus on physical aspects while ignoring the social aspects, which in turn can affect the living environment and overall development of the community. This paper attempts to makes an evaluation of such SRS projects in Mumbai through a survey of the beneficiary slum dwellers to assess their effectiveness. The results indicate that social infrastructure at community level is not well integrated into the SRS project planning, thereby affecting the overall development and living

environment of slum dwellers. Therefore, other Indian cities have to keep it in mind in the planning and design stage of SRS projects.

Keywords: *Urban Poor; Mumbai; SRS; Physical Infrastructure; Social Infrastructure*

Study of Existing Traffic Condition at a Mumbai Suburban Railway Station: Case Study of Kalyan

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Abstract

Transportation is the backbone of any economy as it facilitates the quick and efficient movement of men & material from one place to another. Cities and towns can develop faster if they have a good transport facility in place. Transportation system is an arm of the infra-structure, which will play an important and vital role in promoting economic growth and prosperity. In the near future urban areas will be contributing to sustain the high rates of economic growth if and only if they have proper and efficient transport system. The present study is of greater importance as efforts of implementing SATIS (Station Area Transport Improvement System) have not yielded the desired results and the chaos in the station region and its extended areas continues. This study was conducted to explore the possibility of improving the quality of traffic movement and ease the congestion. In the past decade, although there have been significant technological improvements, in almost all fields, but traffic management technologies have received a step motherly treatment and are still in the primitive stage. A clear framework for traffic operations is necessary especially for traffic delays, congestion, and management functions. The prolific but poorly planned developments in the city have added confusion and chaos. It has also been responsible in creating an unmanageable traffic condition especially near the station area extending almost to a radius of one kilometre around it. This paper is an attempt to study and understand the chaotic conditions, the reasons thereof and the probable remedy in easing the conditions to manageable levels. A detailed study needs to be undertaken and remedies which will help to remove congestion, reducing time delays and presenting a blueprint of the framework of operations can be suggested for the future.

Keywords: *Urban Traffic Control; SATIS; Congestion; Traffic Intersection*

Rain Water Harvesting Through Street Light Poles

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Abstract

The developments in field related to environment are increasing rapidly, so as to save the earth from damage from human being. The disclosure here in is concerned with the continuously decreasing groundwater level and generation of electricity through solar pane, simultaneously. In this work a setup has been designed and manufactured which can easily be implemented on street light poles. And which will result in to harvesting of rainwater (i.e. increase of ground water level) and generation of electricity, simultaneously. There is less literature related to rain water harvesting through street light poles, which can be observed in this study.

Keywords: *Electricity Generation; Groundwater Level; Solar Panel Street Light Poles; Rainwater Harvesting*

Analysis of Productivity Criteria for Selection of Formwork System for Construction of High Rise Building Mega Projects

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Abstract

For the construction of high rise buildings in mega projects where the quantum of work is more, the construction and execution process must be efficient. Various methods of construction are available, and the choice must be made. This paper determines the criteria for selection of construction method based on Speed, Cost, and Quality. The analysis is made by comparing the Conventional Formwork System, Aluminium Formwork System, and Tunnel Formwork System.

Productivity is the parameter of the quantum of work involved in a project which considers the speed of construction, cost of construction and reusability of the formwork in the above-mentioned construction methods. Variation in the productivity with a change in its parameters gives the threshold value to serve as the formwork selection criteria. This threshold of the quantum of work is compared with the estimated work of the proposed project to make the decision.

The formwork cost and the rate of development for a square meter of the built-up area are calculated and verified from the data obtained at the case study for various formwork systems. It is compared

with results obtained by the thumb Rule analysis made by considering the cost and market value for development.

The justification and inference are made based on the results obtained by Rate Analysis, Thumb Rule Analysis, and Productivity Analysis. The paper gives the summarized report on the Interpretation of the Productivity Threshold and its comparison with the obtained and analyzed data.

Keywords: *Project Planning; Productivity Analysis; Selection Criteria; Formwork Systems; High Rise Buildings*

Impact of R&D Expenditure, Innovative Infrastructure and Financial Development on Innovation Activity: A Cross Country Panel Data Empirical Investigation

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Abstract

Over the last decades, the most significant driver of growth rate for many nations has been technological advances and thus any policy that promotes technological innovation always ranks among the top priorities for emerged and emerging nations. The objective of the paper is to see the impact of financial development, innovative infrastructure development and expenditure on research and development (R&D) on innovation activities in a country. Four variables namely High-Technology Net exports as a percentage of total net exports which is used as a proxy of innovation activity (Dependent Variable), R&D Expenditure as a percentage of GDP which is used as a proxy of R&D activities, Domestic credit to private Sector as a percentage of GDP as a proxy of financial development and state of Clusterization which is used as a proxy of innovative infrastructure are the variables identified based on literature review. A random effect panel data regression analysis with robust estimates is used to determine the impact. Breusch and Pagan Lagrangian multiplier test was conducted to find the suitability of random effect model. It is observed that R&D Expenditure as a percentage of GDP significantly drives the high tech net exports.

Keywords: *High-Technology Exports; Clusterization; Infrastructure; Innovation; R&D*

Self Compacting Concrete – Present Scenario and Future Scope in India

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Abstract

The two indispensable requirements of today's modern structures are – Strength and durability. Both these requirements are satisfied by self compacting concrete (SCC), the production and properties of which are greatly enhanced from the conventional concrete.

Developed about 30 years ago in Japan, SCC possesses three unique qualities of - compacting under its own weight, extreme flowability and resistance to segregation even in congested reinforcement. Despite of these benefits, SCC's application in India is very limited as opposed to the global trends.

The paper aims to explore the difference between conventionally vibrated concrete (CVC) and SCC in order to analyze the constrained application of SCC presently. With structures such as Burj Khalifa and the Bandra Worli Sea link to SCC's credit, this work would illustrate how SCC is the need of the hour for India's growth story. Due to the growing need for both high rise buildings as well as greener alternatives – SCC would provide an amicable solution without having to compromise on design or quality. The paper also aims to show that standardization of SCC in Indian codes is needed and that it is bound to happen in the near future.

Keywords: *Self Compacting Concrete; High Flowability; Eco-SCC; High Rise Buildings; Durability*

Energy Efficient Application of Sunpipes in Educational Institutes

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Abstract

Schools and colleges are constantly faced with optimizing limited budgets to ensure maximum facilities. Electricity constitutes a majority of this expense, with lighting costs contributing to 30% of the same.

Sunpipes provide natural lighting even in urban towns with a congested population. Not only this but also a majority of schools in our country do not even have electricity connections (18 states show statistics (2013-14) lower than 50% for primary school electricity connections) resulting in improper lighting conditions, which in turn affects the quality of education.

Sunpipe (patented technology)–a tube or pipe for transportation of light to another location, minimizes the loss of light– thus serves as an effective solution by completely eliminating the need of electricity and incorporating daylight elements as well. India, being a tropical country, provides climate completely favourable to the installation of sunpipes.

Also, the use of sunpipes makes the institutional building Green as it employs a renewable source of energy. At the same time, it would inculcate in the students, from a tender age, the importance of conserving energy and making a sustainable environment.

The present paper would illustrate the energy and economy efficient application of sunpipes in the concrete laboratory of L.D. College of Engineering, Ahmedabad with a view to extend the same to all such institutes.

Keywords: *Sunpipes; Green Building; Solar Energy; Educational Institutes; Daylight*

A Study of Green Buildings in Kerala

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Abstract

Globally, construction industry takes into account for a huge share of energy, electricity, and water and material consumption. The construction sector is responsible for 18% of global emission at present or an equivalent of 9 billion tonnes of CO_2 annually. Thus, there is a momentous need for techniques and measures to be adopted in order to protect the environment. The Green Building practices have great potential to reduce the environmental impact at a little or no cost. The study deals with the countless techniques and skills adopted in construction industry to reduce the impact of buildings on the environment and the human health. Kerala is an emerging state, in terms of development in infrastructure and real estate. Due to the escalating number of construction projects, the environment is being affected in a major way. Hence, it is necessary to develop the conventional methods of construction by the amalgamation of Green Construction techniques. The study has been made with a major focus on the Green Building standards, waste management, preservation of natural features/landscaping, energy efficiency, air quality, solid waste management and green mobility.

Keywords: *Green Building; Green Construction Techniques in Kerala*

Potential of Grey Water to Aid a Competent Water Management System in Gujarat

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Abstract

The interest in the separation and reuse of different wastewater fractions has escalated in recent years enormously due to economic and ecological considerations. Grey water is domestic wastewater except toilet waste (black water) and may include wastewater generated from a washbasin, kitchen, bath, shower and laundry.

Despite the efforts of Narmada project, the drought prone regions of Saurashtra, Kutch and North Gujarat are in throes of severe water crisis. Water levels in the dams are running low. As per an article of The Hindu, Sardar Sarovar dam which has a capacity of 5,860 million cubic meters has only 455 million cubic meters of water in 2018. Grey water is an asset which has huge potential to alleviate this issue. Grey water when satisfactorily treated can be reused in various domestic uses as well as fulfil irrigation requirements. Different types of methodologies may be used for its treatment. People have started realizing the need of grey water and as a result in regions like Mehsana and Rajkot of Gujarat the grey water is being incorporated into the water recycling system. This research paper aims to find the effectiveness of grey water system in certain regions of Gujarat considering its irrigation reuse and domestic reuse. The research paper includes the economic criteria as well as case studies of present condition of recycling systems being used and the future scope of the same.

Keywords: *Grey water; Water treatment; Future Scope; Domestic Reuse; Agricultural Reuse*

Impacts of Complex Building Services and Aesthetical Elements in the Management of Modern Construction Projects

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Abstract

Modern construction projects are becoming increasingly complex and difficult to manage owing to the 4M's – Men, Material, Money and Machines. Each one these M's has its own constraints and the constraints always are expressed in one word – "scarcity". Many a time, delays in projects are credited to the scarcity or non-availability of the resources. The principles of project management theoretically deal with all the risks and constraints associated with a project; and the project manager as well as the project management team is expected at all times to offer a wide gamut of solutions to

any or all of the problems that lead to delays. But the point to ponder here is – what leads to the scarcity or non-availability of the resources? Right from the curvy and complex organic forms of Frank O. Gehry, where fabrication and execution dominate the architectural design process to the SkyPark of Marina Bay Sands by Moshe Safdie, where a collaboration between various consultants were needed indefinitely – the project management team had always gone through tremendous pressure and deadliest deadlines to complete the projects within the schedule. The more complicated and sophisticated the utilities (general building services) and the application of unique materials (imported, rare and expensive materials) for aesthetic appeal on a project are – the more will be the delays – unless and otherwise properly planned. This technical paper deals with the impact that complex utilities and aesthetics can create in a construction project and the ways to handle them through a case example and analyzing best practices.

Keywords: *Construction; 4M's; Utilities; Aesthetics; Resources*

Behavioral Analysis of Commercial Real Estate Market With Reference to Bangalore

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Abstract

Bangalore has been very consistent in being the most sought after destination for the technology occupiers. In 2017, Bangalore retained its dominance in leasing and renting of commercial real estate space. Out of the total commercial real estate market supply of 34 million Sft, Bangalore topped the list with record breaking more than 15 million Sft of leasing, which constitutes to around 36% of the overall supply. At the same time, the vacancy rate was 9% which is expected to come down to 7% towards the end of 2020. It looks to be very difficult to retain the top spot in the years to come – as many occupiers have started looking at Tier II and Tier III cities for their back-office operations while others are more focused towards the nascent concept of "co-working spaces", which offer a greater level of flexibility. Few estimates project that the Indian economy is expected to grow over 7% over the next few years and recover fully from the adverse repercussions of demonetization and implementation of Goods and Services Tax (GST) and the role played by the real estate vertical will be a major one. With more and more acquisition, joint ventures and foreign investments in the pipeline, this study will predominantly focus on the behavioral drivers in the market of the chosen region and their effects on the market dynamics. The various drivers that will be studied upon are expert behavior, consumer behavior, economics behavior, organizational behavior, spatial analytics,

and real estate legal framework. All these drivers have a direct impact on decision making which in turn will change the dynamics of the market.

Keywords: *Commercial Real Estate; Behavioral Drivers; Investment Decision Making; Behavioral Factors; Cognitive and Emotional*

Economic and Technical Analysis of PET Bottles as a Replacement of Brick in Low-Cost Housing

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Abstract

Plastic products have been considered as the world`s most economical packaging solution, it has led to an exponential increase in plastic derived waste. Amongst plastic waste, the percentage of plastic bottles has-been increasing as millions of people drink water, soft drinks, etc. From plastic bottles and as expected they don't dispose of it by crushing. Most of these plastic bottles are made of PET.As PET does not decompose, it remains only as fragments or pieces, and hence their disposal is a serious issue.

There are many possible ways to dispose off/reuse/recycle plastic bottles. But these all alternatives, directly or indirectly are responsible for environmental degradation. As the cost of recycling is too high, very few industries prefer recycling of plastic waste. Out of total plastic waste generated only a limited amount of waste is recycled.

Replacement of brick by the plastic bottle in building construction appears as one of promising solution for reuse of plastic waste. This research works on application of used PET plastic bottles cell (i.e. taking 4bottles together tightly hold with a rope or string or some suitable material) as a brick or concrete block. The PET bottles cells are tested for its strength in compression. Further, analysis would be done on the possibility of these PET bottle cells as a replacement building block in *Pradhan Mantri Gramin Awaas Yojana* (PMGAY).

Keywords: *PET Bottles; Bottle Bricks; Low-Cost Housing; Construction Material; Plastic Waste*

Feasibility Study for Development of an Online Portal for Buying, Selling and Renting of Surplus, In-Hand Material and Equipment Inventory for Construction Companies in Pune Region

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Abstract

Buying, selling and renting of surplus, in-hand material and equipment inventory management in a construction industry is a critical component of the project. The organization needs to understand the effect of use of correct timing for buying, selling, renting of material and equipment for minimizing the project inventory cost. Developing an online portal (platform) for buying, selling, renting of surplus, in-hand material and equipment among the construction projects has the potential to both improve project performance, and availability of material and equipment. Material and equipment represents a major expense in the construction, so the purpose of developing an online portal is to minimize material and equipment holding cost, as it gives opportunities for reducing the overall project cost. The objective of the research paper is to identify several problems with the buying, selling, and renting of material and equipment inventory in construction industries in Pune. The case studies data will be collected, based on semi-structured interviews using questionnaire, with several leading companies in Pune. The findings of this survey will help us to develop a basic online portal to optimize the use of material and equipment at the minimum cost and at a perfect time for the purpose of ease of project execution and to minimize the material and equipment inventory cost for construction projects.

Keywords: *Online Portal; Construction Industries; Material Management; Equipment Management; Surplus Inventory; In-hand Inventory*

Operating Conditions of Cranes Used in Construction Industry – A Case Study

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Abstract

The complex, dynamic, and continually changing nature of construction work has been recognized as an important contributor to the high rates of injuries and fatalities in the construction industry. Construction equipment's are a central component of many construction operations and are associated with a large fraction of construction deaths. Estimates suggest that cranes are involved up to one third of all construction and maintenance fatalities. Safety and health professionals serving the

construction industry need adequate training and knowledge in crane safety devices and procedures so that they may insure these techniques are effectively utilized during construction operations. In the construction sites cranes are used to hoist and transport a variety of loads near and above people, working under crowded conditions, and often under time, budget, and labor constraints. This work regime further increases the safety risk on sites that are inherently hazardous workplaces. A case study was done on cranes used in construction industry to study in detail the operating conditions as well as safety precaution during operations.

Keywords: *Hoisting; Anti Collision; Tower Crane; Gantry Crane; Working Radius*

Liquidation of Construction Claims: An Attempt through the Smart Contracts

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Abstract

One of the most detrimental impacts of delayed resolution of construction dispute is the severe impact on the cash flows of the aggrieved party. Several thousands of crores of monies are held in the form of unsettled disputes at various levels in the hierarchy of dispute resolution. While we cannot blame any party or the resolution process or the methodology owing to the complex nature of construction disputes, it is not justified to delay the process of settlement of genuine claims. Though there have been various attempts at different levels, there has been a minimal success in infusing the much needed liquidity in the construction sector. The need for the day is an arrangement that both preserves the sequential process of dispute resolution as well as meets the cash flow needs in genuine cases. With the help of the General Conditions of Contract of the CPWD, the authors demonstrate a procedure that is expected to resolve the liquidity crises due to unresolved claims. The process however must ensure seamless execution with precision timing and predictability. In such a scenario there is an utmost requirement of self executed, auto controlled system that triggers based on actions agreed upon in the legal contract. Smart contract, a digital contract based on Blockchain could be a solution to this problem. As smart contract enables distributed, encrypted and secure logging of digital transaction, it is an augmentation of traditional legal contracts and provides the execution mechanism for a traditional legal contract. Smart Contract is one such promising framework that the

authors have explored through this paper, which can help contractors to manage claims without getting into liquidity issues.

Keywords: *Dispute; Resolution; Contract; Construction; Smart Contracts*

Analyzing the Influence of Ecological Aspects in Urban Spaces for Sustainable Development: A Case Study of Chennai

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Abstract

Eco-design for the cities achieved through well planned urban green spaces. A green space in urban areas adds aesthetic value as well it gives stress-free environment for the community. It provides social interaction, human-nature interaction, leisure activities and community gatherings. It creates a mood based on its spatial and physical quality and they are the significant elements of an urban ecosystem. Conserving green spaces in the cities helps improve the well being of the people. Integrating the ecological principles in city planning ensures physical, social, cultural and psychological benefits. The natural environment can be achieved through the conservation of natural systems, which paved way for sustainable development. The sustainable city planning transforms urban centers into walkable communities. The outcome of this study suggests the framework of eco-city development and knowledge on eco-friendly sustainable development.

Keywords: *Eco-City; Sustainable; Urban Green Space; Environment; Ecology*

Financial Feasibility Analysis of Slum Rehabilitation Scheme Projects in Mumbai

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Abstract

Slum enclaves in prime localities of the city have turned out to be gold mines for private developers. In an irony of sorts, some of Mumbai's most expensive luxury residential skyscrapers have been built on slum land as part of the state government's controversial slum rehabilitation scheme.

Most of the private developers and Constructions Company wishes to make capital investment for a project where maximum profitability is achieved. However, due to complexity in the full execution of Slum Rehabilitation Authority (S.R.A) scheme project. It is difficult for a developer to find out

decision about investment in SRA projects. The present study shows a financial feasibility analysis carried out for the project to be executed under SRA Scheme. Statutory cost, Construction cost and Other Miscellaneous cost are calculated to find the Total cost of Project. A result of feasibility study demonstrates that it is possible for Developer to achieve profit in the range of 50% - 60% per annum on the Investment.

Keywords: *Financial Feasibility Analysis; Investment; Profitability; SRA Project; Statutory Cost*

Decision Support System for Selection of Sustainable Sanitation System for Medium Towns

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Abstract

Sanitation is one of the most fundamental necessities for any human settlement. On-Site Sanitation facilities (OSSF) are the primary mode of sanitation system in India. Open defecation and untreated faecal septage is the one of the biggest reason for water resource pollution in India. On the other hand centralized sewerage systems are not technically or financially viable for most small and medium towns and areas with water supply less than 70 lpcd (liters per capita per day). So there is a need to develop a broad resource base for decision-makers which will enable them to understand the sanitation needs of a city.

The aim of the study is to devise a standard framework with a range of treatment technology options that will be helpful for urban local bodies in India. The objective includes studying the various types of sanitation system for septage management along with best practices through literature study and identify of the parameters that affect the selection of treatment technology. Further the paper tends to research various tools for sanitation situation assessment of the town

The expected outcome of this study is developing a model with suitable and sustainable sludge treatment technology for septage management based upon the parameters and the characteristics of the town using analytic hierarchy process.

Keywords: *Analytic Hierarchy Process; Onsite Sanitation System; Septage Management; Sustainable Sludge Treatment Technology; Universal Sanitation*

Advanced Investigation of Landslide Soil Characteristics and Mapping Using Remote Sensing and GIS from Barliyar to Coonoor Sector in Nilgiris District, Tamil Nadu, India

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Abstract

The examination region is situated in the Nilgiri region of TamilNadu, India. The greater part of the landslides happened amongst Barliyar and Katteri along the street, Nagapattinam - Gudalur National Interstate (NH-67). In excess of 80 noteworthy landslides were accounted for inside three days from November 8 to 10, 2009, which took away 48 human lives, and furthermore granted extreme harm to houses, streets and railroad lines. The Landslide Weakness Record outline arranged utilizing recurrence proportion technique and it separates the investigation zone into five zones of landslide vulnerability viz., low, low, direct, high and high. In high and high hazard zones, remote sensor is introduced so as to limit the casualty rates. In the remote sensors, weight check, sonar sensor and dampness sensor are utilized. The dependability of inclines is constantly under extreme dangers in numerous parts of Western Ghats, particularly in Barliyar to Coonoor slope street extend, causing disturbance, loss of human life and economy. To limit the shakiness of soil slant in the middle of Barliyar-Coonoor, a basic assessment of streets is required. In this present examination, examination was done at 10 areas in the above said slope street stretch to gauge the factor of wellbeing of the slant decided. Counterfeit Neural System (ANN) Show is utilized to anticipate the factor of wellbeing. Research center examinations are done on soil tests gathered at the locales. Soils at all the areas have high fine substance and low estimations of coefficient of porousness. Limited component examinations of all the case chronicles were done utilizing PLAXFLOW programming to comprehend the disappointment instrument and contributing variables to decide the basic slip surface and factor of security. The info parameters for the (ANN) are picked as Union, Point of inside grinding, Thickness and Incline edge and the factor of safety as yield.

Keywords: *Landslides; Slope Stability; Artificial Neural Network (ANN); Nilgiris*

Comparison of Project Delivery Systems Based on the Cash Flow Projections and Project Growth and Economic Parameters

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Abstract

National Highway projects involve huge capital investments by the government agencies, the contractor and other participants involved in the construction project. This makes the evaluation of best project delivery system very imperative. The study involves the comparison of the project delivery system for and existing Build-Operate-Transfer (BOT) type of Toll Project on a National Highway. The major objective of this study is to formulate and analyze the cash flow projections from the perspective of Company and the government agency involved and to conclude the best project delivery system by comparing the cash flow projections and the project growth and economic parameters. Build-Operate-Transfer (BOT), Engineering-Procurement-Construction (EPC), Hybrid Annuity Mode (HAM) are the three Public-Private-Partnership (PPP) types of project delivery systems compared in the study. The study concludes the selection of suitable project delivery system based on the significant parameters involved in the highway project and also generates project profitability for the construction company. The study also involves description of the various project growth and economic factors such as unit cost of development of project, cost growth, project design and construction speed, construction time, scheduled project growth and project development intensity.

Keywords: *Build-Operate-Transfer; Engineering-Procurement-Construction; Hybrid-Annuity-Model; Cash Flow Statements; Public Private Partnership; Input Tax Credit*

Big Data Analysis and Smart City Projects: How Strong They Go with Each Other

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Abstract

Smart Cities is an emerging concept aiming at mitigating the challenges raised due to the continuous urbanization development. To face these challenges, government decision makers sponsor Smart Cities projects targeting sustainable economic growth and better quality of life for inhabitants and visitors. Information Communication Technologies (ICT) is the enabling technology for smartening.

These technologies yield massive volume of data known as BIG DATA (BD). If spawned big data are integrated and analyzed, both city decision makers and citizens can benefit from valuable insights and information services. The process of extracting information and insights from big data is known as Big Data Analytics (BDA). Although Big Data Analytics involves non-trivial challenges, it attracted academician and industrialists. Surveying the literature reveals the novelty and increasing interest in addressing Big Data applications in Smart Cities. Although literature is replete with abundant number of articles about Smart Cities applications harnessing Big Data, comprehensive discussion on Big Data Analytics frameworks fitting Smart Cities requirements is still needed. This paper attempts to fill this gap. It is a systematic literature review on Big Data Analytics frameworks in Smart Cities. In this review, we will try to answer the following research questions: what are the big data analytics applied in smart cities frameworks? What are the functional gaps in the current available frameworks? What are the conceptual guidelines of designing integrated scalable big data analytics frameworks for smart city purposes? The paper concludes with a proposal for a novel conceptual analytics framework to serve smart city requirements.

Keywords: *Big Data; Big Data Analytics Frameworks; Smart Cities*

Centralized versus Decentralized Wastewater Treatment and Reuse: A Feasibility Study for NITTTR Campus, Chandigarh

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Abstract

In recent times we have witnessed the emergence of a water availability crisis due to scarcity and pollution of water resources. One of the major causes of water pollution is the widening gap between wastewater generation and treatment which has necessitated a paradigm shift from centralized to decentralized wastewater treatment and onsite reuse. The manuscript attempts to answer the question whether decentralization can be termed as an effective solution to deal with the limitations of centralized wastewater treatment. The scope of decentralization has been explored by means of a feasibility study of decentralized wastewater treatment and onsite reuse in NITTTR campus, Chandigarh. The feasibility study takes into consideration the guidelines, appropriate technology and potential reuse options associated with the adoption of decentralized wastewater management. The purpose of the feasibility study is to determine the saving in freshwater use that can result from adoption of decentralized waste water management and onsite reuse.

Keywords: *Decentralized Wastewater Treatment; Feasibility Study; Guidelines; Technology; Wastewater Recycle and Reuse*

Urban Mobility Challenges and Opportunities in Medium Size Cities of Haryana

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Abstract

Haryana is one of the prosperous state located in Northern India with a total population of 2.5 Crore as per 2011 Census. The 34.8% of the total population (8,842,103) is residing in urban, Haryana have total 18 cities out of which 16 are medium size cities (1 lakh to 5 lakh). Total population of these 16 cities is over 40 lakhs which is roughly one half of the state total urban population. The rapid urbanization & growth of the cities is creating urban problems like road congestion, air pollution and high rate of traffic fatalities. All the cities are well connected by inter-city transport but lacks in the intra-city transport service. This leads to increase in the share of private vehicles like two wheelers, car and Intermediate Public Transport (IPT) like three wheelers. Maximum part of the population rely on the IPT mode which are overcrowded having sharing and unregulated system and is costly mode of transportation. This results in the decreased share of Non-Motorised Transportation (NMT). The mobility need of the ever expanding cities cannot be met by NMT like cycle, rickshaw which are considered to be cheap and affordable.

There is a strong need for Intracity transport which can connect the local colonies and city centre and the urban villages together. It also creates challenges for the city transport planners to workout efficient and affordable mode of transportation. One of the primary intention of this paper is to focus on the mobility demand of the urban population of the medium sized cities which is neglected, and if there exists any system to cater to the demand it is not up to standards. The paper will conclude to provide data and the challenges facing for Intracity transportation and to provide appropriate solution for achieving Sustainable Urban Mobility in Haryana.

Keywords: *Urban Mobility; Sustainable; Transportation; Intracity; IPT; NMT*

Development of a Framework for Improving Construction Process Using Value Stream Mapping

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Abstract

In the manufacturing industry, remarkable improvements in productivity are observed which encouraged the emergence of lean thinking into the construction industry. Poor management, output variability, labour intense work, interior work conditions and insufficient quality are the potential problems in the construction industry. Value stream mapping (VSM) represents the main tool for Lean Production, which helps in directly observing the flows of information and materials as they now occur, summarizing them visually, and envisioning a future state with better performance. The aim of the project is to improve construction process by measure productivity of labourers involved in different activities in the construction of steel structure from the fabrication to erection are considered. The future state map shows how the process might be improved after changes are made into the process by identifying value-adding activities and eliminating non-value adding activities to optimize construction processes. Challenge lies in organizing the information in the VSM to reduce or remove non-value added steps. This study will introduce the ideas of Lean Production in construction in a more systematic way, identifying its main problems and proposing actions for improvement throughout the value and information flow.

Keywords: *Productivity in Construction; Value Stream Mapping (VSM); Value Added Activities; Non-value Adding Activities*

Big Data Analytics Potential in Transforming Indian Construction Industry

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Abstract

In general, big data analytics inspects huge volumes of heterogeneous data in order to reveal concealed patterns, correlations and further perceptions. With recent technologies, it is possible to analyse the big data and get specific solutions from it almost instantly but the effort has been slower and less effective because of more conventional business intelligence solutions. Big data analytics in

construction industry facilitates: Cost reduction; Faster, better decision making; Evolution of new products and services; Track and manage projects; Efficient budgeting and planning; Planned completion of work within budget etc. Construction firms are in the preparatory stage to adopt advanced, cloud-powered analytics of unstructured and voluminous datasets. Such techniques have the capability to redefine the conventionally uptight relations among the concerned groups.

In spite of the radical revolution that big data can introduce into the construction industry when compared to other industries, the difficulty in construction sector is that most of the data collected have been isolated by the business sector which composed it, where it is beneficial for their private analytics but can't contribute to the whole industry. The cost of big data systems, its complexity and greatly experienced analysts would likely weaken any chance of data being systematically incorporated into the field in the upcoming future.

Construction firms, collect data in peta bytes (10^{15} bytes) every day. This data comes from Sensor Networks, Internet of Things, Building Information Modelling (BIM), Enterprise Resource Planning (ERPs), etc. probable to multiply exponentially. This paper presents a review of big data analytics in literature associated with construction industry specifically in India. The review shows that advanced data analytics and computational intelligence is still to benefit the area of construction up to its full potential. In this research, we present a comprehensive study of the literature, exploring the application of Big Data analytics in the construction industry.

Keywords: *Big Data; Construction Industry; Data Analytics; Building Information Modelling; Computational Intelligence*

Performance Analysis of Cement Concrete Pavement Blocks Reinforced with Bamboo Mesh

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Abstract

In the current scenario which is demanding a solution for sustainable environment many innovations are essential in construction technology. Concrete is the most used and important material used for construction in the whole world. Concrete is experimentally found to have strong compressive strength but is similarly poor in tensile strength. The aimless infrastructural development is effecting the environment. Steel which is highly expensive, uneconomical and which leads to increase in CO2 emission is being used in construction and is a major construction material apart from concrete. The purpose of this project is replacing steel with bamboo to obtain an environmentally friendly cement

concrete paving blocks which can replace rigid pavement. Use of bamboo reduces the effect on environment due to the fact that bamboo is an eco-friendly material.

This project makes use of bamboo [bamboo is treated with linseed oil and well-seasoned] as a mesh reinforcement in the cement concrete pavement blocks to increase the tensile strength of the blocks and to make it an effective replacement for White topping or Cement concrete pavement. The use of bamboo resulted in providing similar tensile strength compared to steel and also increased the compressive strength allowing it to be used under high wheel loads. The expected compressive strength was 40Mpa with the use of M40 concrete but the compressive test results at 28days resulted in 52 + Mpa thereby giving a clear sign that this is the best alternative to Rigid Pavement.

Keywords: *Compressive Strength; Tensile Strength; Eco-friendly; Mesh Reinforcement; White Topping*

Creating Eco-Communities: A Viable Future

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Abstract

A sustainable city should be able to feed itself with minimal reliance on the surrounding countryside and power itself with renewable sources of energy. The crux of this is to create the smallest possible ecological footprint, and to produce the lowest quantity of pollution possible, to use land efficiently; compost used materials, recycle it or convert waste-to-energy. Eco-cities were founded with the idea of reconstructing cities to be in balance with nature and reforming cities to work within environmental means. This implies change at many levels: social, cultural, economical, infrastructural and at policy-level. The paper aims to examine these changes required from where we are to where we need to be, in order to achieve resource conservation and a balanced healthy living. Various case-studies from all over the world will illustrate successful and failed attempts in this field, in order to chart out an agenda for our future.

Keywords: *Sustainability; Eco-city; Eco-friendly Development; Urban Ecology*

A Study of ERP Implementation in Real Estate Companies

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Abstract

Enterprise Resource Planning (ERP) is software mechanism helps organisation to integrate its functions. ERP can be used to collect, store, manage and interpret data from various department of the organisation in the integrated manners. In recent scenario ERP has become backbone of many top organizations. Variety of literature shows the comprehensive use of ERP where construction sector is not an exception. Use of ERP has given benefits to these organisations. Though ERP is widely used in all the sectors and researchers have studied it many ways, It has been observed that ERP implementation is not been studied with the factors considered in this study. Results have obtained based on the data collected from 30 real estate companies. It has been observed that factors like cost, time, and post implementation support contribute significantly in ERP implementation.

Stakeholders like project managers, sponsorer, team members, and individuals will be benefited from this study. This study helps the organisation to understand the major factors affecting ERP implementation and will help to save time and effort while implementing ERP in their organisations.

Keywords: *ERP; Implementation; Real Estate; Functional Assessment; Challenges*

Experimental Study on the Use of Plastic Bottles in Concrete Blocks

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Abstract

Use of plastic has increased over decades. Polyethylene Terephthalate (PET) bottles are commonly used and most of them are not recycled and end up in landfills, where they take more than 100 years to degrade. Various industries generate waste and these wastes are dumped in landfills or rivers. The ineffectiveness of waste disposal is a large problem the world is facing. In this study, plastic bottles filled with various infill waste materials are used in the construction of concrete blocks which can replace the conventional blocks. Three infill waste materials were used – construction waste, saw dust and plastic bags. Filled bottles are placed in between the concrete in the block with adequate cover and spacing between the bottles. The blocks were tested for compressive strength, water absorption, block density and dimension. Initially six numbers of bottles were used and then then the number was

increased to 7-9 bottles to find the optimum number of bottles. It was found that these blocks can be used as load bearing units for construction. The maximum compressive strength at 28 days was found to be 12.26 N/mm^2.

Keywords: *Plastic bottle blocks; PET bottles; Waste-Reuse; Concrete; Compressive strength*

An Assessment of Safety Measures Adoption and Implementation at Construction Sites in India

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Abstract

In India, the construction sector is second largest employer next to agricultural sector, which is about to grow in next decade up to 30% more and is also considered to be the hazardous industry towards safety. Hence, workers are more prone to the accidents due to lack of better construction safety management. In this fast developing world, various technologies are being adopted for the rapid growth of the construction. But the question is, does concentrating on how to reduce cost and time overrun in a construction project will overcome the seriousness of safety management in construction? Hence considering the significance of construction safety, this paper explores the risk prone activities in construction industry, accompanying root causes and effects of accidents on construction sites and emphasizing on technologies and innovations made for construction safety management. This study also aims towards the comparison of safety between the construction sites using, normal safety tools and high end safety management, using questionnaire.

Keywords: *Safety Management; Accident; Effects; Innovations; Technology*

Heritage Management of Sajjangad

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Abstract

Heritage Management is one of the growing fields in India & around the globe. Heritage sites are invaluable resources for understanding and experiencing cultural significance of any place. Our heritage may it be cultural or manmade is to be preserved in a good condition so that our future generations, when they look back find the precious heritage well preserved & managed which are built by our forefathers.

This study focuses basically on the Management issues concerned with heritage sites, through a selective focus on Sajjangad (Fort cum Pilgrimage Centre) in Satara district of Maharashtra. The complexities have been investigated, that have not yet been examined as of now in the Heritage Management of Sajjangad. The study draws attention on the overall management of Sajjangad, focusing particularly on the infrastructure & built structure management of the site. A thorough analysis is carried out emphasizing on the required repairs & maintenance depending on the task & frequency of Infrastructure & Built Structure. The study focuses on the issues and policies for preparing the Heritage Management Plan of Sajjangad.

Keywords: *Heritage Management Plan; Built Structure Management; Issues and Policies*

Strategies for Reducing Cooling Load of Buildings

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Abstract

One of the significant parameters in developing smart cities is to understand the mechanism to reduce the air conditioning load of buildings. The present study deals with various options available to reduce the cooling load of buildings. In majority of cases, the traditional way of designing air conditioning for buildings was using rule of thumb such as 100 to 150 square feet per ton of refrigeration. Today buildings are built and operated successfully with air conditioning usage of 600 to 700 square feet per ton of refrigeration. This systematic and scientific approach has resulted in drastic reduction in air conditioning load of buildings, contributing towards huge savings in the overall cost of air conditioning system. The present study addresses key areas for reducing the building cooling load. The outcomes of this study will help the architects, consultants, engineers and building owners to effectively design air conditioning system for buildings.

Keywords: *Smart Cities; Buildings; Air Conditioning*

Case Studies of Mixed Land Use Policies

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Abstract

Mixed landuse is said to have the benefits of shorter trip lengths, promote walking, vibrant environ, security with watchful people on streets etc. To harness these benefits many contemporary planning

practices across the globe endorse mixed landuse policies. Based on the strategy of regulations, mixed use manifests in different forms with different implications. Applicability of mixed use differs among cities not only based on their size, population and density but also on their tradition of planning, culture of people, demand of commercial activities etc .If not implemented effectively, there can be detrimental effects like noise pollution, threat to safety, intrusion in private life and loss of residential character.

In this paper a critical comparative study of policies adopted by 6 different cities is done which gives insight into unique ways of promoting mixed use and their experiences. A two-step descriptive analysis approach is followed for understanding the policies. Firstly, a review of policy documents like master plan and development control regulations along with the trailing history of the case study city is done to understand their principle approach. Then, the response to the policy and its effect is studied through literature available in form of news articles, research papers etc. The findings create an inventory of mechanisms to regulate land use so that appropriate mix can be achieved wherein the advantages of mix use can be availed without any detrimental effect. It also gives an understanding about what kind of policies can be effective in a city with particular socio-cultural and demographic scenario.

Keywords: *Mixed Land Use Policy; Citie; Allowed Uses; Restrictions; Experiences*

A Study of the Relation of the Cost of the House Purchased with the Buyer-Related Factors

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Abstract

A house is a consumer durable. In most cases, it is the most expensive product that a person buys in his lifetime. Many people aspire an expensive house, but few people can afford to do so. 621 respondents staying in the jurisdiction of Pune Municipal Corporation limits who had purchased a flat/ apartment recently were interviewed, using a questionnaire. This paper presents the results of a part of the study: it examines the relation of the cost of the flat/ apartment purchased with the age, income and number of persons who will be staying in the house by treating the cost of the house as a dependent variable and the buyer-related factors as independent variables by using multiple regressions.

Keywords: *Cost of house; Buyer-Related Factors; Multiple Regressions*

Study of Optimum Percentage of Openings in Shear Walls

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Abstract

For seismic analysis of an RC building the location of lateral load resisting elements are important in terms of deflection, story drift and stiffness the of building. In RC building other than column, shear wall is considered as lateral load resisting element. Shear wall reduces the deflection of high rise building subjected with lateral loading. Also the placement of the shear wall in building affects the behavior during earthquake. As the provision of doors and windows are required in the building, it is necessary to study the effect of openings and optimum percentage of openings in shear wall. In this paper G+15 story RC building is analyzed using ETABS and study the effects of openings in shear wall related to different placement of shear walls.

Keywords: *Shear Wal; Shear Wall with Openings; Lateral Load; Story Displacement; Story Drift*

Pushover Analysis on R.C Buildings with Plan Irregularity

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Abstract

Earthquake is a major concern when it comes to natural hazards. The lives of people are mostly affected due to collapse of the building under the seismic effect. These issue may take place if the structure is not designed as per IS code guidelines and also if it is not analyzed beforehand up to its maximum load carrying capacity. To prevent such type of major effects it is necessary to analyze the building with proper design criteria as well as with help of the equivalent software. Most of the damages take place in the structure due to its irregularity in the plan which needs to be looked into while construction of the building. In this paper, work has been performed using ETABS 2015 software to analyze such plan irregular buildings as well as regular buildings. Pushover analysis is carried out on such buildings to get the idea about changes that take place in the parameters of the results obtained after analysis such as story shear, story drifts, displacements, pushover curve etc. Work is performed over different shapes of the building like L, C, I, plus (+) plan irregular buildings and compared its parameters with the geometric regular building. Also compare results in terms of performance point for above mention buildings.

Keywords: *Irregularity; Pushover Analysis; Story Shear; Story Drift; Displacement; Pushover Curve; Performance Point*

Comparative Study of RC Structural System

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Abstract

The construction of high rise structures is the development of urban infrastructure to satisfy new challenges in civil engineering aspects. Lateral loads are main consideration for designing of high rise structures, that can be resisted by introduce shear wall and couple shear wall in structure. But as the height increases of the structure the stiffness plays important role and introduction of outrigger beams between central shear wall core and external columns that increases the lateral stiffness to the structure. The outrigger system helps to control the lateral deflection and drift of the structure subjected to lateral loads and minimise the structural damages. This system can be generally chosen for high rise structures located in seismic active zone or wind dominated areas. The objective of this study to understand the behaviour of the outrigger system under later loads and the appropriate location of outrigger with efficiency of this system.50 Story RC buildings are modelled in ETABS with different structural systems i.e. Rigid Frame structure and shear wall at different location with adding outrigger in this structural systems comparison carryout in terms of lateral deflection, story drift and story shear under seismic loading. Also the belt is introduced at exterior periphery of structure connected to columns with deep girders.

Keywords: *High Rise Building; Shear Wall Location; Outrigger; Belt Truss System; Deflection; Base Shear*

Understanding the Measures for Effectiveness of Stakeholder Engagement in Public Private Partnership Infrastructure Projects

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Abstract

Infrastructure development is one of the core drivers of economic growth in developing countries with maximum contribution coming from transport sub sectors like aviation, railways, ports, and roads and highways. Large infrastructure needs of the country cannot be met, single-handedly by the government and participation of the private sector is significant. Public private partnerships have

evolved over the years to create unique deliverables through complex project management methodologies. One of the key and essential component of project management delivery is stakeholder engagement. Through careful selection of processes and procedures, project management teams strive to coordinate with diverse stakeholders to deliver optimum results. The results are not always favourable due to continuous changes in the environment, technology, stakeholder aspirations, legal and regulatory challenges, and factors beyond the scope of the project and there is room for improvement. Further, the measures to evaluate how effectively stakeholders have been engaged on the project, to be able to proactively support the success, are not widely known, and also, not consistently practiced across the sector. This paper investigates the different measures available for the project manager to understand and evaluate how stakeholders have been effectively engaged on the project. The findings of this paper will help program management teams, sponsors, and senior stakeholders to assess and evaluate project performances.

Keywords: *Stakeholder Engagement; Stakeholder Management; Public Private Partnership; Infrastructure Sector; Effectiveness Measurement*

Role of Axis, Symmetry and Fractal Geometry as Design Parameters in Extrusion of Hindu Temple Form and Construction Management

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Abstract

Culture plays an inevitable role along with heritage and natural environment in shaping the built environment of an area, especially in India, for it being a land of temples. The typical temple typologies are of wide varieties in varying contexts in its form, style, symbolism, structural aspects, art, ornamentation, etc. Axis being an ordering design principle has emerged as an integral part in designing the pivot of religious, social, economic and cultural element in India from ancient times, i.e. temples. The design of every temple shows its uniqueness with its own distinctive style in accordance to the local adaptations, their traditions and culture. There have been traditional methodologies and certain principle that have been adopted through the course of time in history for designing temples. Cosmic hierarchy has been holding a stake in this process. Amalgamation of these strategies with design principles have made it possible for witnessing evolution of different types of artistic and functional plan forms as contributions to the heritage of India. The spatial organization of various elements in a temple follow the general Indian philosophical concepts of centre, axis and relativity to cosmic reality. Its implications in the built form gives exquisite impact and influence on

the construction, function, form and Vedic religious practices related to the structure. This paper attempts to explore the strategic planning approach in designing and construction of temple forms with execution of axis as an integral principle, and its vital role in freezing the temple form with implication of symmetry and fractal geometry. It wanders through various examples of such implementations. It holds an evident research and review on various styles of temple architecture which implemented axis as a driving philosophy in their design process. It further tries to create a scope for inspired built forms in today's contemporary world.

Keywords: *Hindu Temple Architecture; Temple Form; Axial Symmetry; Fractal Geometry; Temple Construction Management*

Study on BIM Advantages and Barriers to Its Adoption on Construction Project Sites in India

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Abstract

Building Information Modelling (BIM) is well established within the construction industry in developed countries. Use of BIM on building construction project sites has significant potential to improve performance on such projects. Previous research related to BIM showed that use of BIM on construction project sites reduces reworks, changes and increase overall productivity. In spite of this, BIM has not taken roots as a designing approach in India. Construction industry in India is at the very earliest stage in the adoption of BIM for design and construction of different projects. This situation has promoted the need for research to investigate advantages of BIM adoption as well as barriers to BIM adoption. A questionnaire survey was used to collect primary data regarding BIM advantages and barriers to its adoption. The questionnaire is intended to determine the professionals' opinions about BIM advantages and barriers to its adoption on construction projects. The questionnaire was developed by using extensive literature review. Relative Importance Index (RII) was calculated to rank advantages and barriers. This research study will help construction industry stakeholders to understand barriers to BIM adoption. Construction project stakeholders can overcome such barriers to use BIM on all their construction projects.

Keywords: *Building Information Modelling; Advantages; Barriers; Construction Projects*

Identification of Marketing Strategies Suitable for Small & Medium Scale Business-To-Business Firms

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Abstract

The increasing rate of globalization and technological advancement has created enormous challenges for business to business (B2B) firms in the intensely competitive world. Select B2B companies which operate at much larger scale have created dominance in the market that makes it extremely challenging for new firms to enter the market. While small & medium scale B2B firms are appeared to be more adversely affected by new government policies or laws like GST implementation and demonetisation, very little adverse impact of such policies is observed on major or bigger companies. Because of increasing economic growth, foreign direct investment (FDI) and technological sophistication, more and more demand for industrial products, services & projects have been created. But there is a greater likelihood of this demand being tapped by large established firms on account of their overall superiority over small & medium scale firms. These developments certainly reduce business opportunities for small potential firms. One of the major reasons is the lack of awareness on the part of clients about some of the promising small & medium scale B2B firms with sophisticated technology and superior managerial processes. Hence, it becomes extremely important for these firms to market themselves. This paper emphasizes the importance of marketing and aims at identifying marketing strategies suitable for small & medium scale companies to penetrate the market. The paper emphasizes the use of project marketing framework for these small scale B2B firms. The paper adopts the case study approach to understand various marketing strategies adopted by certain firms who have emerged as successful firms in B2B market in India in recent times. Further, the study aims to sort out the marketing strategies that can be used by small scale firms based on the characteristics and resources availability of these small firms.

Keywords: *Marketing; Project Marketing; Strategy; Business-To-Business Market; Small & Medium Scale Firms*

Factors Affecting Selection of Concrete Structure Formwork

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Abstract

Formwork system is an essential component in deciding the construction project duration. It has been found from various research studies that progress of projects is dependent on factors like speed, buildability, constructability, and safety in use of the formwork systems. In typical Reinforced Cement Concrete (RCC) building construction, cost of formwork accounts significantly. A rough estimate shows that it is about 40 to 60 percent of the cost of concrete frame and roughly equal to 10 percent of the total cost of the building structure. Further, it is found major component of this cost is labour dependent and poses a significant control over safety, speed and competency. In the present work, an attempt has been made to study the factors influencing the selection of formwork system. Traditional and modern formwork systems are studied using a questionnaire survey to assess selection factors. The crucial factors, which were considered for different formwork systems such as traditional formwork, Mivan, and Doka, are cost, quality, cycle time, number of repetitions, and safety. This research study will help construction project contractors to select appropriate formwork system for safe and economical concrete construction.

Keywords: *Building; Construction; Concrete Structure; Formwork*

Hybrid Annuity Model in Highway Projects: A Review of Current Challenges and Possible Solutions

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Abstract

The Hybrid Annuity Model (HAM) was introduced by the Government of India as a project delivery framework for highway projects mainly to ease the financial issues that many developers faced while executing infrastructure projects, especially highways in the Build-Operate-Transfer (BOT) and Engineering, Procurement and Construction (EPC) mode. Even after incorporating terms that were considered to help developers by easing the financial burden on developers and bringing in equity from Government, the response by the private developers were not encouraging. The lukewarm

response signals the presence of unresolved issues. In this paper the authors explore the existing literature to understand the various shortcomings of the HAM delivery framework and list down specific areas in the Model Concession Agreement (MCA) that may be bothering the developers to adopt the delivery model enthusiastically. Subsequent to the identification of the drawbacks of HAM, the possible solutions that could ease the concerns of developers, financiers and the government are identified. The expert viewpoint also suggests that there are concerns of HAM that needs attention and resolution. As the HAM is relatively new, this study is expected to help the practitioners as well as the body of knowledge to bridge the gap in understanding of this hybrid model of Public Private Partnership (PPP). In the opinion of the authors, HAM may be 'quick-fix' solution that may need to undergo structural changes towards the traditional PPP models as the economic situation eases.

Keywords: *Hybrid Annuity Model; Model Concession Agreement; PPP*

A Management Plan for Optimization of Construction and Demolition Wastes

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Abstract

Construction and Demolition (C&D) Waste has been defined as wastages which are generated from activities of construction, demolition, renovation, deconstruction, surplus materials and damaged products in the course of C&D process. While Retrievable items like bricks, wood, metal, tiles are reused or recycled, concrete and masonry wastes (>70% of total waste) are not effectively recycled in India. This study would give an insight into C&D waste management strategies and the role of regulatory authorities in management of C&D wastes. Construction wastes are not anymore wastes but are renewable resources. Today, in most European countries, it is economically feasible to recycle up to 80–90% of the C&D waste and latest demolition and recycling technologies are generally in practice.

A defined manual as such is not available with regulatory authorities for effective management of C&D wastes. This report is envisioned to be a pilot study towards preparation of such a manual. Fixation of standards regarding C&D waste management and maintaining a centralized Data Base would facilitate urban planners and policy makers in devising effective strategies for sustainable management of C&D wastes.

Reused and Recycled products from C&D wastes can save huge amount of natural resources, reduce CO_2 footprint, reduce environmental impact, create space in urban areas, reduction of large space

required for dumping sites, creation of jobs and business opportunities across India. This report studies the properties of demolition waste, its hazardous effects and suggests safe recycling/reuse/disposal methods and proposes a Business Model to recycle masonry and concrete wastes. This Business Model combined with authenticated environmental and economical parameter can make a powerful tool for next generation in managing C&D wastes.

Keywords: *Construction; Demolition; Management; Waste; Reused; Recycled*

Issues and Challenges of Lean Construction in Real Estate Projects

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Abstract

The concept of lean promises effective delivery of real estate construction projects under highly complex environment and severe constraints of resources. Realizing the benefits of the lean, many real estate developers are proposing to implement lean construction for their projects despite enormous issues and challenges involved in its implementation. This paper has made an attempt to evaluate those issues and challenges and suggest recommendations for successful implementation of the lean concept in construction.

A systematic literature review of journal articles, conference proceedings, books, magazines followed by field survey using structured questionnaire and interview of site personnel as a part of the research approach.

To arrive at the appropriate findings, evaluation of the publications and the field data analysis has been carried out that led to the identification of those issues and challenges throwing obstacles/barriers in successful implementation of lean construction in real estate projects.

The study is limited to focus on real estate projects within the State of Maharashtra, India. The study can be further extended to all other geographical locations in India.

This paper has reviewed the issues and challenges in implementation of lean concept in real estate projects and its practical implications in lean construction.

Many countries around the world is encouraging to implement the lean concept in all types of construction projects despite several issues and challenges in its implementation.

This paper aims to investigate the key issues and challenges in real estate projects that should be strategically tackled by implementing the concept of lean construction. It might open up new frontier

of research in the field of lean construction that would contribute to gain more practical knowledge and add value to the construction world.

Keywords: *Lean Construction; Challenges; Implementation; Toyota Production System (TPS); Real Estate*

A Social Cost Benefit Analysis of Samruddhi Mahamarg

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Abstract

The rapid urbanisation and expanding towns and cities put pressure on almost all infrastructure facilities viz., schools, hospitals, utilities and transport. Based on the concept of sustainable development of the society, transport has a significant importance for the balanced development of economic and social systems of a country. However, with limited resources that the governments own, it is imperative for a government to make prudent choice in allocation of scarce resources. This implies that if a specific resource is used for one project or policy it will prevent its availability for alternative uses. So the investment projects should be measured against these forgone opportunities. A government's crucial role therefore is to use these scarce resources to where they will most benefit the people at large. For this purpose, social cost benefit analysis (SCBA) is utilized. SCBA is a procedure evolved for appraising investment projects from the point of view of society as a whole. SCBA has been employed widely in transport literature as an appraisal tool for different types of plans or projects. Therefore, in this paper, SCBA is carried out for Samruddhi Mahamarg, an upcoming eight lane expressway in Maharashtra State, which is about 706 kms long from Thane (Mumbai) to Nagpur and will be connecting 10 Districts, 26 Talukas and 392 Villages of the state. SCBA of this Mahamarg is undertaken to gauge the direct and indirect costs and benefits of the project.

Keywords: *Transportation; Expressway; Social Cost Benefit Analysis, Sustainable Development*

A Study of Employee Engagement and Motivation Practices in Construction Organizations and its Correlation with Employee Performance

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Abstract

Construction organisations today are facing numerous challenges due to mounting performance pressures, changing technologies, dynamic environment and demanding clients. To remain competitive in such situation, well planned human resource management strategies have become critical for construction companies as the human capital plays a significant role in any construction organisation's success. In spite of its economic importance being a major contributor in the growth of Indian economy and being the largest employment generator, the construction sector is plagued by the issues like low productivity, high employee turnover, limited mechanisation and lack of professionally trained employees. There are many evidences of inconsistent performance of Indian construction projects and the trend is growing rapidly. Projects are reportedly failing across all key performance measures including cost, time and quality. Hence, there is a strong need to examine whether some intrinsic factors affect these key performance measures apart from the routinely cited technical and situational factors.

The study in this context, tries to explore the correlation of an organization's intrinsic policy factors like employee engagement and motivation with individual employee performance in construction organisations. The main objective of the study is to examine current employee engagement and employee motivation practices in construction organisations in India and find out whether it correlates to employees' individual performance along with the overall impact it may have on the construction project's performance. A structured questionnaire survey was carried out using standard instruments like Schaufeli and Bakker (2003) and Goodman & Svyantek (1999). The results present the problems in current employee engagement practices and highlight the most important aspects affecting performance of individual employees which in turn affects the overall performance of the project in which they are working. The results would be useful to industry practitioners as implementing strong policies in this area would go a long way in improving overall performance of construction projects in all performance measures.

Keywords: *Employee Engagement; Motivation; Commitment; Construction; Performance*

Analysis of Political Literacy with Demographics of Voters in Delhi

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Abstract

In the digital age, every individual is well connected with current happenings across the globe. There are number of means of communication through which every individual can be updated. But when its time is to cast vote, which is the only political right an individual has in democratic nation state, information access is seemingly very low in India. Difficult to attribute any one cause as number of factors are responsible for it but certainly political literacy is one of them. This study is aimed at analyzing the level of political literacy among voters of Delhi.

The main objective of this study is to analyze the level of political literacy among the voters with respect to demographic variables- gender, marital status, age, education and profession.

Descriptive design is used and data is collected through well-designed questionnaire from 617 voters of Delhi.

The results revealed that there is significant difference in male and female voters but there is no significance difference in single and married voters. The level of literacy is not significant among different age groups but there is significant difference with respect to education and profession of voters.

It is recommended that there is need to create political awareness about their political right among the voters irrespective of demographics then further exclusive awareness programs is to be customized as per demographics.

This study is about the level of literacy and knowledge about political rights of voter with respect to demographic variables of voters in Delhi.

Keywords: *Political Literacy; Demographic; Voters; Age; Education; Profession; Gender and Marital Status*

Personnel Performance Appraisal Practice in Small and Medium Construction Contracting Organizations in India

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Abstract

Effective Personnel Performance appraisal (PPA) system is important for success of organization. Implementation of any strategies is dependent on effectiveness of the management system and efficiency of human resource**.** In construction industry where competition and employee mobility is high, it is important to develop employee ability and retain competent professionals through enhancing their job satisfaction. To achieve this, PPA is an important tool. However, the practice in construction industry is not investigated in detail. This paper is aimed at assessing the practice in the context of Indian construction industry focusing on small and medium scale organizations. Qualitative data was collected through interview with HR managers and professionals in addition three organizations were considered for case studies. The findings indicate small and medium organization use informal practice to evaluate their employee performance and the PPA practice is poor. The organizations mainly concentrate on work ignoring human resource aspect. Performance of organization directly or indirectly associated with quality of human resource hence organizations in construction industry needs to understand importance of PPA for their success and improve their practice.

Keywords: *Personnel Performance Appraisal (PPA) Practice; Employee Performance; Indian Construction Industry*

Ground Improvement Techniques and Geosynthetics

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Abstract

During construction of a project various problems arises in the site that are encountered during the execution phase. Sometimes soil is naturally suitable to bear structural loads, but sometimes not suitable to bear heavy structural loads. Therefore Geotechnical Engineers have no choice left to construct the structure on this soft or poor soil. The technique used to convert these soft or poor soils into dense soil, and to improve the engineering properties of soil is known as ground improvement techniques. The ground can be strengthening by reliable ground improvement techniques such as dewatering, vibro-compaction, dynamic consolidation, geosynthetic, and grouting method.

Dewatering is used to remove pore water from the soil layer. Vibro-compaction is the densification of soil and is used to improve the stability and compressibility of loose soil by using vibrators where vibro-replacement stone columns improve the bearing capacity of soil and vibro-displacement displace the soil by using new soil columns. Dynamic consolidation improves the bearing capacity of granular and moist soils and also reduces the uneven settlement. Geosynthetic material is used for reinforcing the soil and to increase the shear strength of soil. Grouting is the technique in which stabilizers are introduced by injection into the soil. The aim of these techniques is to increase the bearing capacity of soils and decrease the settlement. These techniques have a wide range of applicability from fine grained soil to coarse grained soil. This paper gives an idea about different available modern ground improvement techniques and discusses their practical applications.

Keywords: *Ground improvement; Geosynthetics; Vibro-compaction; Stone columns; Dewatering; Dynamic Consolidation*

Sustainability Optimisation of Residential Buildings Using Genetic Algorithms

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Abstract

The expanding residential building sector is concerned with improving the social, economic and environmental aspects of the building in recent times. To overcome the problem of today's resource exhaustion, environmental deliberations and to address sustainability indicators a model needs to be present which can address the issue of environmental pollution at the same time also protect the developer's investment. The assessment guidelines and Rating systems present are able to assess the sustainability of the building but do not suggest measures to attain sustainability. Materials are the main source of pollution and cost and hence should be closely monitored.

Considering this condition, a model is proposed in the paper to optimise the sustainability of the building. The model works as a Multi Objective Optimiser (MOO) optimising the following 3 objective functions: 1) Cost of the Building, 2) Carbon Dioxide (CO_2) Emissions,3) IGBC New Building Rating System Points ®. These three objectives were chosen to account for each of the important topics to be considered while selection of materials i.e. Profit to owner, Damage to environment and adherence to national standards. The solution space increases by a factor of 2 with each addition of material which increases computational load significantly and hence there is a need to develop a model which can find the optimum solution faster without an exhaustive search. The model developed could assess and give better solutions than 'All conventional' and 'All Green'

materials. The model obtained an accuracy of 70-75%. The model can also be appended with constraints and additions of materials which will further increase the viability of the model.

These capabilities of the developed model are expected to support building developers and owners to achieve 'Green Building' certification from government authorities and to promote the use of green materials which are economical, towards the construction of new buildings.

Keywords: *Material Optimisation; Genetic Algorithms; Multi-Objective Optimisation; Sustainability; Residential Buildings*

Redevelopment of Housing Societies: The Legislative Aspect

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Abstract

Housing development refers to the process of reconstruction of residential/commercial premises by demolishing the existing structure and construction of a new building as per approvals from the Municipal Corporation (Sec. 2(7) Maharashtra Town Planning Act 1966).The old and unsafe co-operative housing societies have only option to go for redevelopment. Whereas, on other hand even the building is not old the builder opts for redevelopment in order to avail the advantages of additional Floor Space Index (FSI) including the Transferable Development Rights (TDR).

The research study involves the redevelopment laws in in the State of Maharashtra specifically in Mumbai. The researcher analysed the judicial opinion.

Keywords: *Redevelopment; Property; Law; Society; Transfer*

A Detailed Study about Management of Construction Risks and Hazards in Pune Underground Metro Project

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Abstract

The Metro Rail Transit System has always provided a safe, reliable, efficient, affordable, commuter friendly and environmentally sustainable rapid public transport for major cities in the country. A number of reasons such as availability of lesser ground space, retaining the city landscape, safeguarding the historic and heritage structures in the city etc hold true for the proposal of an underground metro rail corridor. Such a complex project needs a detailed study of probable risks and hazards that could be encountered during the actual construction. The paper includes a case study on the proposed Pune Underground Metro Rail Corridor carrying out a thorough investigation to identify

the probable construction risks and hazards that are likely to be posed during the construction and suggestions for mitigating the identified risks and hazards.

Keywords: *Metro; Risks; Hazards; Tunneling; Underground Construction*

Mathematical Model to Overcome Delay in Construction

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Abstract

The construction industry is one of the largest sectors of employment and is the symbol of development. Majority of the construction projects suffer from delay, which result in loss of productivity, increase in project costs, and contract claims and these leads to abandonment or termination of projects partially or completely. Construction delays can be minimized only when their causes are identified. In today's era, delay has still remained everybody's main concern. The objective of this study is to identify the major causes of construction delays, the effects of delays, to develop a mathematical model to overcome the delay in the construction industry and to suggest methods for minimizing construction delays in a proactive manner. Based on literature review, the 24 delay factors which were occurring in the various projects were majorly divided into 8 major heads. A questionnaire survey was prepared and disseminated among the personnel working at various projects in different sectors of construction. The consideration of the frequency of occurrence and the importance of each of the delay factors would give Delay Impact Index (DII). Utilisation of the Impact index scale would give prior notification and understanding of the possible delay that may occur over the due course of time. A mathematical model was developed with respect to the major heads, in order to quantify the delay in the construction. This model shall provide ample opportunity for the planning engineers to initiate the corrective action plans and facilitate to complete the project in time.

Keywords: *Construction; Delay; Factors; Impact Index; Mathematical Model*

Critical Factors Impacting BIM Uptake in the Indian Built Environment Sector

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Abstract

It is believed that the Indian AEC industry is lagging behind when it comes to building information modeling (BIM) adoption. Therefore, the purpose of this research is to establish a clear understanding of the present level of awareness of BIM. Furthermore, the study aims to identify significant BIM functions and barriers that might impact the BIM adoption rate. With the help of a survey method, a questionnaire was distributed to the target sample of 80 professionals out of which 65 responded by completing the questionnaire. The researcher selected the sample using a convenience sampling technique. The responses were analyzed using the relative importance index (RII) method to draw the results. The results indicate the current status of BIM awareness and reveal the factors that influence BIM adoption in the form of key BIM functions and barriers from the perspective of professionals. Indian professionals working in the field of technology can use the results drawn in the form of BIM key functions to provide more focused training about them, to ensure their successful diffusion. They can also work on eliminating the key barriers to boost the BIM uptake. Previous researches have essentially focused on finding out the BIM's presence in India. This research contributes primarily by examining, from the perspective of professionals and using the relative importance index (RII) method: the critical factors involved in BIM adoption. Establishing such critical factors is of significant value as they can expedite or hinder BIM's adoption rate in India.

Keywords: *Building Information Modelling; Relative Importance Index; BIM functions; BIM barriers; awareness*

Daylight Simulation of Residential Building to Reduce Energy Demand

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Abstract

Sustainability is the essential requirement of building envelope in today's developing scenario. Efficient daylight, ventilation, glazing system and insulation create the more sustainable living environment inside building envelope and improve occupant's satisfaction. The essential focus of the study is to daylight analysis of a residential building at the design and pre-construction stage to

provide visual comfort to the residents. Computer-based software simulation methodology has been used for analysis. The strategy is helpful to examine natural light level inside the building. The case study is represented to illustrate the amount of daylight absorption by the interior spaces of the building, which are especially oriented towards south facade. The effect of different glazing unit within the living spaces is shown to reduce demand of artificial lighting system, subsequently to reduce energy demand. The case study assists for optimization of energy consumption.

Keywords: *Daylight Simulation; Daylight illumination level; Daylight factor; Glazing Unit; Energy Demand.*

Evaluation of Urban Redevelopment Projects: A Citizen Survey in Pune

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Abstract

With the rapid urbanization, there is increasing pressure on converting the rural land into the urban land (also known as Greenfield development) giving rise to urban sprawl. As urban sprawl is inefficient from extending the urban services and development of land, the redevelopment of inner city areas (also known as Brownfield development) has been gaining importance in both developed and developing countries. Therefore, all major development authorities have been promoting urban redevelopment projects, particularly in the dense and already congested areas of cities. In India also, several cities have begun undertaking urban redevelopment projects in a big way, particularly under the National Urban Renewal Mission of the Government of India.

However, there is an academic debate about undertaking such large projects. Unlike the new development, urban redevelopment is a reconstruction of a previously developed area. Specifically, redevelopment changes the land use between types of urban land, while new development is changing non-urban land into urban land. But, in the process, it is also essential to take the different views of stakeholders and subject the projects to public scrutiny. In this context, the current paper proposes to evaluate an urban redevelopment project proposed in Pune city. Based on the survey of the citizens living in the proposed redevelopment project area, the paper brings out some of the important aspects of project planning and development that are hitherto not considered in such projects. The paper emphasizes that these aspects need to be carefully considered for better project implementation and success.

Keywords: *Urban Renewal; Redevelopment Projects; Project Evaluation; Citizen Participation*

Study of Building Information Modelling Implementation for Sanctioning & Town Planning Procedure

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Abstract

Construction practices and procedures are Evolving into complex work flows that require better coordination amongst the stakeholders. BIM is a promising technology that provides better collaboration and control on the project planning and execution also allowing one to be able to easily track and modify the plans to suit the real-time situations. BIM has been incorporated in the workflows of numerous large scale construction projects across the globe and found to have impressive results in terms of increased profits, time savings and faster project delivery. Currently construction industry is accelerating with a great pace and it is to be noted that not all projects comply with the regulations prescribed by the town planning authorities. This paper provides a study of the currently implemented technologies such as Paper based sanctioning process, Auto-DCR, etc. that were implemented by the government to combat the malpractices and control the growth of the city. The paper also offers a concise overview of the advance IT technologies that could be implemented to construction project and town planning authorities to enhance efficiency of the system and avoid miscommunication, malpractices such as corruption and illegal development. The use of cloud system, block-chain and IoT devices in management of town development coupled with AI & Machine learning algorithms are the later objectives to be achieved once the concept is implemented as a large dataset will be available to train the algorithm so as to enable autonomous planning & sanctioning. The purpose of BIM being to enhance collaboration and coordination amongst all stakeholders especially the government and the planning authorities which are often excluded and considered an outsider in the project development. This concept is keen on enhancing the inclusive approach and making efficient use of IT on Construction projects.

Keywords: *Building Information Modelling; Advance IT Technologies; Town Planning Authorities; Construction Projects*

Impact of Demonetization on Real Estate Market in Pune City

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Abstract

On 8 November 2016, India's Prime Minister Narendra Modi announced the Government of India's decision to cancel the legal tender character of ☐500 and ☐1,000 banknotes with effect from 9 November 2016. These demonetization measures have had significant and immediate impact on the state of the Indian economy. These measures are also expected to result in long-term impact on certain industries and sectors. These measures have resulted in a significant decrease in liquidity in the short term, which is expected to ease gradually with the introduction and circulation of the new currency notes. As a result of these measures and increased deposits with banks, the bank deposit base has increased significantly, and financial savings are expected to increase as a result of the shift from unproductive physical asset based savings to interest-bearing financial assets. This, in turn, is expected to enhance the liquidity position of banks, which can be leveraged for lending purposes. An increase in the deposit base may also enable banks to lower the blended cost of funds as higher CASA (current accounts, savings accounts) deposits enable replacement of higher borrowing costs and decrease overall cost of funds. With cash transactions impacted by a decrease in liquidity, alternative payment methods, such as e-wallets, online transactions using e-banking, debit and credit card usage have increased significantly. This will increase usage of such payment systems, and enable a shift towards an efficient cashless infrastructure. Reduced liquidity has also caused a sharp decline in the availability of disposable income, affecting spending patterns and consumption trends in the economy in the short term. These trends, together with certain industry-specific issues discussed below, are expected to affect India's GDP growth rates adversely in the fiscal year ending March 31, 2017. While rating agency Fitch has projected a decrease in India's GDP growth by approximately 50 basis points, other projections peg India's GDP growth rate for fiscal years ending March 31, 2018 and 2019 lower by approximately 30 basis points. These forecasts indicate that an upgrade of India's credit ratings for the next two years remains unlikely; although India's current sovereign credit rating of 'BBB-' is expected to remain steady in the long term. The long term impact of demonetization measures on the real estate sector is expected to be positive, and complement other measures undertaken by the Government of India, including the introduction of the Real Estate (Regulation and Development) Act, 2016 (RERDA) and the implementation of the Benami Transactions (Prohibition) Act, 1988 (BTPA). The RERDA contemplates the establishment of the Real Estate Regulatory

Authority (RERA) to regulate residential and commercial real estate transactions. It requires all real estate projects involving land exceeding a specified area to be registered with the RERA. In order to ensure appropriate application of earmarked project funds, it also requires developers to maintain a significant percentage of the project funds in a dedicated account. The BTPA prohibits property transactions, including transactions undertaken for and on account of a third party beneficiary funding such transaction, irrespective of complicity of the named owner; such transactions are now subject to criminal penalties as well, and the relevant property may be subject to confiscation. The study aims to consider the following objectives:

i. To measure the immediate impact of demonetization on real estate demand both commercial and residential sectors in Pune city.
ii. To measure the long-term impact of demonetization on real estate demand both commercial and residential sectors in Pune city.
iii. To find out the scope of employment generation from demonetization in Pune city.
iv. To measure the awareness of people for demonetization and its benefits.

Keywords: *Demonetization; Employment Generation; Commercial Sector; Residential Sector and Real Estate Regulatory Authority (RERA)*

Dispute Resolution Decision Support System for Indian Construction Contracts

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Abstract

The development of technology and modernization over the last few decades has stemmed in an infrastructure boom in India. Most of the construction projects are executed through contracts. Both, contractor and client related to the contract pursue their aims, and try to amplify their benefits. This chase results into claims and eventually into construction disputes. The delay in settlement of disputes through litigation and arbitration not only hampers project progress, but also contributes to the cost and time overruns and damages relationship between parties to contract. During dispute settlement there are chances that due to human element involved the decisions may be subjective. Thus there is a need to standardise the decision procedure for dispute resolution.

This paper highlights the concept of development of Decision Support System (DSS) for faster resolution of disputes and as a means of litigation avoidance to some extent. An attempt has been made to integrate information related to the disputes arising out of "Variation and Deviation" in Indian Construction Contracts to develop DSS. The DSS includes questions in hierarchical order

reflecting the manner in which disputes are resolved so that most of the points related to claims arising due to "Variation and Deviation" are referred before taking decisions. Further, a software for the DSS has been devised which aims at providing guidelines for the dispute resolution much faster than the prevailing system of arbitration and litigation helping the professionals to understand the results of the disputed claims.

Keywords: *Construction Contract; Construction Dispute; Dispute Resolution; Decision Support System; Contract Administration*

Implementing Lean Construction Theory in Construction Processes Waste Management and Assessing the Impact

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Abstract

Waste in the construction industry has been the subject of several research projects around the world in recent years. Researchers implement different methods to reduce the amount of waste in construction industry. One of effective methods is application of lean approach to construction industry. Lean construction is a result of the introduction of a new form of production management. Although lean construction is still evolving, the generic principles, techniques and tools of lean construction can already be applied. Waste reduction in order to improve performance is one of the basic concepts of lean thinking. In general, project managers tend to conceptualize "waste" as physical construction waste, but there are noticeable wastes in the construction processes, which are named "nonvalue-adding activities" by lean construction theory. In this paper, we described how lean construction principles reduce process waste and assessing the impacts of implementing lean construction.

Keywords: *Lean Construction; Last Planner System; IT*

Smart City Development: Program Management Approach and Challenges

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Abstract

The smart city movement in India is a big development happening which will be an important driver for overall socio-economic growth for the country in the near future. Smart city development is the major initiative taken by the government of India to cater to the upcoming needs of the residents, industrialist and manufacturer.

The developers/organisation for such smart city development adopt Program management techniques and establishes Program Management office - PMO, which generally leads to better implementation of organisation strategy through project deliveries.

The work involves development of cities from scratch. Such smart city development requires multiple projects of basic infrastructure like roads, power, water, sewage treatment, effluent treatment and moving to modern projects like Metros, Intelligent City components and others. The smart city development projects are high capital intensive and long duration program which involves multiple stakeholders, each having their own expectation and vision from the Program. Hence Program management skills and expertise are required for effective implementation of smart city development activities for meeting the overall outcome.

The present case discusses the Program management practices which can be adopted for development of smart cities for leveraging the economies of scale and scope for implementation of many projects simultaneously. The paper further discusses the challenges involved in implementation of many projects simultaneously as this kind of execution is quite different from any other project being handled on standalone basis. The paper also test these execution challenges and towards end paper also proposes some solutions to overcome these execution challenges.

Keywords: *Program Management; Program Management Office – PMO; Smart City Development; Interface Management; Implementation Challenges*

Governance Issues in PPP Procurement Process for Infrastructure Development in India

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Abstract

The federal government of India has adopted the public-private partnership (PPP) route for the development of infrastructure projects since the economic liberalization initiated in 1990s. Though, the PPPs have used as preferred procurement route for infrastructure development in India since the last three decade, but still, some areas of PPP procurement process need to improve with the perspective of governance issues. The main aim of this article is to study the PPP procurement process for infrastructure projects from the perspective of good governance principles. The study helped in identifying areas where the procurement process has shortcomings from the governance perspective. The qualitative content analysis through literature review has used as a research method for this study. The coding procedure using open and axial codes has conducted to analysis the literature review data. The study concludes that the shortfalls identified in PPP procurement process have failed to promote good governance principles throughout the life cycle of infrastructure project. The study further recommended a conceptual idea on how to overcome these shortcomings through an inclusion of the governance aspects in PPP procurement process. The data used in this paper has restricted to the Indian context using literature review as a research approach.

Keywords: *Public-Private Partnerships; Infrastructure Development; Governance; Procurement Process; India*

Analysis of Rapid Sand Filter with Coconut Shell as a Capping Media

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Abstract

In conventional water treatment plants rapid sand filters are very common. The main problem associated with it is layered system, which restricts the whole utilization of sand bed used. One of the promising method for improving the performance of rapid sand filter is capping of existing rapid sand filter. Capping is a process of covering the filtration media by alternative capping materials such as Anthracite coal, Bituminous coal, Crushed coconut shells, etc. While the anthracite coal and bituminous coal are quite costly materials, also its heavy weight adds up to the transportation cost. In

the present study an attempt has been made to examine the effect of capping (Coconut shell) of Rapid sand filter on the properties filtered water.

For the analysis of Rapid sand filter using coconut shells as a capping media, series of tests were carried out on an indigenously developed scale model where the sand bed thickness is varied viz. 0, 50, 100 and 150 mm of crushed coconut shells. The size of crushed coconut shells used is between 1to 2mm. The raw water is passed through capped sand bed and various tests viz. pH, suspended solids and turbidity are carried out on filtered water and the results of various configurations are compared with pure sand bed. The result shows that 50 mm sand layer may be replaced by 126 mm thick coconut shell layer to obtain the comparable results of turbidity removal of raw water for the filtration rate of 4000 lit/sq.m./hr.

Keywords: *Sand Filter; Filtration; Coconut Shell; Turbidity; Filtration Rate*

Energy Optimization in HVAC Systems-A Practical Approach

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Abstract

HVAC systems are major contributors for the energy consumption. Optimization of these systems will help to save more energy. The poor design and operations of these systems are the major concerns in current scenario. The development of the new optimization techniques will enable hassle free energy conservation. According to the industry, capacity of the HVAC systems may vary but the components and controlling techniques are almost homogeneous in nature. A practical approach has been established for various sub systems in HVAC systems towards a sustainable savings. A potential savings are observed in the following sub systems of the HVAC systems like VFD (Variable frequency drive),&BMS (Building Management Systems).This approach enables a potential savings. To sustain this benchmarked approach a strategic policy flow chart for the energy optimization also been developed for ease of handling in different industries.

Keywords: *HVAC; Energy Conservation; VFD; BMS; Optimization*

Application of Lean Techniques in Construction Projects

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Abstract

Lean concept is presently developing as a new technique to administer projects in construction. The concept envisages the application of principles of manufacturing to construction through standardisation of processes and has been considered as a concept that can be applied to manage dynamic projects. Lean construction is all about improving efficiency and thus construction sites need to implement these techniques to save cost and time. Lean construction advocates savings by completing jobs faster with reduction in wastage of materials, time and labour and thus its adoption in complex projects is essential. This study discusses the Lean techniques that can be adopted in construction to improve productivity, reduce errors, improve quality and reduce need of rework. Tools like 5S, Last planner system, Percent plan complete and Value stream mapping are applied on a construction projects and the benefits gained are signified.

Keywords: *Lean; Techniques; Construction; Waste; Time*

A Hierarchical Model of Constructability Improvement Barriers in the Indian Construction Industry

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Abstract

Past research has established that barriers to constructability improvement exist at project level and organizational management level. Multiple researchers have identified and ranked these barriers and suggested measures to overcome the same. However, the literature lacks in terms of establishing the interaction between these barriers and their hierarchical structure. Such a hierarchical model may provide additional insights into possible reasons of these barriers and may help senior management and project managers in developing strategies to overcome the barriers. Present research aims to fill this knowledge gap by modelling the barriers identified through a comprehensive literature review and ranked through a questionnaire survey. Interpretive structural modelling (ISM) and MICMAC analysis were used to develop hierarchical model and driving power-dependence-power diagram respectively for the top 15 barriers identified from the survey. The model revealed that barriers like

discontinuity of key members, poor communication management, lack of training and skill development, poor timeliness of inputs from suppliers were having high driving power and hence of strategic importance to senior management. On other hand, barriers like lack of willingness of field personnel to offer preconstruction advice, no accessibility to existing knowledge database and non-identification of problems in initial stage of project, were found to have higher dependence and therefore have more importance for the project managers.

Keywords: *Constructability; Constructability Improvement; Barriers; Interpretive Structural Modelling (ISM); India*

Enhancing Ridership of BRTS by Ensuring Last Mile Connectivity: Case of Pune, India

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Abstract

In India, major cities are facing a huge challenge in regard to enhance mobility on one hand and reduce congestion and pollution on the other. Transportation literature points out to BRTS as an important sustainable transport option for cities. Pune was the first city in India to operationalize a BRTS corridor with funding from Government of India. The number of trips generated in Pune city on a daily basis is about 2.5 million. But, the modal share of Public transport in the city is merely 13–20 percent. Vehicle ownership private automobile dependency and congestion on Pune's streets are increasing day by day which indicates that mere provision of facilities and infrastructure is not sufficient to encourage people to use public transportation. It is important to ensure that with the shift from private to public modes of transport, people are not compromising upon factors like accessibility, convenience, Journey time and /or cost, comfort and Last mile connectivity. Provision of economical Last Mile Connectivity (LMC) option is on the least priority of public transport facility providers in Pune. This compels commuters to use own vehicles for LMC thereby discouraging a shift from private modes to public modes of transportation. Lack of LMC also makes the overall journey expensive, tiring, unsafe and unpleasant for the transit users. This paper presents results of a study based on the context of BRTS and LMC in Pune City. The important aspects of assessment of comfort, time, distance and cost incurred in Last Mile Connectivity as percentage of the total journey; user preferences and options available for Last Mile Connectivity were also studied. The findings

point out that LMC is the most important and influential factor for enhancing the ridership of BRTS in Pune City.

Keywords: *BRTS; Last Mile Connectivity; Urban Mobility; Travel Behaviour; Per Capita Trip Rate*

Chennai Container Terminal (CCT):- A Comparative Study among International Container Ports in the Region Such as Singapore, Dubai, and Colombo Ports

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Abstract

Chennai Container Terminal (CCT) became operational in 1983. A second new container terminal was also built and commissioned in the year 2009. The Built-Operate-Transfer agreement was signed by the Chennai Port with the private operator. The two container terminals of Chennai Port handled 1.55 million containers in the year 2012-2013. The Chennai container port is the gateway port of the Eastern Coast of India and currently handles about 15% of total container cargo from India. It has good international connectivity and is connected to 50 container ports around the world. The study incorporates the following objectives i) to identify the key parameters for the development of Chennai Container Port as an international mega container port, ii) to benchmark Chennai Container Port against various other international container ports in the region such as Singapore, Dubai, and Colombo ports and iii) to measure the growth of selected four container ports' throughput over time and their comparison.

Keywords: *Chennai Container Port (CCP); Throughput; Twenty Equivalent Units (TEUs); Cargo Traffic; Shipping Lines; Freight Forwarders*

Manpower Development in Construction Industry: The Case of Ethiopia

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Abstract

Most of the challenges of construction industry development are associated directly or indirectly with availability and competence of manpower in the industry. Hence, manpower development is important element for development of construction industry. Achieving effective manpower

development needs concerted effort of stakeholders; academic institutes, government and the industry organizations. This paper assesses the practice in Ethiopian construction industry specifically focusing on the role of these three parties. To get opinion of professionals on the practice, the data was collected through questionnaire survey. Professionals from different background; Employers, Contractors, Consultants, Academic and Regulatory Authority were participated in the survey. Relative Importance Index (RII) was used to prioritize the improvement variables. Almost all RII values are greater than 65%, this indicates as the manpower development practice in the industry is poor. From role of academic institutes; (1) relevant and practice based education, (2) investigating manpower related challenges in the industry and (3) short term training to fill skill gap in the industry are indicated as priority areas. From role of government; (1) policy that enhances integrated and collaborative manpower development program, (2) forecasting and monitoring of manpower demand and (3) competence based licensing system are indicated as the priority area. From industry organizations side; (1) devising performance based pay system, (2) improving leadership style and (3) clear career development plan for all levels of employees are identified as priority areas to improve their human resource management practice. Findings of this study provide information for the stakeholders to take appropriate action to improve manpower development for effective development of the construction industry.

Keywords: *Construction Industry; Manpower Development; Academic Institute; Human Resource Management; Ethiopia*

An Experimental Study to Determine the Properties of Recycled Aggregate

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Abstract

Recycled aggregate are obtained from demolished concrete structure, laboratory crushed concrete, concrete waste at RMC plant and mass concreting site and the concrete made from recycled aggregate is known as recycled aggregate concrete. Use of recycled aggregate has many benefits to the environmental prevention in civil works, financial savings due to reduction in transportation and production energy cost of primary aggregate. The application of recycled aggregate has started in construction in European, American and Asian countries in recent decades. In India recycled aggregate application in lower grade concrete work is also observed. However effect of recycled aggregate on workability, strength and durability of concrete restricts its use in higher grade work.

This paper represents the series of tests carried out on recycled aggregate. Test results are compared with the natural aggregate to set a relation between natural aggregate and recycled aggregate. On comparison of recycled aggregate with natural aggregate it is found that recycled aggregate shows poor quality. It is mainly because of adhered mortar attached to the aggregate. Adhered mortar increases porosity of the recycled aggregate and forms a weak zone between aggregate surface and mortar. In addition, test results shows the defects in recycled aggregate and help to identify area where concentration is necessary to improve the quality of recycled aggregate.

Keywords: *Recycle Coarse Aggregate; Natural Coarse Aggregate; Adhered Mortar; Concrete Recycling; Sustainable Construction*

Comparing the Housing Loan Facility by State Bank of India versus Other Banks: A Study from Female Customer Perspective

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Abstract

The paper aims at comparing the housing loan facility taken by women in comparison to men provided by various banks. The study focuses on basics of taking a loan for house especially by women. We discuss various aspects like MCLR and its impact in deciding for a home loan. In our study, we are focusing on two objectives mainly. First to find the various factors that a customer takes into consideration before choosing a bank for taking housing loan and secondly to compare the interest rate of various other banks charged in context of providing housing loan. In last, we concluded that what are the various factors that need to be keep in mind while taking a loan and after taking a loan, to ease the repayment.

Keywords: *MCLR (Marginal Cost Of Funds Based Lending Rate); BPS (Basis Points); CRE (Commercial Real Estate); PNB (Punjab National Bank); OBC (Oriental Bank Of Commerce); EMI (Equated Monthly Installments)*

Key Risks Affecting Project Completion in the Indian Real Estate Projects

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Abstract

Real estate projects in India are getting delayed a lot nowadays. The real estate industry has experienced exponential growth in last few decades but we need to analyse the reasons for delays for completion of real estate projects. The research led to identification of 45 risks from the project inception till construction phase of a real estate project through literature review. We have met 100 respondents in person and 50 people responded by filling the questionnaire rest respondents were not interested to fill the questionnaire. We can see that sample size is substantially small but the quality of responses were highly reliable because the level of interaction personally with the respondents and people who filled questionnaire had good understanding of subject matter .The technique used was relative importance index to rank the risk attributes. We have found that project funding has maximum impact on the delay to project completion followed by clearance by authorities and delay in payment by client. We also found from the study based on grouped mean of factors, the environmental clearance has maximum impact on the project completion. This may be very specific to Delhi/NCR as during the last few months as the construction activities was stopped a number of times in recent past due to increase in pollution levels. This research work can help Indian real estate industry professionals to understand the root causes of delay in completion of real estate projects.

Keywords: *Relative Importance Index; Relative Weights; Real Estate Risk Assessment; Risk Impact; Risk Likelihood*

Treatment of Water using Various Filtration Technique: Review Study

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Abstract

Water scarcity has been listed by the World Economic Forum as the largest global risk in terms of potential impact over the next decade. Due to water scarcity one-third of the global population get severely affected. There is 3% amount of fresh water available in the earth but however lack of accessibility of water due to various factors, humanity is facing a water crisis. So, in order to avoid a

water deficient future it has become essential for every country all around the globe to take a step towards water conservation.

Apart from water scarcity one major area of concern is water quality. Lack of clean drinking water has put billions of people's health at risk diseases like malaria, cholera, hepatitis A, typhoid fever and many other diseases are spread because of the consumption of contaminated water. That is why treatment of water before consumption is necessary.

In view of all the above parameters, this review study is to discuss about the various filtration techniques available. Natural substitutes used as a filtering medium which are less expensive, or which may be a by-product of any agricultural or manufacturing process. For example, tamarind seed, which act as a natural coagulant and other natural materials like bentonite clay, red soil etc. The filtration system usually are of gravitational type and the backwashing process of pressure type.

Keywords: *Water Scarcity; Filtration; Water Borne Diseases; Natural Adsorbents*

Floating Wetland – Sustainable Green Technology for Treating Domestic Wastewater

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Abstract

Water Pollution is a major environmental issue in India. The largest source of water pollution in India is the untreated disposal of sewage into tanks, lakes and rivers and therefore, most lakes and rivers in India are polluted. The magnitude of wastewater has been increased due to a rapid increase in population and industrialization in the world. The study presents a feasible analysis using a free water surface floating wetland system for treating the wastewater. The proto type lab scale model of floating wetland was made ready. The study shows that after a relatively long retention time, the overall Biochemical Oxygen Demand (BOD) reduced by 91.8% to 93.3% and the Total Suspended Solids (TSS) reduced by 87.2% to 87.9%.Floating islands are characterized by a mat of recycled plastic foam layered with soil at the water surface on which plants can be planted and through which water passes. Two plant species *Tulsi* and *Typha* were selected and they were allowed to grow in a proto type set up of small aquarium like glass rectangular tank filled with domestic wastewater. Mainly Three parameters BOD, COD and TSS were taken into consideration for checking the treatment efficiency of the set-up treating domestic wastewater for BOD and COD depletion. TSS

was efficiently removed in all systems examined (>90% removal). These results suggest that floating treatment wetlands are a viable alternative for domestic wastewater treatment and for treating the contaminated surface water body.

Keywords: *Domestic wastewater; Floating Wetlands; Biological Oxygen Demand (BOD); Chemical Oxygen Demand (COD); Total Suspended Solids (TSS)*

Review on Comparative Study on Soil Stabilization using Natural Materials

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Abstract

Soil stabilization is the method used for improving the engineering properties of soil thereby increasing the stability and durability of soil and reducing the permeability of the soil as the primary concern. There are various methods of soil stabilization such as compaction, drainage, pre-consolidation etc. There are various materials used in the process of soil stabilization such as lime, Fly-ash, cement, bitumen and other chemicals. In this review study discussing about application of natural materials used for soil stabilization like coir, combination of jaggery and fruit waste, egg shells, tamarind, vegetable waste etc., in the form of liquid or powder. Use of natural materials has several advantages such as they are non-toxic, environment friendly, easy to use, reduces compaction effort, increase density etc. Hence these materials are cost effective comparing to conventional materials.

Keywords: *Durability; Natural Materials; Soil Stabilisation; Stability*

Comparative Study of a Non-Rated Residential Building and SVAGRIHA Green Building

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Abstract

In today's world the construction industry consumes a huge amount of energy. Due to the extreme use, thenon-renewable resources are getting constantly depleted. Construction industry accounts for emission of large quantity of greenhouse gases which leads to climate change and depletion of the ozone layer. This adverse effect on the environment triggers the need for sustainable construction techniques which reduces the total embodied energy and carbon emissions. Any green building works

on the principles like sustainable site plan which makes sure that the site is planned taking the site topography and local climatic conditions into consideration, usage of green materials and resources which have the least embodied energy, water conservation techniques to use as less water as possible, energy conservation by making use of passive design and using solar energy and maintaining good indoor air quality by using low-VOC paints and other less hazardous materials in construction.

The study focused on a conventional building's cost that was compared with that of the Green building of same site area after including all the Green criteria recommended by SVAGRIHA (Small Versatile Affordable Green Rating for Integrated Habitat Assessment) council. It was found that the total construction cost of the Green building after incorporating 14 criteria recommended by the council for a five-star rating was 9.05% more than that of the conventional building. Also, by performing the Cost Benefit analysis the payback period of the green building was found to be 6.67 years. ECOTECT and DIALUX are used for the effective design of fenestrations and artificial lighting system respectively.

Keywords: *Green Building; Embodied Energy; Svagriha; Ecotect; Dialux*

Fuzzy Logic Model for Selection of Concrete Placement Methods and Formwork Systems

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Abstract

Cost plays a significant role in construction project. Formwork systems share an approximate of 20-25% in building construction cost in Indian scenarios. Selection of appropriate formwork system and concrete placement methods plays an important part yet challenging role in achieving significant cost savings in selection. In India, formwork selection is based on the fundamentals instinctive of site engineers. From the literature survey it was found that various advancements have been made in construction industry with help of automation and technology. Fuzzy logic theory has been applied in construction operations to forecast, decision making process, and control of actions in environments characterized by uncertainty. The research work represents the development of fuzzy logic based selection system for formwork system and concreting placement works. Formwork systems and concreting placement widely used in India are identified with most governing factors affecting their selection process. The important factors are identified through questionnaire survey and tabulated. Factors are considered as input variables and formwork systems as output variables. Rule based Fuzzy system is developed in accordance with factors and formwork systems. To automate the

selection process Fuzzy logic model is developed in MATLAB. The developed model is validated by applying it on real-life case study (on-going project and completed project). The results obtained seems favorable and Fuzzy logic plays promising role in selection process.

Keywords: *Formwork System; Concrete Placement Methods; Decision Making; Fuzzy Logic; Construction Management*

Performance Studies on High Strength Concrete with GBS Sand

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Abstract

There is a necessity of designing a concrete mix using component materials which are cost effective and sustainable. The high strength concrete (HSC) provides several benefits over normal concrete in terms of design aspects, strength, durability and performance of the structure. There is a necessity of utilizing an alternative eco friendly material for fine aggregate in concrete making due to depletion of river sand. In the current work an attempt has been made to produce HSC mix replacing conventional sand by granulated blast furnace slag (GBS) sand. The GBS sand is a waste by product obtained from the steel industry. The compressive strength and flexural strength of HSC are studied at the age of 3day, 7day and 28days. Also durability properties such as water absorption, chloride resistance and water permeability are studied. The Ultrasonic pulse velocity test was conducted to establish relation between pulse velocity and compressive strength. The results revealed that HSC can be obtained even at a sand replacement level of 100%. Maximum strength properties are obtained at a sand replacement level of 60% with GBS sand. Relations between compressive and flexural strength are established for HSC with GBS sand and reference concrete mixes. The HSC mix developed was found to be highly durable.

Keywords: *High Strength Concrete, High Range Water Reducers, GBS Sand, Silica Fume, Chloride Resistance, Permeability*

Estimation of Solar Energy Potential for Regional Energy Planning using GIS Techniques

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Abstract

Renewable energy systems use resources that are constantly replaced in nature and are usually less polluting. Increasing negative impact of fossil fuel on the environment in addition to limited resources have forced many countries to gradually switch to environmental friendly alternatives that are renewable and are sustainable in the ever increasing energy demand scenario. In order to tap the potential of various renewable energy sources, there is a need to assess the availability of the resources spatially. Calculating the potential of solar energy is the focus of this paper.

The study employs Geographical Information System (GIS) to map solar energy potential in wasteland areas of Maharashtra. The spatial database of resource availability and the demand facilitates in regional energy planning. Regions and districts suitable for tapping solar energy are mapped on the basis of global solar radiation data (Direct Normal Irradiance & Global Horizontal Irradiance), and this analysis provides a picture of the potential in the state of Maharashtra. With the help of this data, we can also estimate the potential power generation of these areas which would be helpful in mid to long term regional energy planning.

Keywords: *Solar Energy; Maharashtra; Global Horizontal Irradiance; GIS; Wasteland*

Civil / Structural Design Optimisation for Industrial Projects with its Uncertainties and Challenges

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Abstract

The paper presents the quantities and cost modelling for real industrial problems for various combinations of design variables. Design variables considered are seismic zones, Soil Bearing Capacities (SBCs), material of structure and bay spacings. Foundations considered are isolated, raft and pile foundations under different allowable pressures. Materials considered for building structures are RCC and Steel. The study provides Civil/ Structural cost comparisons for different designs variable combinations. Paper also highlights about uncertainties and challenges faced while doing design optimisation for real Industrial problems. The results of the study are useful for the design

professionals and cost engineers during early stages of design development and cost planning.

Comparative Calculation of Carbon Footprint of Conventional Self-Compacting Concrete and Green Self-Compacting Concrete using Dholpur Sandstone Slurry

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Abstract

Self-Compacting Concrete (SCC) is the new generation concrete, which is used globally in the concretesector. The capability of flow in between narrow reinforcement is the prime reason for its growing popularity. Use of maximum amount of powder content makes this concrete workable and increases its usefulness in congested reinforced concrete structures like column, tunnel, metro, bridges. The primary powder content in SCC is cement. Increasing demand for cement content is directly proportional to increase in carbon footprint. Carbon footprint is a stimulant for Assessment of Life Cycle (LCA) of concrete. Self-compacting concrete may only be accountable as sustainable concrete, when cement content is decreased up to the minimum requirement as per grade of concrete. Introducing other alternative powder material will reduce the cement content along with maintaining fresh properties, strength characteristics and durability properties. Dimensional stones (Granite, Marble, Limestone and Sandstone) are the predominant construction materials since ancient times for plenty of availability from the natural rocks. In different stages of processing of stone, various by-products are generated. These by-products are discarded as waste materials which create environmental hazards.Sandstone slurry waste is used as partial replacement of cement at 5%, 15%,25% and 35%. In this research,CO_2emission of conventional self-compacting concrete compared with self-compacting concrete made with Dholpur sandstone slurry. CO_2 emission stages includes production of raw material, transportation of material and production of concrete. In this work authors intends to draw a comparative calculation of CO_2 emission from rich SCC using >550kg/m^3 cement and green SCC using 380-315 kg/m^3 cement with the use of sandstone slurry waste as partial replacement of cement in Self-Compacting Concrete.

Keywords: *Sandstone Slurry; CO_2 Emission; Self-Compacting Concrete; Carbon Footprint*

Construction Planning with BIM (Building Information Modelling) Framework and BIM Model as Virtual Prototype during Conceptual Phase of a Project Facility – Case Study of a Treatment Plant

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Abstract

Pre-construction phase of every project encompasses with calculated assumptions, risks, constraints and imaginary versioned project outcome in the minds of project stakeholders. Typically a plethora number of two dimensional digital platform technologies are available, but the lack of data or integrated information platform and parametric object oriented model developments for a particular facility deemed to be a bottleneck. It is very uncommon to witness and implement digital prototyping technologies in construction industry unlike in aeronautical and automotive industries which vehemently reaped fruitful outcomes through the usage of information systems and embracing of such simulation technologies. This paper elucidates how these technologies can be implemented in construction industry during the inception phase of a project for co-ordinated and effective planning at preliminary level.

The research methodology adopted here is the development of a BIM (Building Information Modelling) framework for a treatment unit building and evolution of virtual prototype on behalf of the contractor in order to ameliorate the decision making capability of planning team with the generation of BIM Model. The inferences and key takeaways were considered with the execution of BIM framework for a Treatment Unit Building and validate the key planning competence through a pilot case study. The results from the case study recognizes the role of digital prototyping in components' modelling, site logistics modelling, construction methodology visualisation and virtual identification of safety hazards prior to actual execution at site premises.

Keywords: *Building Information Modeling; Construction Planning; Virtual Design & Construction; Parametric Models; Logistics Planning*

Contract Risks Identification and Mitigation in Solar Installation Projects Covering Prolonged Contract Duration

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Abstract

This research paper identifies the Contractual Risks involved in Solar Power Installation and Supply

Projects spread over a prolonged period and suggests mitigation measures for the Contractors involved in the same. For a continued profit sustainability, the Contractors are required to ascertain risks and plan to avert the same to a certain degree. The Research Paper covers mainly the contracts risks causing any direct financial implications viz. global inflation, political instability, devaluation of the local currency, technological enhancement requiring an upgrade, force majeure conditions and the social acceptance.

Some world known standard Contract conditions (FIDIC) as well as laws of the land (Indian Contracts Act 1872/ UAE Civil Code) are discussed for use in certain events.

Keywords: *Solar Contracts; Contract Risk Management; Prolonged Contracts; Risk Mitigation; Solar Power Plants Construction and Supply Contracts*

Risk Prioritization in Infrastructure Projects with FAHP- A Case Study

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Abstract

The construction and mega infrastructure projects are generally executed in complex and dynamic environments and are vulnerable to various uncertainty and risks predominantly due to the uniqueness of various activities in construction industry. These projects often fail to meet their objectives of cost and time adherence for the presence of the different risk factors involved in the project. Hence there is a need to identify, quantify and analyse the various risks and also formulate the risk response strategies that comprises an effective and systematic risk management process. The risk quantification and analysis processes as available in literature mostly utilises expert opinion and responses from the various stakeholders involved in the project. Hence there are chances of uncertainty and vagueness in experts' opinion which is utilized for the risk quantification and analysis. A fuzzy system has the ability to explain its reasoning process. It may be thus applicable to the risk analysis process. It is very subjective and so it relates to inexact information which is often vague and similar to that found in construction industry. This paper makes an attempt to recognize and prioritize the various risks related with the construction industry using the fuzzy Analytical Hierarchy Process (FAHP). It utilises the case study of the phase I construction of Bangalore Metro rail project and identifies the various risks inherent in the project. It also prioritizes the risks in order of their significance with respect to the project objectives i.e. time, cost, quality and scope for the project considering execution phase (contracts, tendering, construction planning, casting and erection,

utility & traffic diversion etc.). It is seen from the study that execution risk have the highest impact on project objectives which is also validated through a one way ANNOVA test which shows a significant effect of execution risk on the project objective of time cost and quality.

Keywords: *Construction; Infrastructure; Fuzzy; AHP; Risks; Megaproject*

Living Roofs – The Future is Alive

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Abstract

Concrete jungle is the newly coined name of the extensively sprawling urban areas. Tropical countries are getting exposed to various issues due to reduction in vegetation and scanty rainfall. The eco-friendly concepts tackling these problems have become inevitable in all the semi-arid urban sectors for their sustainable development.

We would like to propose one such concept - Living Roof or Green Roof. The proposal is to have the concrete jungles supported with technically strengthened, eco-friendly roof vegetation. Along with the healthy protection, it has an added advantage of reduced temperature, energy consumption, air pollution, enhanced rain water harvesting and aesthetic appearance.

As an experimental setup, a living roof of $25m^2$ was established on the roof of a room on a residential building at Vijayapur, Karnataka. A reduction of 5-15 degree Celsius in the internal room temperature and 60-70 % cost reduction in cooling charges was noted. Along with this the living roof produces oxygen that is sufficient for 10 persons a day and reduction of air pollutants like particulate matter and carbon dioxide, which resulted in the enhancement of air quality.

Keywords: *Concrete Jungles; Sustainable Development: Living Roof; Eco-Friendly; Temperature Reduction;*

Study of False Ceiling Design and Execution Process

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Abstract

A False ceiling is a ceiling made below the main ceiling of the any structure. In other words, it is a second layer of ceiling hanging from the main ceiling with the help of metal or wooden frame. By use of different shapes and design of false ceiling, it improves the aesthetics of the room. It plays a main role in the elegance, acoustic and thermal comfort of any structure. There are mainly 03 types of false

ceiling- i) plane ceiling ii) Grid ceiling iii) combined ceiling. As per a 2015 study of Gyproc Company on residential energy consumption, lighting consumption contributes around 30%of the residential energy consumption in India. In fact, lighting contributes to 10%-20% of our homes' total electricity bill. By using given design criteria for false ceiling, we can use lesser LED lights to get the same brightness of light as compare to traditional way and save money by reducing electricity consumption. Similarly, by false ceiling system we can reduce AC electricity load with aesthetic view. So Along with aesthetic reason & effective Illumination system, energy efficient structure & Mess free structures can be made in any type of construction. This study includes referring case study of false ceiling of auditorium which have 1000 people seating capacity located in Ahmadabad. This study intended to provide design criteria, construction process of different type of false ceiling, and different available materials for false ceiling. And it will be great tool for construction advance construction projects.

Keywords: *False Ceiling; Advancement of Construction; Energy Efficient Structure; Aesthetics of Structure; Mess Free Structure*

Imperative of Contract Management in Construction Sector

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Abstract

The Contract strategy will generally include procurement planning but will also cover the various contract types. The roles and responsibilities of the contract manger should also be taken while selecting contract strategy. Timely completion of words to established standards is possible only when both employer and contract should understand their responsibility towards the project.

Better contract management must include risk management plan, risk response plan and procedure for monitoring and controlling of various types of risk which will occur during project life cycle.

Keywords: *Procurement; Contract Manager; Contract Strategy; Solicitation; Contract Administration; Source selection*

Performance Assessment of Green Building Rating Systems in India

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Abstract

Construction sector in India is rapidly growing which consumes a huge amount of non-renewable resources. There is a great need to understand the need of non-renewable resources and their

existence in future. This urges for the development of sustainable buildings has become extreme important. The sustainable building sector helps in addressing issues, like less usage of fossil fuel, waste management, water and energy efficiency. There are various rating systems to certify green buildings like Indian green building council (IGBC) and Green rating for integrated habitat assessment (GRIHA) but performance is not assessed, this is an attempt to understand the performance of such rationing systems. In this paper, assessment of various Green Building Rating Systems and their performance of different rating system when compared with conventional educational campus building based on their ratings. The comparison of educational institute which are GRIHA rated, LEED rated, and Non-rated are done for certain parameters. The comparison of the buildings is based on the design, site planning management, sustainable transportation, water conservation, energy efficiency materials (artificial lighting, heating and cooling system) and resources management, health and well-being green education, innovation and design. Based on some statistical tools by collecting data regarding human comfort at respective buildings comparative statements are obtained. From the assessment it is observed that GRIHA rated campus is efficiently working as per its norms and thus contributes to sustainability in all considered parameters.

Keywords: *Green Buildings; GRIHA; IGBC; Rating; Performance Assessment*

Identifying the Perception of Adaptability of Modular Housing Techniques in Construction Industry: A Case Study Surat City

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Abstract

This presented work is intended to analyse about prefabricated technique utilization in a Surat city where conventional building techniques are more used in residential building for living purpose. A questionnaire based survey was developed while searching from different literature to get an idea and view about current situation of modular method in Surat City from different stakeholders. SPSS tool and Relative Importance Index was used to identify the research factors which will help for implementation of this technique in future period.

Keywords: *Modular Housing; Prefabricated Materials; Offsite Construction*

Alliance Contract in Housing Redevelopment Projects

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Abstract

Housing redevelopment in metro cities, despite being a profitable business, is criticized for issues such as less involvement of society members, delays due to litigation, lack of transparency, nonclarity in absorbing the profits and losses by stakeholders, etc. To address this concern, this paper focusses on implementing certain alliance contract provisions in the traditional redevelopment contracts. The alliance model, widely used in Australian infrastructure projects, focusses on integration of all stakeholders and sharing all risks, thus creating an environment of collaboration and unanimous decision making. Through a review of literature of alliance contract and housing redevelopment, as well as Development Agreements, and Alliance Agreement templates, certain issues which are addressed in a different way in alliance contract model and traditional redevelopment contract model are identified. Subsequently, the practical applicability of alliance provisions pertaining to these issues is analysed by conducting structured interviews of experts, mainly developers and project management consultants. Respondents recommend improvement in professionalism of society members, a well-defined risk sharing method, team integration, transparency, greater commitment and collaborative effort by all stakeholders as a necessity. Overall the data indicates that there are certain areas in redevelopment contracts, which if substituted by alliance provisions, will enhance the contractual relationships. However, there is also little scepticism amongst the respondents regarding few other alliance provisions. The study represents an original contribution towards enhancing the contractual relationship between housing society, project management consultant (PMC) and developer, by adopting alliance provisions. The suggested alliance provisions can be individually discussed further with wider group of professionals for further finetuning them, if necessary before their inclusion in redevelopment contracts.

Keywords: *Alliance Contract; Housing Redevelopment; Team Integration; Redevelopment Contracts*

Recent Aspects in Digitalization of Construction Industry

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Abstract

Digitalization is a huge opportunity for enterprises today. Construction companies shift to digital stand to realize significant gains over the competitions. Major areas impacted by digitalization include enterprise, knowledge, construction sites, project collaboration, and skilled labor networks. The productivity of the building and construction industry, in general, is largely left behind compared to other industries due to the slow digitalization. Poor planning, lack of automation, insufficient communication, and inadequate risk management are the main factors hampering productivity and cause significant cost and time overruns. Digital technology is changing the construction industry. Some construction trends shaping the industry are detailed: 3D Building Information Modeling (BIM), cost and schedule modeling with 5D Macro-BIM, pre-fabrication, energy-saving building systems, smart buildings, robotic automation,3D printing in construction and enhanced job-site safety. The need to boost productivity coupled with the need to minimize project overruns and unskilled labor are the top drivers for IT adoption in the construction industry. Digital transformation in the construction industry focuses on three key areas: i) Big data: management of bulk data allowing sharing information on accountable platforms and processes, encouraging a collaborative and intuitive decision-making process. ii) Automation: facilitates competitiveness, reduces unpredictability contributing to time and cost overruns, and improves resiliency to threats and interruptions. iii) Standardization: leads to efficient resource management, simplifies operations and supply chain, minimizes waste and boosts efficiency, facilitates innovation and sustainability. Thus, the digitalization in the construction industry provides opportunities to realize large construction projects within their time frame and budget limits. Besides, one should consider today's construction industry is at an inflection point. In the new digital world, new business models are emerging, disrupting the industry and requiring new processes for the way we work and deliver services.

Keywords: *Digital Transformation; 3D Printing; BIM; IT Adoption; Automation*

Reits in India: "To Be or Not To Be"

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Abstract

The real estate segment in India is majorly closely held. A cursory look at the real estate companies listed on the Bombay stock exchange shows that out of the 30 companies which have an overall market capitalization of over 90%, 25 are closely held and family controlled businesses. This paper seeks to examine the initial regulatory issues in the launch of REITs. The paper would contribute in understanding the modus operandi of REITs and some of the challenges in launching it in India.

Keywords: *Real Estate Investment Trusts; SEBI Guidelines; Indian Commercial Real Estate*

To Study the Utilization of Robots in Building Construction for Finishing Activities in India: A Case Based Approach

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Abstract

Economy of India is growing very rapidly, and real estate has good contribution to it; it is expected that real estate will reach around 12 trillion rupees by 2020. Also, government has plan for constructing large numbers of houses, commercial places etc. in coming years, but traditional technologies used by construction industry are unable to meet this large demand. Also, in any building works finishing is a tedious work and need a large quantity of skilled labors, which possess a concern to Indian construction Industry. Thus in this paper, we try to study the utilization of roots in building construction for finishing activities.

Keywords: *Finishing Activities; Indian Construction Industry; Robots*

Advances in Plaster Materials Used in Building Finishes: Ready-Mix Plaster

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Abstract

Building construction has taken momentum due to implementation of policies like demonetization, Real Estate Regulatory Authority (RERA), Real Estate Investment Trusts (REITs), Goods and Services Tax (GST) etc. Builders and Developers also required to respond for this increased demand and step-up the speed of construction completion with the use of faster and economical construction materials available in the local market. Aesthetic, planning, design of building and use of construction materials have to match with the building traditions in the area and lifestyle of the people. Appropriate technology and methodology is important in selecting suitable and locally available building construction materials. One should select the technology in accordance with the prevailing local condition and at the same time structures built should be durable, reliable and functionally as desired. In building construction, various finishing materials are used to enhance the esthetic of the structure. In the past few decades, market has provided varieties of alternative construction materials with better functional performance, economical, faster and safer construction. Developers and Builders have quickly adopted the new building materials specifically finishing materials which are economical and fast in application/installation. Traditionally, in building construction wall surfaces are coated from the inside with cement mortar and layer of '*neeru'* on it. Ready-to-use wall finishing materials replaced the traditional cement mortar. In this study, various alternative wall finishing materials available in the market are technically compared along with their adaptability under different building situation. This study will help Builder/Developer to select appropriate wall finishing materials to enhance aesthetic and building functionality at lower cost and do the construction at faster rate.

Keywords: *Adaptability; Alternative Finishing Materials; Building; Construction*

Work Sampling and Productivity Analysis for an Industrial Project

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Abstract

Productivity is an alarming issue in construction. Research reports that rate of productivity has marginally increased by only 1% in the last two decades. Lean principles and techniques address this concern. However, there are limited studies that demonstrate the productivity issue on live construction projects in India. To this end, a team of 4 students were sensitized to work sampling technique on an experimental project for a period of 2 weeks. Subsequently data was collected from a live industrial project for a period of 6 weeks. The activities during the period of study included rebar bending, rebar threading, shuttering, preparing concrete reinforcement for three different column dimensions and waterproofing for vertical and horizontal surfaces. Data was collected by a single analyst through observation. Time spent by the workers for each activity was recorded in minutes and categorized into value adding, non-value adding and non-value adding but necessary activities. Pie-charts were generated to understand the proportion of non-value adding activity in percentage. Findings showed that above 50% of the time was spent on non-value adding activity during concrete reinforcement process. For the remaining activities, only around 30% of the time was spent on value adding activities. Productivity analysis was subsequently carried out with the data available on the site. Interviews were further conducted with the supervisors, contractors and engineers to ascertain the causes for lower productivity. Recommendations through lean implementation techniques are suggested for improvement. Similar approaches can be adopted by project managers and contractors to improve productivity issues on their project sites.

Keywords: *Productivity; Work Sampling; Lean Principles; Construction Management*

Smart Cities and Sustainable Development

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Abstract

India has undergone rapid urbanization over the last few decades and the witnessing cities are mostly of Class-I & II tiers. To cater the issues developed by this phenomenon, the governing authorities have taken up initiatives over the years, in the form of programmes that have mainly focused on providing basic infrastructure services and utilities to the cities and have not paid much attention in achieving sustainability in the approach.

In this study we track the status of work done in Smart City Project of Ahmedabad, analyse how the pending targets could be achieved sustainably and ways to promote sustainable & inclusive cities and give a decent quality of life to its citizens with a clean sustainable environment comprising of smart solutions.

Keywords: *Urbanization; Smart Development; Sustainable Development; Smart Growth; Smart City*

Negotiation Analysis- A Case of Real Estate Property Deal

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Abstract

This is a dyadic negotiation analysis in which a representative of buyer and a representative of seller is negotiating over the sale of a piece of property. The negotiation scenario is developed by using primary research i.e. interviews of relevant parties involved in negotiation. The scenarios are the confidential role information of the respective parties (buyer and seller) and both the parties is having their own set of information. The negotiation scenario is presented to demonstrate distributive (i.e. value claiming) tactics in zero-sum negotiation. Further, the negotiation analysis is presented on the following topics: BATNA analysis, reservation value calculation, assessment of Zone of Potential Agreement (ZOPA or bargaining zone), the critical role of information, the potential for information asymmetries, the use of contingency contracts to protect against fraud and overcome problem of distrust. Finally, the researchers prepared the check list to be considered by buyer and seller before

going for sales negotiation in property dealing. Researchers maintained the confidentiality of the research participants by using hypothetical names.

Keywords: *Zero-Sum Negotiation; BATNA Analysis; ZOPA; Reservation Value; and Contingency Contract*

Liquidity and Profitability Analysis in Selected Real Estate Companies in India

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Abstract

In the financial year 2017-18, real estate sector of India saw two major reforms come into force, namely, the Real Estate Regulatory Authority (RERA) and the Goods and Services Tax (GST). For under construction properties, the government has allowed one-third of an apartment cost to be deducted towards the transfer of land and GST at the rate of 18 percent to be paid on the balance amount, which brings the effective GST rate on under-construction properties to 12 percent. While occupation costs are likely to go up marginally as the 15 percent service tax has been replaced with an 18 percent GST; completed properties as well as rented apartments have been kept out of the purview of the GST. The other big reform, RERA, which came into force on 1 May, 2017 was passed to ensure accountability, infuse transparency and bring uniformity in real estate practices. Now these two reforms set stone for interesting and exciting time for the real estate sector of India. In this context, it becomes very relevant to look into the fundamentals of some selected real estate companies in India over a period of last five years and assess the readiness of the sector to face these challenges. This paper attempts to study the liquidity and profitability position of top five such companies for the last five years. The key variables considered for this study includes current ratio, quick ratio, return on equity, return on capital employed and return on assets.

Keywords: *Liquidity; Profitability; Current Ratio; ROE; ROA*

Analysis of Public Private Partnership Projects in India and Techniques Implemented in Other Countries

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Abstract

Public-Private Partnership (PPP) is an arrangement between the government entity and private entity for the provision of public assets through the investment made by the private party for a specific period, where there is a well-defined allocation of risk between the private sector and public entity,

and the private sector receives performance-related payments measured by public organization. The relative merit of the idea of PPP is oriented mainly around a mutual benefit.

Considering India's infrastructural needs, PPPs are not just an option, but a necessity. It has been seen that PPP has many merits such as large investment in public (both urban and rural) infrastructure, efficient service delivery, cost-effectiveness, contracts that are performance-based, sharing of risks, etc. In spite of numerous benefits in PPP projects, over past decades, most of the projects in India were failed due to the inefficiency of proper methodologies and practices being followed in it. This led to inefficient service provided by both parties. Hence, understanding the causes of failure in India and success of PPP projects in countries other than India is of utmost importance.

This study consists of identifying the various reasons of failure of PPP projects in India, different techniques which are implemented in other countries that lead to the success of numerous projects, evaluating the methods that are performed in other countries that can be implemented in Indian projects which results in increasing the efficiency of PPP projects in India.

Keywords: *Public Private Partnership; Infrastructure*

Intelligent Transportation System: A Promising Solution for Traffic Management and Transportation System in India

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Abstract

The transportation system comprises fixed facilities, the flow entities, and the control systems. All these components together contribute to the efficient and safe movement of people and goods-that is what the comprehensive transport system all about. While fixed facilities refer to roadway segments, railway track, etc., flow entities and control systems refer to the vehicles and the vehicle flow controls respectively. Improving transportation infrastructure means building new roads or upgrading existing ones. At the same time, the future of the transport industry lies not only in the basic components, but also increasingly using information technology (IT). The IT which transformed many industries is now in the early stages of transforming the transport system. The application of IT tools in the transportation system both passenger and goods modes are precisely known as Intelligent Transport Systems (ITS). Travel information for commuters in city buses displayed on electronic display system is a simple example of "Intelligent Transport System." This form of ITS makes travels easier

and convenient for the passengers. The Intelligent Transport System, abbreviated as "ITS" basically works using very advanced technology-GPS, and it is a broad set of devices, facilities, and processes which uses computers extensively and other electronic and electrical devices for management and operation of the transportation systems across various modes. However it is mostly used in the monitoring and control of transit unit operations, fare collection, passenger information system, etc. The objective of this paper is to focus on the complex conceptual aspects related to the IT sector as well as the application of ITS technology in various transportation systems operational in India.

Keywords: *Transportation System; IT; ITS; GPS; CCTV; Surveillance System*

Assessing the Effect of Prioritization of the Critical Chain Activities on Project Duration

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Abstract

Projects are essentially black box and therefore, it needs a huge amount of visibility in the way the projects are scheduled. In this regards, Critical chain project scheduling has been considered as a promising methodology to bring in the visibility in the project schedules by curtailing project duration. CCPM involves establishing a critical chain and sizing buffers with respect to resource constraints. However, determination of critical chain with constrained resources is computationally time consuming and iterative process. The length of critical chain varies with the set of priority rules employed. Each of the priority rules can potentially level the resources in different ways. Therefore, identifying an efficient priority rule to level the resources in the critical chain is a researchable problem.

In order to investigate the effect of prioritization of critical chain activities on project duration, three priority rules: Relay race resource scheduling, exploiting available float and late start scheduling have been employed. The total 11 cases under each of the above priority rules were investigated with a reasonable size project network. For each of the priority rules, it is found that the project duration varies inversely with the magnitude of feeding buffer and varies in direct proportion with the magnitude of project buffer time. Therefore, it is practically significant for the project planners spend more time in sizing and placement of feeding buffer in critical chain scheduling. Therefore, it is found that the feeding buffer can also potentially control the project duration regardless of the priority rules employed. The research contributes in establishing an efficient priority for critical chain scheduling and put forward a process for estimating a confirmed critical chain from the initial guiding critical chain.

Keywords: *Critical Chain; Feeding Buffer; Project Buffer; Project Duration*

Study and Development of Karandi Khedebar Village as a Smart Village

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Abstract

This paper deals with the study and development of Karandi Khedebar village as a smart village. This village is situated in bhor taluka in pune district. In this paper we have focused on major rain water harvesting, improving sanitation conditions, use of renewable energy, solid & liquid waste management, functional bank account, education facilities and medical facilities. As smart village is the modern energy access acts as a catalyst for balanced development. The study is considering two objectives (1) To prepare cost effective model for village (2) To highlight the prospects of future development

Keywords: *Smart village; Karandi Khedebar; Catalyst; Balanced Development*

Delay in Construction Projects: Types, Causes and Effects

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Abstract

Delay in the construction projects is one of the most recurring issues in construction project worldwide. It can be defined as the lateness of completion, It either exceeds the date specified in the contract or the date decided by the parties for delivery of the project. The objectives of this study are to discuss the types of construction projects delay and their causes and effects. This study is carried out based on different types of delays mentioned by different authors. There are a lot of causes that are responsible for the delay. However, some causes are more effective than others. No set of causes are agreed upon to be the most effective. The classification of the most effective causes is different from one study to another. The various effects of delay that were identified include: time exceed, cost exceed, dispute, arbitration, total abandonment, and litigation. The study mostly concludes that time and cost overrun is directly proportional to delay in construction projects.

Keywords: *Construction Delay; Types of Delay; Concurrent Delay; Causes of Delay; Effects of Delay*

Reusing Plastic Waste by Manufacturing of Paver and Solid Block

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Abstract

Plastic waste is increasing everyday due urbanisation and population growth. In developing countries like India it is very difficult to handling and dispose of plastic waste and 70% of the plastic is discarded as waste. Due to improper solid waste management enormous amount of plastic is dumped into the landfill which is severe thread to environment and ground water. In other way large amount of plastic dumped into the ocean illegally. 13 million tonnes of plastic thrown into the ocean each year according to United Nation Environment Development Program (UNEDP) in 2050 there will be the more plastic in ocean then the Fish. Due to plastic pollution human health is affected like through disruption of various hormones mechanism and cancer. In India around 5.6 million tonnes per annum of plastic waste is generated which about 15,400 tonnes per day.As we can see that 70% to 80% of earth surface have concrete work. Due to this its create difficulty afterexpiring the structure. After demolishing the structure it's difficult to manage that construction waste(Debris)it will harm public healthas well as environment. According Ministry of Environment, Forest and Climate Change the most annual report estimate of C&D waste in India Cities is generated 165-175 million tonnes during the period 2005-13 and in 2017 25-30 MT has been generated its increasing day by day.

To avoid that problem in this project we are utilising both the waste (Construction and Plastic) with different design mix ratio and plastic waste is using as a Binder by burning and as a aggregate by Crushing 10mm down.

In this project we are utilization of plastic waste (polyethylene, High density polymer, polyethylene terephthalate) and Construction waste (Concrete) for making paver and Solid block.

Keywords: *Plastic Waste; Paver Blocks; Ceramic Waste; Construction Waste*

Asset Maintenance Management with Internet of Things in Commercial Buildings

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Abstract

Asset maintenance management is becoming obsolete with the planned and reactive maintenance strategies. The risk involved in their implementation procedures is causing breakdown of equipment and higher costs incurred in labour and spare parts maintaining for the commercial building facility

managers and for the owners in capital and operation expenditures budgeting. To avoid, overcome and have better maintenance of assets with optimized uptime and reliability better strategy and method is required.

The aim of this study is to determine how the Internet of Things can be used in Commercial buildings for the enhanced assets maintenance management. The research is followed by the question; what impact can the Internet of Things have in the assets maintenance management? In this context, the question is intended to level of impact and the Internet of Things can bring in the effective maintenance management of assets.

The question is answered by an online survey questionnaire sent to respondents. A holistic approach is taken into consideration from the responses of different individuals working in various sectors of the physical asset management field. The responses show that most of the professionals, experts feel and believe in Internet of Things will have a better influence on asset availability and maintenance management with reduced costs for labour, energy, spares. These results indicate that the vision to adopt new technology for improved assets management and for the organisations to transform themselves to sustain in the competitive market.

On this basis, it is recommended to have the Internet of Things in commercial buildings for the assets maintenance management in sustainable and improved performance method of maintenance. Further research can be undertaken for the detailed classification of the available Internet of Things devices in the market and their performance measurement criteria of the asset.

Adapting Modern Methods of Urbanisation through Sustainable Methods of Connectivity Until the Last Mile

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Abstract

Urbanization is predominantly the process by which towns and cities are formed and became larger as more people begin living and working in central areas. Urbanization is usually measured according to the different disciplines that are geography, sociology, economics, urban planning and public health. In the recent years the problem of urbanization has got more attention. The definition of urbanization is more about migration from semi or undeveloped area (rural) to urban areas, where the facilities are being provided to the occupant. A region's progress used to be measured on the rate of urbanization but now it's time to gauge it at the rate of sustainable urbanization.

As it time to realize that urbanization is not always beneficial, in fact it carries over more concerns. There are three major problems of urbanization. They are job competition; crisis of natural resources

and environmental pollution and imbalance. This research is based on the impacts of physical and mental effects of existing urbanized modern modes of commuter's perceptions providing comfort on separated or on-street transportation facilities. Commuters comfort is mainly influenced by the road statistics and surrounding conditions on physically and geographically separated paths while they pay attention to the effective riding carrying space and traffic situations on lanes leading to development of urbanization for all groups. A detailed study has been carried out at mass public transportation hubs in the city of Noida, India to identify the possibilities of promoting modern methods of transportation facilities to the last mile connectivity and the understand the reasons for existing misconceptions and concerns in using sustainable and environmental modes for commuting.

Keywords: *Transport Management; Transport Planning; Environment; Public Health; Management*

Mediation of Employee Engagement between Communication Process and Work Life Balance

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Abstract

Rationale: These days it is imperative for Human Resource professionals to engage employees to shape their organizations to face uncertainty in the business environment.

Purpose: There are many research studies related to employee engagement, however there was a need to study mediation of employee engagement between communication process and work life balance.

Design/methodology/approach: Cross-sectional data was collected through survey questionnaire from permanent employees of banking sector irrespective of the designation but at least have completed 5 years of service. The data were analyzed using structural equation modelling to explain the correlation between explanatory variables and outcome variable and to find out mediation role; and a regression analysis to find direct and indirect effect.

Findings: A significant association between communication process and employee engagement in indirect relationship exists; additionally, maintaining open communication process in organization about organization system, process and policy has positive and significant relationship with work life balance of employees. Regression analysis was done to test the direct and indirect relationship between variables. This study concludes with the full mediation of employee engagement between communication process and work life balance.

Implications: In the business world, where cutthroat competition is constantly rising; this study holds managerial implications for the organization.

Limitations and future scope: The present study was limited to three constructs only. Other constructs can be used to test relationships and research methods such as qualitative methods can be utilized for in-depth analysis; a longitudinal study can identify some unknown organizational dynamics those occurs over a time.

Keywords: *Employee Engagement; Communication Process; Internal Communication; Work-Life Balance; Mediation*

Admixtures in Concrete – A Review

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Abstract

Admixtures are liquids or powders added in concrete, based on mix design computations, with an objective to improve the fresh as well as enhance the hardened state properties of concrete. Workability, strength and finish of the concrete influence the quality, cost and durability of the concrete. With the growing challenges of environment pollution and adoption of sustainable construction practices, in addition to cost-quality-time pyramid of construction projects, adoption of smart construction practices is the key. Concrete production using admixtures is one of the solutions to meet the above challenge. Chemical admixtures, along with the mix water, impact the rheology of concrete. Chemical admixtures influence the fresh state as well as hardened state properties of concrete. The beneficial impact of use of chemical admixtures on concrete mix can be visualized through the mega structures that have been constructed in the recent past or under construction. Admixture chemistry plays a significant role to transform normal concrete mix into a high performance concrete mix. This paper attempts to present the time line on the development of chemical admixtures, transformation observed in the admixture chemistry and the applications of the admixtures in some major concrete constructions.

Keywords: *Concrete; Admixtures; High Performance Concrete*

Areas of Application of Artificial Intelligence in Construction Project Management

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Abstract

The study is aimed to find out areas in which Artificial Intelligence (AI) can be suitably implemented during pre-construction, construction and post-construction phase of project. Various research papers have reviewed to find out these areas and benefits of AI in the respective areas. Around eleven areas were identified. These areas include, Site layout & Alignment selection of the project, Planning & Scheduling, Cost & Duration estimation of projects, Contracts Management, Traffic & Accident Management, Valuation, Logistics Management, And safety Management, Demand Forecasting, Alignment selection of construction projects, Integration with Building Information Modeling (BIM). A survey was conducted to verify the feasibility of AI applications in these areas. The liker scale of Least to Most Feasible (1-5) was used to collect the responses of the construction professionals. The result showed that areas such as Logistics Management, Integration with BIM and Cost and Duration Estimate of construction Projects are the most feasible for implanting AI applications and will be efficiently benefited. The study will provide a basic framework to the construction professionals to decide on implementation of AI in construction project management.

Keywords: *Artificial Intelligence;Construction Project Management*

A Case Study on Aundh-Baner-Balewadi (ABB) Area of Pune as a Local Area Initiative

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Abstract

Every city wants to be a Smart City (SC) nowadays as cities are engines of growth for the economy of every nation, including India. Current cities are complex systems that are characterized by massive numbers of interconnected citizens, businesses, different modes of transport, communication networks, services and utilities, population growth and increased urbanization raise a variety of

technical, social, economic and organizational problems that tend to jeopardise the economic and environmental sustainability of cities. The conceptualization of Smart varies from city to city and country to country, depending on the level of development, willingness to change and reform, resources and aspirations of the city resident. Key initiatives are planned to fix hard infrastructure and make it future ready since with increasing urbanization the population grows 4 times compare to the existing current population & thus requires comprehensive development of physical, institutional, social & economic infrastructure to set the motion of growth. Smart city is a step in that direction. The aim of the proposed study is to assess the impact of Smart City on socio-economic area based development of Aundh-Baner-Balewadi (ABB) area of Pune. The study is considering the objectives of i) to measure the impact of local area initiative of Aundh-Baner-Balewadi (ABB) on education & professional skill development, healthcare facility, waste management & pollution control for the surrounding area and further city as a whole and ii) to find out the scope of employment generation from local area initiative of Aundh-Baner-Balewadi (ABB).

Keywords: *Smart City; Sustainability; Social; Infrastructure and Socio-Economic*

An Exploratory Study of the Leadership Skills for Construction Project Success in India

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Abstract

Leadership skills play a vital role in construction project success all around the globe and India is no exception. Leadership can be viewed as an art of influencing others to achieve organisational as well as personal goals. Possessing appropriate leadership skills are important for the success in all organisations including that of construction. Construction engineers, who join organisations, have education, which provides them with technical competence. These young engineers over a period of time progress to become junior managers and gain experience in functional areas and managerial abilities. Leadership skills adopted by these managers are learnt from the leaders they have interacted in the past or their immediate bosses.

Project leaders play a crucial part in identifying and enhancing the positive people skills that result in improved managerial performance. Leadership skills and project management skills are divergent as well as complimentary. The Management has to confront the challenge of balancing both these skills as management skills focus on operative functions such as planning, organising and controlling while leadership skills focus on motivation, communication and influencing the members to achieve the desired results. Construction organizations need leadership that provide the collective vision, strategy

and direction towards the common goal for a sustainable future and growth. Research in these areas in construction industry is gaining prominence.

The present study focuses on exploring different project leadership skills currently existing and that are required for successful completion of projects in the Indian construction industry.

Keywords: *Leadership Skills; Competence; Construction Engineers; Project Success; Construction Industry*

Role of Urban Local Bodies in Disaster Management in Chhattisgarh

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Abstract

Every city is prone to a few hazards like flood, cyclone, water scarcity, epidemics, and earthquake, and fire, chemical and industrial hazards. All over the world rapid urbanization is taking place. According to World Bank by the year 2025, 80% of world population will be residing in urban areas. This is most critical and disastrous situation. Disasters has got two phases which is required to be managed, pre disaster and post disaster phases. Both faces can be further divided in to the risk identification, mitigation, risk transfer, and preparedness, emergency response, reconstruction and rehabilitation. The main contribution of this project to the body of knowledge is to provide a source data of what is the current status of disaster preparedness in Chhattisgarh state.

Keywords: *Disaster; Hazards; Preparedness; Urbanization; Mitigation*

Energy Management Methodologies - A Literature Review

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Abstract

Availability and reliability of Electrical Energy plays important role in developing countries like India. The nature of electricity differs from that of other commodities since electricity can not be stored and there have been significant seasonal and daily variations of demand. Power shortage particularly peak load shortages have an adverse effect on the overall economy. The uncertainty, randomness, seasonality and non-stationarily related to electricity market sometimes make it difficult to take appropriate business decisions.

Energy availability decides socioeconomic behaviour of any urban development. Indian electrical grid have deficit of nearly 5% during peak hours.

Indian government have planned to develop 100 cities in near future.21st century will see horizontal and vertical growth of the city. Water distribution system demands electrical energy to supply water in high rise building.

How to mitigate the peak hour demand becomes the key issue throughout the Indian continent. Demand Side Management (DSM), Time of Day (TOD), Efficiency Improvement, Renewable energy utilisation and many other options are available. By clubbing the two and more energy management techniques Indian Electricity Grid can handle the peak load demand.

Energy Management Methodologies offers the largest and most cost effective opportunity for developing nations to limit the enormous financial, health, and environmental costs associated with burning fossil fuels.

Keywords: *Energy Management; TOD; Urban Areas; Peak Demand*

Assessment of Project Success in Construction Using Performance Indices

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Abstract

Predicting the performance of a project and chances of its likely success has become difficult owing to the kinetic nature of the construction industry. This paper aims to study the background and processes involved in analyzing the performance of a project and assess it based on its success. The parameters for evaluating project success and the indices to measure success/performance of a project are identified through literature study. Through questionnaire surveys aimed at the stakeholders in the projects, data is collected from two live case studies (an ongoing and completed project) on the overall performance in terms of its success/failure. Finally, with the help of SPSS tool, the data collected from the surveys are analyzed and applied on the selected performance indices. The score calculated by using the indices and models helps in assessing the overall performance of the project and interpreting it to find out whether the project will be a success or failure. This study acts as a reference for firms to carry out performance evaluation and success measurement on a regular basis helping projects to identify the areas which are performing well and those that require improvement. The study signifies that by evaluating project performance; a project's deviation towards success/failure can be assessed thus helping in suggesting early remedial measures to bring it on track ensuring that a project will be completed successfully.

Keywords: *Construction Project; Project Performance; Performance Indices; Project Success; Success Assessment*

Implementation of BIM in Infrastructure Projects: A Review of Literature

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Abstract

This paper develops and discusses the different literature for an implementation of Building Information modeling in infrastructure sectors. first the literatures on BIM are investigated and then different literatures on application of Building Information Modeling in different sectors and in different stages of project life cycle are explored. The traditional construction industry's production efficiency is comparatively low. Digitization of the construction process by using Building Information Modeling will enormously reduce risks and strengthen bankability of infrastructure projects, besides improving their viability and asset lifecycle. BIM software provides three dimensional visualization, parameterization, and virtual simulation of the objects. With help of BIM technology, we can solve many technical problems, issues in communication amongst the major and minor stakeholders, construction delays, cost control, quality standards, carbon emission and many other issues throughout the entire life cycle of the project. Implementation of BIM in infrastructure projects is greatly enhanced allowing infrastructure companies to present initial stage design ideas to stakeholders and planners so they can visually ascertain the impact of potential infrastructure projects. In this paper, we will find out how BIM implementation is helpful in infrastructure sector and how we can make full use of the many advantages of BIM technology to improve the engineering quality and construction efficiency of the any infrastructure projects and to complete the operation and maintenance.

Keywords: *Building Information Modeling(BIM); Infrastructure Projects; Multidimensional Framework; Quality Management; Facility Management*

Seismic Behaviour of Concentric Reinforced Cement Concrete and Steel X – Bracing System in High Rise Structures

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Abstract

Structures in seismic zones are designed for lateral forces in addition to gravity loads. To make structures earthquake resistant, several resisting systems are provided namely Shear Walls, Bracing Systems, Diagrid Systems, etc. The present study analysed the combined behaviour of RCC and Steel X – Bracing system in high rise structure (G+10). Also, the comparative study of performance of

RCC and steel X - Bracing system in high rise commercial structures under seismic loading was performed. The RCC bracing results in higher stiffness and stability as a potential advantage over other bracing systems whereas Steel bracing results in increase in stiffness without much increase in seismic weight. The total of 4 structural configurations viz., Moment resisting frame (Model 1), MRF stiffened with concentric RCC X – bracing system (Model 2), MRF stiffened with Steel X – bracing system (Model 3), MRF stiffened with both RCC and Steel X – bracing system (Model 4A, were modelled and then analysed.

The IS: 1893:2002 has been taken as a standard criterion for analysis using STAAD Pro V8i software. The seismic parameters taken into consideration are base shear and storey displacement. The post analysis results concluded that Model 4 (Moment Resisting Frame stiffened with both concentric RCC and Steel X – bracing system) is more efficient, safe and economical in earthquake as compared to other analysed models.

Keywords: *Reinforced Cement Concrete Bracing; Concentric Steel Bracing; Storey Displacement; Base Shear; Seismic Analysis; Story Drift*

Improvement in Geotechnical Properties of Red Soil Using Blast Furnace Slag

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Abstract

A large area of land is used for industrial purpose due to which pollution increases day by day. The waste material extract from industries is utilized in this paper to improve the geotechnical properties of red soil. Red soil is found in areas having low rainfall. These soil contents high irons due to which the colour of the soil becomes red. The strength of these soils is lower as compared to other soil due to its porosity. The strength of these soils can be improved by using some additives on it. In this research work, the stabilization of red soil is done by using additives such as blast furnace slag. It consists of silicates, aluminosilicates, and calcium-alumina-silicates. The mixture of red soil and blast furnace slag helps to improve the stability of soil.

Keywords: *Red Soil; Blast Furnace Slag; Waste Material; Pollution; Stabilization; Strength*

Assessing Team Performance Using SNA in BIM Based Projects

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Abstract

Construction projects are envisaged as temporary project networks, wherein several stakeholders of the project come together for a specific period of time to complete project goals either face-to-face or virtually. Striving at efficiency and high performance, researchers have shown interest to explore team dynamics and its impact on project performance. However, there are limited studies that have addressed this concern with respect to domestic and global projects. To this end, two BIM based MEP projects were selected for the study, one from a firm executing domestic projects and the other from a firm providing offshored engineering services. To assess the team dynamics, communication across the participants were collected through emails and minutes of the meetings for a period of 12 weeks. Data was analyzed both quantitatively and qualitatively using social network analysis techniques and ethnographic coding respectively to explore on team dynamics and network of conversations necessary for high performance. The findings showed that the domestic team were more cohesive compared to the virtual team as the project progressed. Virtual BIM project mandated the role of a central connector to coordinate information across stakeholders. Further, there were more exchange of information in the virtual project in the form of instructions (declare), requests and discussions compared to the domestic project. The findings are expected to act as a stepping stone for enabling team performance in construction.

Keywords: *Team Dynamics; High Performance; Building Information Model; Social Network Analysis; Construction*

Comparative Study of Silica Gel Based Concrete with Normal Concrete

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Abstract

The silica gel based concrete (SGC) is one innovation which provides strength, durability and other properties to concrete. In this work we tested M50 grade concrete cubes of size 150x150x150 with Nano silica (gel) and Crushed Glass powder and tested their properties for 7 , 14& 28 days

respectively. Cement was replaced with varying percentages of Nano silica and the results were tabulated. The results showed that 10% replacement of cement with silica gel gave the maximum strength to the concrete, increased its initial strength and also durability.

Keywords: *SGC; Nano Silica; Glass Powder; High Strength; Durability*

Performance Areas for Measuring Project Success- An Indian Construction Industry

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Abstract

The success of a construction project means satisficing, expectations of the major stakeholders; owner, client, designer, and consultant. The expectations differ to some extent among stakeholders depending on their primary objectives. The satisfaction depends on the performance of the projects and there are different measurement parameters of project performance. The aim of the paper is to identify the performance areas that ensure successful completion of construction projects in the context of the Indian construction industry. Data for the study was collected through questionnaire from 76 construction professionals. The data were analyzed using the mean score and standard deviation and ranked. The study revealed ten important performance areas that help to measure project performance in the construction industry. The identified performance areas are ;(1) quality (2) schedule (3) safety (4) Finance (5) cost (6) productivity (7)customer relation (8)communication and collaboration (9) stakeholder satisfaction and (10)environment. The study has identified the correlation between the performance areas and the performance of a project. The findings will help professionals to understand performance areas to improve project performance.

Keywords: *Project Performance; Project Success; Indian Construction Industry*

Proposal & Assessment of New Competitive Bidding Strategy models in Construction Contract Management

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Abstract

Construction companies must have the ability to deal with various bidding situations successfully in today's highly competitive construction market. The aim of this study was to build two models based on the factors that influence on bid or not to bid decision, value addition & distinctive competencies of

firms to develop a user-friendly tool to support contractors to guide to win bid among the competitors. Here two models were proposed, given as follows:

- 'Bid or Not to Bid Decision Matrix Model' to analyze bid or not to bid
- 'Five Force Multi-attribute Decision Model' to analyze how to win the bid

'Bid or Not to Bid Decision Matrix Model' was proposed based on four important variables i.e. Complexity of project, Profit prediction, Contractor's financial capability & Bids in hand.

For 'Five Force Multi-attribute Decision Model', five forces are: Strategic decision making in bidding incorporates into three broad groups of factors i.e. internal, external and environmental factors, Value management & Distinctive Competencies of firm.

Questionnaire survey & data was collected from 17 respondents of 5 construction firms. To analyze the study, Relative Important Index method (RII), Spearman's rank order correlation coefficient method, Kruskal-wallis & Chi-square test were used.

Keywords: *'Value Management';'Distinctive Competencies'; 'Bid Or Not To Bid Decision'*

Real Estate in India Post Year 2017: Transition from Developer Market to Buyer Market

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Abstract

The paper discusses the characteristics of real estate sector in India post the year 2017. During the year 2017, the Real Estate sector in India has seen sea of policy level changes. The notable ones are according infrastructure status to affordable housing, the inclusion of Goods and Services Tax in real estate, and the Real Estate (Regulation and Development) Act 2016 which delivered Real Estate Regulatory Authority. These policy level reforms have impacted the dynamics of all the stakeholders of the real estate development process. This paper discusses the changed behavior of buyers, the changed profile of investors, the changed participation of organized and unorganized developers, the role of real estate consultants and real estate brokers or agents, the financing structure of new launches, the change in trend of unsold inventories and the factors influencing sales. The paper aims to understand: Whether, Real Estate is transitioning from developer's market to buyer's market and if it is so then what's influencing this trend. The article borrows concepts of Efficient Market Hypothesis to understand the state of real estate.

Keywords: *Real Estate; RERA; Developer Market; Buyer Market; EMH*

Evaluating Benefits of Building Information Modelling (BIM) Using A 5D Model for Construction Project

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Abstract

The Building Information Modelling (BIM) has come forth as a key stream in civil engineering and project management, and has received ample attention by researchers in last decade. BIM can be considered as evolution of CAD (Computer-Aided Design) and its implementation will contribute to increase construction sector efficiency. To study the unrealised advantages of implementation of BIM, a Level-2, Level of Development (LOD)-300, & 5-Dimensional model of a residential project were developed and compared with conventional process. The model was developed by following a systematize methodology and various tools & software's like Autodesk Revit, Autodesk Naviswork and Microsoft project have been used. The aspects like real-time cost planning & conceptual Modelling were studied. It was noted that by adopting the multi-dimensional BIM model the rework is reduced with the help of clash detection, the productivity was improved due to reduction of conflicts and changes during construction. The findings of this study suggest that by adopting the 5-D BIM can boost the growth of construction industry. Further, by integrating Internet on Things (IOT), Machine Learning (ML), Artificial Intelligence (AI) and Virtual Reality (VR) with BIM will provide a new direction to BIM technology in future.

Keywords: *Building Information Modelling; LOD-300; Level-2; 5-Dimesional Model; Cost Planning*

Models for Total Suspended Solids (TSS) using Ideal Remote Sensing System

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Abstract

Total Suspended Solids (TSS) affects the growth of mangroves, causes loss of swamps and is a menace to the marine environment. The colloidal portion of TSS play role in fate, transport and transformation of pollutants.

The laboratory experiment was conducted in a specially designed sedimentation tank. Ideal remote sensing system conditions are maintained throughout the experimental work. The spectro-radiometer was compatible to spectral resolution of IRS-P3 MOS B satellite sensor. The sediment samples were extracted from the Thane creek, adjoining Mumbai.

Linear and Multiple regression models were developed between TSS and reflectance values obtained from spectro-radiometer (compatible to IRS-P3 satellite). A very high regression coefficient values *(*greater than 0.98) were obtained for both of these models.

Keywords: *IRS-P3 MOS B, Total Suspended Solids (TSS), Multiple and Linear Regression Models, Spectro-Radiometer*

Analysing the Factors Influencing Quality throughout the Lifecycle of A Road Project

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Abstract

The measurement of quality in an integrated form is necessary to evaluate the performance of any project. A number of papers have been published for evaluating qualities of construction projects. However, limited studies are reported on the measurement of quality in an integrated form. To address this research gap in the body of knowledge, this study is aimed at identifying and analysing the factors influencing the quality of road pavement throughout the lifecycle of a road project. Different stages of quality such as quality of concept, quality of design, quality of construction, quality of conformance and quality of performance are considered in this study. On the basis of both, detailed literature review and expert opinions, a total of 54 factors were identified and then a questionnaire was developed to obtain the opinions of respondents to measure the effect of each factor identified. The questionnaire was circulated to owners, engineers, contactors, design consultants, construction managers and 27 responses were received. The effect of each factor was measured in terms of its importance index and then were ranked accordingly. The reliability analysis of data obtained is done using Statistical Package for the Social Science (SPSS). The result of this study demonstrates that owner's policy and effective quality management system found to be highly significant factor at conceptual stage. In the design quality, the nature and type of subgrade soil and design errors found to be extremely important factors. Similarly, quality of raw materials i.e. aggregate etc. and method of construction are of prime importance in quality of construction. Effectiveness of QA/QC program and subgrade failure, rutting, shoving are significant factors for

quality of conformance and performance respectively. The findings of this study will help the project managers to focus on the critical factors in order to achieve better quality in construction of road projects which will result in less maintenance cost.

Keywords: *Critical factors; Lifecycle; Project Management; Quality; SPSS*

Cost Escalation in Project Management: Study of a Real Estate Project in India

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Abstract

Construction projects are usually of quite lengthy ranging from several months to several years. All projects are to be performed according to a pre-confirmed contract amount and contract agreement in principle. Therefore, there is a strong probability that the cost of labour and material will rise or fall periodically, to a greater or lesser extent during the life of project. Hence there is a possibility for most of contractor is that they have to bear damage at that particular period due to sudden change rise of international raw materials or exchange rates under lump sum or fixed price contract. Therefore, the provisions regarding contract price escalation should be rearranged systematically to cope with the sudden price changes.

Escalation is a term used in most countries, to indicate extent of these changes from the commencement of a project through any point during its life. As equivalent terms fluctuations rise and fall and contract price adjustments are used interchangeably. The financial success of construction projects can be uncertain and at risk due to changes in escalation rates during construction. The success of a construction projects is mainly influenced by to what extent of cost escalation identified and allocated to the projects. Cost escalation is part and parcel of construction projects in India. Escalation in construction market in recent years has been extremely volatile, and this trend expected to continue in the near future due to competition for resources and skilled workers. This situation has created a great deal of uncertainty and nervousness among construction field.

This work is an overview of the causes of cost overrun with specific reference to India. It has been found that all the factors are not similar to every project though few of them are common viz. impact of inflation, poor management, inaccurate material estimates, constructability and financial condition of the contractor. An attempt has been made to discuss both Infrastructure and Real Estate sector of construction.

Keywords: *Cost Overrun, Causes, Construction Projects, Inflation, Project Schedule, Market Condition, Constructability*

Challenges and Opportunities Using "R" Tool for Analytics in Decision Making for Construction Projects – A Case Based Approach

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Abstract

Analytics have changed the fundamental pattern of data analysis and forecast in the construction industry. It has developed the potential to extract actionable insights in the industry from the huge amount of data that is being generated now and then. Huge amount of structured and unstructured data is produced in the industry and with this data we could help a firm to make a game changing decision. Construction industry stakeholders maximize their revenue potential and must have the solution to harness the velocity, variety, and velocity of data coming into their that want to be innovative and maximize their revenue potential must have the right solution in place so that they can harness the volume, variety, and velocity of data coming into their organization and leverage actionable insight from that data. A real estate firm these days faces an unprecedented number of external pressures such as eroding profit margins, higher owner expectations, rapidly changing technology, dwindling workforce and, thus, this paper focuses on the future prices of the vicinity based on various factors and to remove the uncertainty from the minds of both buyer and developer.

Key words: *Analytics; R; Decision Making; Real Estate; Construction Industry*

Geostatistical Analysis of Vertisols Micronutrient –A Case Study in Gulbarga Taluk, Karnataka

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Abstract

Proper management of soil nutrients is significant for meeting prerequisites of ever-increasing population of India without deteriorating the environment. Due to the lack of knowledge in precision agriculture among small scale (less than 2ha) farmers and poor soil management, the yield of the crop has declined. The present study investigates spatial patterns of available zinc (Zn) in soil vertisols by a Geostatistical approach using SpaceStat 4.0®. Sixty-eight composite surface soil sampling (0-15 cm depth) are taken in fields of Gulbarga taluka, Karnataka, India, and chemical analysis iscarried out in

Microwave Plasma-atomic emission spectroscopy (MP-AES). Geostatistical semivariograms analysis indicate that Zn was best fitted to a spherical model with a range of 974 m. The best fit model is selected based on the mean sum of square error (MSS error) values and initial flatness in the model. The moderate spatial dependence of Zn over a long distance and the dependency is attributed tothe rate of fertilizers applied and soil type. Ordinary kriging, accomplished by traditional estimator, is used for generating spatial variability maps. Spatial variability maps show the available Zn is high inthe north part of the study area compared to the south. The overlay analysis of spatial patterns and soil types give us a greater understanding of how intrinsic factors affect the spatial variation of available micronutrients. Here, the spatial variability is due to agricultural practices and use of fertilizers. Farmers should assess their soil condition and apply fertilizers as per the requirement.

Keywords: *Sustainable Environment; Spatial Variability; Vertisols; Ordinary Kriging; Zinc.*

ECO Friendly Low Cost Material for Eradicating Water Pollution Problems - Case Study on Pervious Concrete

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Abstract

Alternate building materials are those which can be used economically by replacing the conventional building materials .Now-a-days we all are aware of the fact of environment degradation due to use of excessive natural resources in building construction. Due to this, deterioration of natural eco balance is disturbed hence forth it is necessary to take a prominent step towards a greener construction ideology which can be accomplished by use of alternate building material. The most basic building material for construction of houses is the conventional burnt clay brick. A significant quantity of fuel is utilized in making these bricks. Also, continuous removal of upper surface of soil mass which if the fertilized soil layer is getting depleted, due to which the production of grains will be largely affected in upcoming years. In producing conventional bricks, creates environmental problems. A feasibility study has been done on the comparison of fly ash brick and conventional clay brick. Conventional clay bricks can be replaced with fly ash bricks, which can reduce the cost of housing. To prevent runoff of rainwater use of pervious concrete is recommended which will be used for percolating the rainwater and recharging the groundwater table. This study also investigates the performance of using waste tire crumb rubber as an alternative aggregate for concrete pedestrian block. Our aim is to find out different construction material their optimum uses along with advantages and a disadvantage has been discussed in this paper.

Keywords: *Fly Ash; Building Material; Pervious Concrete; Percolation Rainwater; Water Logging*

A Study on Origin – Destination Survey for a Section of Highway System

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Abstract

This study uses traffic data for the Origin-Destination survey on a highway system in India. This roadside survey was conducted for one day (24 hours) at a station along National Highway 86 (NH 86) linking Kanpur to Dewas in India for a distance of about 674 kilometer (km) using video cameras. The traffic at the site of roadside survey was considered homogeneous with reasonably leveled terrain for good visibility. The site of the survey was located near a police station for convenience and safety of stopping vehicles. This study is meant to present a methodology for understanding the current travel pattern in the region applying method IRC 102-1988. This study has extended to show the sensitivities of Zone Influence Factors (ZIFs) using tornado graphs for their risk ranking using the current travel pattern.

Keywords: *Origin – Destination; Estimation; Design; Highway System; India*

Study of Energy Consumption Benchmarking of Construction Equipment-Ready Mix Concrete Plant

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Abstract

In Infrastructure and Real Estate construction projects, the mechanization of construction activity results in to introduction of various mechanical equipment for excavation, loading, Compaction Grading, Drilling, Blasting, Mixing and Paving. The mechanization results in reducing the time for construction, however, the effective use of mechanization depends on productivity of the equipment. The ready mix concrete plant is one of the major plant equipment and consumes electrical, energy and water as resource depending on type of ready mix.

In this paper, the energy consumption in ready mix concrete plant is discussed the considering the major steps of process. The primary energy consumption is electrical energy consumption by conveyers, crushers and mixers which are plant equipment, where as auxiliary energy consultation is

in transportation concrete. The most significant resource is water apart from major raw material and its consumption is decided by specification of concrete based on type of cement.

To make the construction project energy efficient with low carbon foot print, there is a need to establish method of benchmark for energy consumption by plant machinery; along with its water consumption; also the effect of plant capacity and also specification of concrete. This paper elaborates the factors for establishing the energy consumption for ready mix concrete plant.

Keywords: *Mechanical Equipments, Energy Consumption, Energy Efficiency*

Numerical and Experimental Study on Bubble Deck Slab with M-SAND

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Abstract

Compare to other load bearing structures, Slab is one of the prevalent intense concrete members to carrying a dead load. The essential part of the building is a slab and it should be profitably anticipated and utilized. While constructing the slab requires additional concrete. During the constructing of slab the co_2 emission is elevated and its leads to global warming. The average minimum cost per square foot of a concrete slab is Rs -140, While transferring the load from slab to beam and then column load mechanism is purely based on type of slab and the load can be transfer to beam either in one or two direction .The entire construction weight and cost saving is also elevated by reducing the dead weight of the slab. Nowadays in many engineering projects around the world bubble deck slab is one of the recently developed prefabricated for construction technology. Steel balls or hollow balls can be used in normal slab can be called as bubble deck slab will reduced the dead weight of the slab and also removed the concrete part where the shear will be minimum or zero. By using ANSYS software the model is analysed with appropriate support conditions and applied uniformly distributed loading in the bubble deck slab and in conventional slab. The stress and deformation results were evaluated and compared the bubble deck slab with conventional slab were pragmatic using finite element analysis. At final the self weight of Bubble Deck Slab with the Conventional slab were compared. From the assessment of these results, Bubble Deck Slab gives enhanced concert than that of the conventional slab.

Keywords: *Recycled Plastic; Bubble Deck Slab; Conventional Slab; Composite Concrete and Reinforcement Concrete*

Smart City Development: An Indian Retrospect

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Abstract

As the Smart City mission now completes almost three years, it's probably afair time to examine, what exactly Smart City development means for the Indian sub-continent. A huge percentage of city dwellers in the Indian sub-continent today are still struggling with issues regarding liveability, searching for appropriate places to work, live and enjoy. On the other hand the Government of India is driven to focus on creation of slogan-led hundred urban domains. There is an urgent need to look back and evaluate the true mission of Smart City Development concept as well as its envisaged development and management model. This paper intends to simply apply a humanitarian approach to the Smart City Development initiative and confirm if it adheres to the simple and realistic concerns of the city dwellers in the Indian sub-continent.

Keywords: Development; *Smart; Liveability; Management; City; People*

Stabilization of Black Cotton Soil Using Marble Dust and Lime

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Abstract

Soil which has a high shrinkage and swelling property and having poor shear strength has poor stabilization property. By using different techniques, this type of soil characteristics can be improved. Due to negative property i.e., high swelling and shrinkage of black cotton soil for construction work of any structure first thing to check the type of soil presents in that area and accordingly soil stability. The stabilization of soil is an important factor before starting any construction work. It is very difficult to construct any structure on these soils. In this paper black cotton soil is stabilized with the help of waste material such as marble dust and adding small quantity of lime into it. Because marble dust pollutes the environment so it is utilized in this research work increase the stability of soil. Also small amount of lime added to the soil and marble dust mix to provide hardening and better stabilization of the soil.

Keywords: *Black Cotton Soil; Lime; Marble Dust; Shrinkage; Stabilization; Strength*

Value Creation and Value Based Management

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Abstract

Cost engineering is a scientific technique to improve the value of analyzing specific features. Value as described is the ratio of feature to value. Cost engineering is the systematic utility of characteristic–oriented techniques by means of a multi-disciplined crew to analyze and enhance the cost of a product, procedure or service. fee engineering is considered as a tool of production management which could help to improve the strategies, services and very last merchandise regarding the wishes, with appreciate to time, value and pleasant. The v.e. technique has evolved from previous strategies primarily based on the idea of value and useful approach. Cost engineering is a technique used to investigate the feature of the goods and offerings and to gain the required features of the consumer at the bottom total value without reducing the important quality of performance. Production cost modelling (c.c.m.) is a beneficial device in which the fee is disproportionately excessive whilst considering their function, use, necessity. production fee modelling is an improve elaborate method for price engineering in construction management, where it is able to cause a considerable of huge and complex production whose fee are excessively excessive whilst considering their function, use or necessity, are highest as ideal topics for value reduction efforts. the supplied paper have a look at pursuits to make clear the idea of fee control in construction industry, thru literature review, and references and books using fee engineering in global level and to provide a short description of the worldwide realize.

Keywords: *Value Engineering; Construction Cost Modelling (C.C.M.); Costing; Economy; Necessity*

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