4th International Conference

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

Abstract of Papers

Organised by

NICMAR

National Institute of Construction Management and Research
Pune, India

December 13 - 14, 2019

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 United Nations Development Programme (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 257 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 487 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.

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4th International Conference

On

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

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

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Convener's Message

On behalf of the organizing committee, I welcome you to the 4th International Conference on Construction, Real Estate, Infrastructure and Project (CRIP) Management (ICCRIP 2019), December 13–14, 2019, 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 promote research and facilitate discussions and knowledge exchange across the wide spectrum of CRIP management areas.

We have received a large number of scholarly 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, Smart City Development and Management, Transportation Technology and Systems, Technological Development in CRIP Sectors and Issues in General Management. 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 its participants with an intellectual feast and it will indeed be an enriching experience for everyone. You will be able to listen to our highly distinguished chief guest, the guests of honor and the chief patron of ICCRIP 2019 during the inaugural function. Furthermore, there are plenary addresses by our eminent keynote speakers. A panel discussion with experts has been organized to give the participants an opportunity to interact on advancement of research and academia in CRIP sector. During the valedictory function of ICCRIP 2019, there will be addresses by the leading experts from industry and eminent academicians. It is our belief that ICCRIP 2019 will serve as a good forum for disseminating and enhancing knowledge, promoting research and publications in the CRIP domains and supporting networking among the leaders from industry, educational institutions and the participants.

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

Dr. Jonardan Koner
Conference Convener, ICCRIP – 2019
Professor and Dean – Research & Publications,
NICMAR

Acknowledgement

As the Convener of ICCRIP 2019, 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, Ms. Poonam Chandok – Head, HR-Transportation Infrastructure IC, Larsen & Toubro Ltd., Mumbai and Mr. Ravishankar Chandrasekaran – Vice President and Head of Strategic Business Units (Buildings, Airports & Smart Cities - Urban Built Form Business) Tata Projects, Mumbai and Guest of Honour, Sri. Biju Prabhakar, I.A.S. – Special Secretary in charge of the Department of Social Justice and Women & Child Development of Government of Kerala and Dr. Brijesh Dixit – Managing Director, Maharashtra Metro Rail Corporation Ltd., Nagpur for cordially accepting our invitation and gracing the conference with their esteemed presence.

I thank the Keynote Speakers, Dr. Noushad Ali Naseem Ameer Ali - Associate Professor and Director Internationalisation & Engagement, School of Built Environment, Massey University, Auckland, New Zealand and Adjunct Professor, University of Science, Malaysia, Mr. Sudhanshu Mani – Former General Manager, Integral Coach Factory, Urban Rail Expert, Lucknow, Mr. Rana Gupta – Executive Vice President, Shapoorji Pallonji Real Estate, Kolkata, Mr. Sharath Waikar – Co-founder & CEO, Lean Station Pvt. Ltd., Singapore, Mr. Satya Narayan Kunwar - Project Manager, Kolkata Metro Rail Project (Underground Stations & Tunnels), AFCONS Infrastructure Ltd., Kolkata, Dr. Hemant Sonawane – General Manager (HR), Maharashtra Metro Rail Corporation Ltd., Pune Metro Rail Project, Pune and Mr. Ajay Goyal – Director, Indian Railways Institute of Civil Engineering, Ministry of Railways, Government of India, Pune 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 without whom the conference would not have been a reality. Our Platinum Sponsor is Shapoorji Pallonji & Co. Pvt. Ltd. Gold Sponsors are Larsen & Toubro Ltd. | L & T Construction, A.P. Hospitality Services and ICICI Bank. Our Silver Sponsors are: HDFC Credila Financial Services Pvt. Ltd., Saraswat Co-operative Bank Ltd., Canara Bank and Sridevi Constructions (Engineers & Contractors); along with co-sponsors: Prathima Infra, Janata Sahakari Bank Ltd., HDFC Ltd., Bank of Baroda and Bank of Maharashtra.

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, and Dr. Amol Pawar, NICMAR, Pune for their active cooperation in organising this conference.

I am grateful to the paper presenters, research scholars from different universities and institutes, who have submitted their research papers / posters 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 – 2019
Professor and Dean – Research & Publications,
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Content

Smart City and its Impact on Society: A Live Case Study on Indore City

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Abstract

Smart solutions are to be applied which will enable cities to use technology, information and data which will enable to improve infrastructure and services. By this way the quality of life, employment creation and income enhancement for all especially the poor and the disadvantaged will be improved. In this context a research study is done on smart cities and its impact on society. This research is carried out with the help of a live case study on Indore city in Madhya Pradesh and some of the conclusions of the research study was that the Indore smart city project impacted in a positive way on society in the direction of increasing productivity of work by saving time, money and reduce carbon emissions & improved traffic flow through good transportation and traffic management.

Keywords: *Urban Management Institutions; Economic Growth; Quality of Life; Area-Based Development; Employment; Retrofitting; Redevelopment; Green Field Development*

Application of BIM in AECO Industry using 5D Methodology

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Abstract

There are various drawbacks in conventional method used for planning, estimating cost, scheduling and monitoring projects in architecture, engineering, and construction industry. The traditional CPM schedule does not provide any information pertaining to the spatial aspects or context and complexities of the various components of a construction project. Different project members may develop inconsistent interpretations of the schedule when viewing only the CPM schedule and usually makes effective communication difficult. Also, the traditional cost estimation method and resource monitoring techniques fail to respond efficiently with the changes and modification in the project. Application of Building Information Modeling (BIM) for project scheduling and monitoring by combining it with the currently used tool like Oracle Primavera help in linking of the activities in a critical path method schedule with the corresponding elements of a three-dimensional 3D model, from Autodesk Revit, thus making the project sequence easier to interpret. BIM provides the user with a real time representation of the project which may improve and speed up the construction planning as well as ensure data integrity and accuracy. By integrating and displaying specification/recommendation and construction resource information, the schedule in BIM promotes

interaction and collaboration among the project team members from different fields. This paper concerns with creating one such 5D model, simulating real time representation and effectiveness to change in cost and resource allotment with respect to modification of project.

Keywords: *Building Information Modeling (BIM); Construction Management; 5D Model; Time Over-run; Cost Over-run; Virtual Simulation*

Construction & Commissioning of 720MW Mangdechhu Hydroelectric Project, Bhutan

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Abstract

The Government of India and the Royal Government of Bhutan entered into a Bi-lateral Agreement for developing 10,000MW Hydropower in Bhutan. The protocol to the above referred Agreement was signed between the two Governments on 30th April 2010. An Autonomous Organization named Mangdechhu Hydroelectric Project Authority (MHPA) was created by the Royal Government of Bhutan on 8th June 2010. All the major Civil and Hydro-mechanical works i.e. Concrete Dam, Head Race Tunnel, Underground Power House and the Radial Gates/other miscellaneous gates were awarded on 20th March 2012. The major Electro-mechanical & Transmission Line/Sub-station works were awarded on 13th January 2013. The total awarded cost for the Civil and Hydro-mechanical works was Rs. 1498.10 Crs, similarly, the awarded cost of all electrical works was Rs. 794.59 Crs and the awarded cost of the Transmission Line and Sub-station was Rs. 815.71 Crs. Thus, the entire project works were awarded at Rs. 3108.4 Crs. The execution model which has been followed in implementation of the Mangdechhu Project is now becoming a benchmark among the contemporary projects which are under execution in Government and even in Private sectors. The cost per MW is now around Rs.6Crs excluding Transmission System and including Transmission, shall be around Rs.7Crs, which is the cheapest among the similar size projects. The overall economy in execution and almost timely completion have been achieved by the Project Team by following the latest Bidding Documents for the award of the works, by induction of new construction methods and equipment, faster settlement of Extra and Deviated Items of the major contracts and also efficient management of all the Contracts. In nutshell, it is now established after the execution of the Mangdechhu Project that it is possible to execute the Hydroelectric Project well within cost and time, even in Government owned setup.

Keywords: *Bi-lateral Agreement; Hydroelectric Project; Civil & Hydro-mechanical; Design & Engineering and Commissioning*

Simultaneous Project Execution and Traffic Solution for Smart Cities Using Building Information Modelling and Geographic Information System

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Abstract

Smart cities initiative is based on urban renewal and retrofitting to develop more than 100 Indian cities influenced by digitalization and technological advancements. The core of this initiative revolves around execution of a huge amount of infrastructure and real estate projects which creates hindrances in daily traffic operations creating traffic locks and jams which cascade towards accidents and mishaps. Stagnated traffic also imposes environmental impact in the form of pollution, wastage of fuel and time. For a proper integrated development of new smart projects and already existing infrastructure, Building Information Modelling and Geographic Information System can be used to create a digital system. This paper proposes the usage of said platform to increase co-ordination between on-going project site execution and help smoothening the traffic-project interface and focuses to smart execution of smart cities projects.

Keywords: *Smart Cities; Traffic Operations; Building Information Modelling and Geographic Information System*

Building a Real Estate Investment Framework for Energy Efficiency to Enhance Value in Commercial Real Estate Portfolios

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Abstract

Institutional real estate investors have started considering the choices of reducing carbon footprint of buildings thereby enhancing sustainability as these have become critical issues in a globally warmed world. A recent study by Carbon War Room analyzed the performance of REIT's (Real Estate Investment Trust) using a Global Real Estate Sustainability Benchmark dataset consisting of 56,000 buildings worth US$ 2.1 trillion. The study found that REIT's with a higher sustainability ranking not only performed better in terms of return on assets but also on the return on equity. Another marquee example is the way in which a real estate fund was launched by Credit Suisse Real Estate Investment Management that aims in achieving a top quartile energy star in three years by reducing energy consumption and CO2 emissions to create a carbon neutral portfolio. Credit Suisse does this by ensuring that all projects must meet Credit Suisse Asset Management's strict investment and environmental criteria as defined by their "green property quality seal" for real estate projects. Any

investment other than in the conventional real estate sector needs compelling data and framework model to do so. In developing countries like India, the private players contribute to a greater part of the necessary financing– including but not limited to developers, banks, private equity partners, and wealth managers. To promote the delivery of investments, the financial entities need adequate processes, methodologies and tools to identify and monitor the impact of the activities and projects to be invested in. This paper will focus on building and developing a framework that will aid the investors who would like to get a better return on their investments and also the developers who would want to see value addition to their real estate portfolios.

Keywords: *Sustainable Development Goals; Carbon Footprint Reduction; REIT; Investment Framework*

Tailor-made Cold Mix Technology for Construction and Maintenance of Roads

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Abstract

In current practice, conventional bitumen emulsion based technology is used for construction and maintenance of roads which pose different limitations like low binding properties, availability of varied aggregate quality, need of pre-wetting of aggregates, presence of moistures in aggregates, inability to utilise existing hot mix equipment etc. Therefore, a process of mix design based "tailor-made cold mix technology for construction and maintenance of roads" overcomes all the barriers of the current "State- of -the -Art" technology is needed. Key Elements of the technology are Aggregate, Tailor Made Cold Mix Binder, and Recommended Cold Mix Design Process (RCMD) for Simulation of Site Condition, Equipment and Application type. In accordance with the technology, the designed bitumen emulsion (Tailor made) is a key element. The process includes diagnosing characteristic of aggregates, it includes physical properties of aggregates, defining a type of road to be laid and paved, preparing a designed bitumen emulsion, the composition of the designed bitumen emulsion is selected on the basis of the physical properties of the aggregates, available existing modified hot mix equipment to eliminate the need of heating and burning, climatic condition, type of road to be laid; and mixing the aggregate with designed bitumen emulsion to pave the resultant bitumen emulsion-aggregate mix for road construction to ensure required lead time of the mix to meet desired workability on transportation to site during laying of the mix. Cold mix as per design is produced in modified hot mix plant to eliminate the need of heating of aggregate and binder in controlled

condition, transported to the site, laid by self-propelled mechanical paver followed by compaction by the roller to achieve finished road as per standard quality norms. The technology is environment friendly, energy efficient, controls pollution to large extent, all weather execution, user friendly, ready to use – simple to use, fast progress in construction and achieve durable roads. Using the technology, solution is provided to construct 7000 + kms roads in India. The technology is developed by CSIR-CRRI, New Delhi in India and transferred the technology to BitChem Asphalt Technologies Ltd, Guwahati in 2011. The technology has tremendous potentials in the construction of Rural Roads and Forest Roads across India.

Keywords: *Tailor-made; Cold Mix Technology; Conventional; Hot Mix Technology; Aggregate*

Appropriate Development Models under PPP for Smart City Projects: A Study of Two Smart Cities in India

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Abstract

Post 2015, the development of 'Smart Cities' has emerged as the focus of urban renewal and development practice in India. There has been a great buzz about the smart city development on a pan – India scale. While the features and advantages of the smart cities are somewhat well known, the development of smart cities can be a costly proposition, especially when the finances of the urban local governments are in shambles. The current approach of the Union government does not provide for an adequate funding base for the realisation of smart city development in a big way. Therefore, it is imperative for the city governments to deploy alternate development models such as those that involve private sector participation in the form of Public-Private Partnership (PPP). Based on this premise, a survey was conducted among the public and private sector representatives of smart city projects in two listed smart cities – Warangal and Madurai. A questionnaire survey was used to identify the appropriate development models under PPP for the smart city service components. Based on the survey, we list out some suitable PPP types and map them with the appropriate PPP models that can be deployed in the smart city development projects in India.

Keywords: *Smart Cities; Project Financing; Development Models; PPP Types and Models*

Compressive Strength of Concrete Produced With Recycled Concrete Aggregate

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Abstract

Concrete is the most widely used construction material by the construction industry in India. The tremendous growth of the construction industry in India has boosted the demand for concrete. For the production of concrete, a huge quantity material are mined and processed yearly. This will undoubtedly create major impact on the environment. Concrete is not an environmentally friendly material because of the use of natural materials. The recycling of waste and industrial waste attracts an increasing interest worldwide to make concrete environmental friendly. The major objective of the study was to investigate the compressive strength of concrete produced with recycled concrete aggregate. The test on concrete samples was conducted at four different locations in India. The large variation in compressive strength of concrete was observed which can be accounted for due to several reasons. It was concluded that concrete produced by using recycled concrete aggregate is suitable for non-structural works.

Keywords: *Concrete; Recycled Concrete Aggregate; Compressive Strength*

A Study of the Relation of the Size of House with the Buyer-Related Factors

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Abstract

A house is a basic need of a human being. The most expensive product that people buy in their lifetime is the house. Most people would prefer to buy a large house, but few people can afford to do that. Data was collected from 421 respondents staying beyond 8 kilometers from the center of Pune city who had purchased a flat recently with the help of a structured questionnaire. This paper gives the results of the study which examines the relation of the size of the flat/ apartment purchased with the age, number of persons and income by treating the size of the house as a dependent variable and the buyer-related factors as independent variables by using multiple regressions.

Keywords: *Size of House; Buyer-Related Factors; Multiple Regressions*

Appraisal of Land Acquisition Acts and their Fallout in Contemporary India

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Abstract

Acquisition of land in India is a process based on principle of 'eminent domain' through which state or central government can acquire private land for a public purpose. The land is acquired for the purpose of industrialization, development of infrastructural facilities or urbanization of the private land and compensation is provided to the affected land owners besides rehabilitation and resettlement. Until the year 2013, acquisition of land in India was governed by Land Acquisition Act of 1894. Due to long delays in acquiring land through this Act and the public perception of this law as draconian, this Act was repealed and a new act Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 (LARRA 2013) was enacted and came into force from 1st January 2014. The new law is already seeing amendments by several state governments diluting the provisions of the law enacted by the Union government.

This paper discusses the provisions made in land acquisition acts and reasons for delay/failure of land acquisition through these acts. Four case analysis, two each of successful land acquisitions and delayed/failed land acquisitions are made. Findings from these case analysis have been used to determine factors responsible for success of land acquisitions.

Keywords: *Eminent Domain; Land Acquisition; Rehabilitation; Resettlement; Transparency; Litigations*

Affect of Astrological Interpretations on Decision Making Process of Real Estate Buyers: An Exploratory Analysis in India

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Abstract

The buying decision of a real estate property is complex. Traditionally, it is believed that such decisions are made on economic rational (neoclassical economic theory) which aim to maximize utility of the buyer. This presumption primarily mean that physical characteristics of a property and the pricing decides the decision making process. However, off late, authors have examined the impact of behavioral aspects such as hedonism and individual biases on the buying behavior. The current study examines the perception of residential real estate buyers about astrology. The study attempts to find do buyers of residential real estate consult astrologers before they make buying decisions? And if

yes, which particular astrological interpretations play a major role in buying/not buying a real estate property? The study is exploratory in nature and a questionnaire survey was carried out and a total of 111 responses are collected during study period. The data is analyzed using tables and regression method and it is found that buyers of residential property do not give a lot of importance to astrological advice, even if they have a firm belief in the astrology science. The decision to consult the vastu expert or an astrologer is not driven by the belief in astrology rather it is driven by the fact that astrological interpretations can help you make better decisions. Therefore, if the buyers feels that astrological interpretations add value to the decision making process, than they would consult them.

Keywords: *Astrological; Real Estate; Decision; Astrologers; India*

Analysis of Force Majeure Clauses in Indian Construction Contracts

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Abstract

Construction projects, due to its inherent risks and uncertainties, are prone to disputes. Many researchers have observed that the way the construction contract is drafted and administered has a major impact on the dispute and claim occurrence in a given construction project. There is a need to have a clause–by-clause understanding of a contract so that inconsistencies, if any, can be assessed and suitable mechanisms can be put in place to avoid serious escalation of the conflicts and problems. On these lines, in the paper, the authors have chosen the Force Majeure (hereinafter called FM clauses) in the construction contracts and analysed them in detail across various standard forms used in India. The choice of FM clauses was in the light of the authors' reading of some of the related court cases, in which it appeared that provisions under FM clauses, stipulated in standard formats and very commonly in construction contracts, to be tricky and confusing. The analysis of the FM clauses gave light to five dimensions that were found important in constructing FM clauses and in each of these dimensions, authors have noted some of the important observations, which in accordance to the authors, may have an impact on appreciating the real meaning and intent of providing the FM clauses in such construction contracts (in the public construction projects of Indian context). To validate, court case analysis was performed. These key learnings from the analysis of court cases were found supportive to the observations made. Though, only 7 cases were analyzed in this work, the observations and the recommendations made would be of a good start in a systematic analysis of FM clauses from judicial standpoint, specifically in the Indian construction context.

Keywords: *Force Majeure; Construction; Contract; Court; Cases*

A Review-Based Comparative Study on River-Sand and Sea-sand

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Abstract

Just like food, water and shelter are some of the basic needs of human beings; in a similar manner, cement, and fine and coarse aggregates are also the basic requirement for a stronger/durable structure. It has rather come to our kind attention that the river sand has been diminishing at a higher rate which would in turn affect the development of the nation as a whole. The fine aggregate such as sand is used in higher volumes just next to water, thereby making it as one of the highly used materials on earth. Moreover, sand affects the workability, compressive strength, bond strength, drying shrinkage, bulking and surface area of mortar. The formation of sand has been taking place for thousands of years through various erosive processes. Nowadays, for maintaining the stability of structural empire; sand has been under aggressive consumption at a rate faster than its own manufacture. A well-planned schedule, for carrying out the activities such as sand mining and dredging, has to be developed in order to handle the overburden and reduce the damage caused due to its ecological impacts. There are many substitutions for sand such as quarry dust, desert sand, incinerator ash etc. This plays its own role when used in concrete.

In this paper, a trial for collecting information has been explained in detail to implement different techniques on replacing the river sand with the treated sea sand. This is an effort towards the research on this field.

Keywords: *Sea sand; Chemicals; Washing; Treatment; Process*

Impact of Pune Metro Construction Work on Traffic Flow – A Case Study

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Abstract

In past few years it is observed that, traffic congestion has become a major problem in many cities of India and all over the world. Though metro rail project is aimed for public benefit and smooth flow of traffic but lack of planning and implementation norms for this long-term construction work (elevated) leads to many problems such as reduction of road widths, increase the travel time, fuel consumption and queue length which results in increase in pollution, wastage of time and energy that has negative impact on economy and environment. The objectives of project are to study the various traffic

congestion problems occurring in Pune city for two locations (i.e. at Paud Phata intersection and at Nal-Stop square) and study traffic flow characteristics at both the intersections, as these are one of the busiest intersections in the city and present feasible solution with effective traffic management, for smooth flow of traffic at these intersections. Since construction work of Pune metro is underway in these areas, people facing traffic congestion problems on regular basis in the respective area.

The study is based on the various traffic surveys done on roads which were found from video recordings at CCTV control room of Pune traffic control police and manual surveys done at the road side during period of two months for peak hours (morning 9 am to 11 am and evening 7 pm to 9 pm) and non-peak hours (afternoon 2 to 3 pm). The study also aims at presenting a traffic flow simulation model using Vissim software. Based on the data collected, the project discusses various possible solutions at two junctions with their advantages and limitations. The most effective solution and diversion plan is suggested with discussion.

Keywords: *Traffic Congestion; Traffic Surveys; Traffic Management; Construction Work-zones; Vissim Software; etc.*

Improving Workmanship Issues in Infrastructure Industry

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Abstract

"Infrastructure Construction industry" which occupies the prominent place in the economic growth of the Nation Building. The construction project life is depends on mainly in quality of construction which plays a crucial role. But unfortunately, it is one of the highly neglected/ignored part in construction projects. In the world of digitization and automation, Infra development projects aren't in synchronizing with it. At the outset the three main basic requirements of any construction project is time, cost, and quality. Customer's demand on quality requirement in construction projects is well defined. Quality is the "Key factor" of any infrastructure project needs revamp with systematism. As per the internal data, around 65% of quality issues are related either directly or indirectly to poor workmanship. This paper is about the study, analysis and recommendation to improve workmanship in the construction through a systematic framework. This will optimize the cost of poor quality and improve customer satisfaction.

Keywords: *Workmanship; Rework; Surface Finish; Aesthetics; Defects*

The Law and Governance of Smart Cities in India

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Abstract

Smart city means balance of environment, economy and standard of living of people in the area. It includes the area based development. The smart city development is based on the smart governance in that particular country. In order to effectively manage the public health, environment, Information and communication technology, transparency and accountability, our cities need smart administration and governance. Several studies analyse the "smart city" development based on collaboration of three wings one is State Government, Municipal Corporation and Citizens of India. The objective of the research paper is to study the challenges of governance of smart city and make recommendations for smart governance of smart city.

Keywords: *Smart City; Governance; Law; Environment*

Review on Delay Factors Due to Improper Construction Equipment Management

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Abstract

A very common problem affecting the construction industry and hence the economic growth of the country today is 'Delays in construction projects'. Various causes factor in like the extensive use of machines that compete with men and exhibit a huge difference in terms of 'work progress'. On the downside, with every new technological development comes a negative impact. Past studies reveal that one of the important causes for delay is 'improper construction equipment management'. Studies in the past focused mainly on overall construction delay. It was observed that there is a significant lack of research pertaining to improper construction equipment management delay. In course of this study, all delay causes due to construction equipments was extracted from overall delay causes dealt with in past studies. The extracted delay causes are categorized into 8 major key factors. The recommendations to overcome these issues are discussed. Potential future scope has been given to further enhance research in this area.

Keywords: *Construction Equipment; Delay Management; Improper Equipment Management; Maintenance Management*

E.H.S. Solutions and Implementation of Simulation Exercises on Workers before Recruitment as a Safety Initiative in Highrise Construction

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Abstract

Highrise construction is a unique industry which requires various types and levels of execution techniques to be performed at high altitudes such as façade work, finishes, etc. Even if safety is being treated as a priority, workers tend to ignore safety standards due to lack of awareness about its consequences. Importance of safety gets amplified during monsoon and in areas experiencing high wind. This paper focusses on proposing simulation exercises on Highrise workers as a parameter of recruitment and provides site safety solutions based on observation and experience. This paper also presents various methods employed by contractors to provide safety on site and how they can be modified.

Keywords: *Highrise Construction; Safety; Simulation; Recruitment*

Factors Influencing Land Acquisition, Rehabilitation and Resettlement (LARR) Act in India

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Abstract

Land acquisition Act, in India is one of the most controversial acts that has resulted conflicts and protests in Infrastructure projects. Development of projects for the public purpose is necessary but land procurement difficulty is increasing for the government. Major problems in delay of projects include funding, poor coordination and decision making. Even though government has taken actions to reduce these problems still a lot of changes have to be made for improvement of completion of projects in time. This study mainly emphasizes on factors that are influencing land acquisition, resettlement and rehabilitation act with reference through various case studies on infrastructure projects which address the key issues and mitigate the factors. This objective will be achieved through finding out the factors from various case studies and questionnaire survey. Relative Importance Index (RII) technique is adopted to determine the ranking factors that are affecting Land acquisition act.

Keywords: *Land Acquisition; Compensation; Relative Importance Index (RII); Rehabilitation; Resettlement*

To Study Various Techniques that Helps in Application of Construction Automation in Real Estate in India

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Abstract

Real estate has great potential in India, and it is expected that it will reach around 12 trillion rupees by 2020; as traditional methods which are used currently in Real estate in India faces many issues like lower quality, labor intensive and productivity, thus will not be able to fulfill this enormous demand. In this paper we will study various techniques which help to apply Construction automation in this sector.

Keywords: *Construction Automation; Indian Construction Industry; Real Estate*

VR/AR in Architectural, Engineering and Construction

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Abstract

The advent of new technologies slowly saturating the construction industry, the modern methods and tools for planning and execution is desideratum. Virtual Reality/Augmented Reality (VR/AR) would be able to visually simulate the construction activity and bring new perspectives to the users helping to solve issues at macro level. VR/AR would provide a platform for the project team to exchange, acquire, update, develop and discuss on data. Civil Industry with automation in future is unequivocal and having proper inputs validation is necessary therefore dealing with computer based data can't be avoided. This Paper attempts to explore the possibilities of the VR/AR technology and its industrial acceptance by interviewing experts in the field. It would discuss practical consideration, application and its potential scope. The virtual reality combined with BIM will provide an ultimate solution in Architectural, Engineering and Construction

Keywords*:* *Virtual Reality; Augmented Reality; Architecture; Engineering; Construction*

Composite Rammed Earth Structure an Experimental Study

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Abstract

While constructing (developing) any structure (asset), its impact on the environment should always be assessed. As we know, cement is a key building material that is commonly used but also creates pollution during its manufacturing, storage handling, transportation and usage. So, what if we construct a composite rammed earth structure in which the frame will remain of RCC but the walls will be made up of soil (mud). In a composite rammed earth structure instead of using cement concrete blocks for constructing the walls (outer & inner) of a structure we can make use of soil (mud) which will act as an alternative building material and thus help in reducing the use of cement. As we know, Mother Nature i.e. our planet Earth offers us naturally existing and abundant Soil (mud). Cement, as a main component of construction material mix, when replaced by naturally and locally available mineral soil (in different proportions) will result in reduced carbon footprints which otherwise is high for cement supply chain. Natural soil with additives (if required) in designed/customized amount are compacted in layers within sturdy formwork. From series of field experiments we conducted, the proportions for the components like Soil, (part) Cement and Fly Ash were determined. The proportion of these constituents mainly depends on local availability and climatic condition in & around the construction site. The resultant construction product mix is a monolithic wall structure with superior thermal insulation properties, fire resistant and most importantly eco-friendly.

Keywords: *Eco-friendly; Sustainable Home; Thermal Insulation; Fire Resistant*

Smart Agriculture: Owner Entrepreneur Partnership Model- Solar Agricultural Hybrid Model for Jalgaon District

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Abstract

In Indian Scenario With the increasing level of population there is increase in the level of demand for water requirement, electricity requirement, homes requirement, Jobs requirement, infrastructure requirement etc, on the other hand the supply for these requirements is no sufficient which creates a

huge gap between the supply and demand proportion for these requirements. Therefore there is a need of having additional ways which are renewable and nature friendly to increase the supply rate and match the demanded rate. One of the alternate methods to generate electricity is through solar panels. The study leads with proposing an Owner Entrepreneur Partnership Model – Solar Agriculture Hybrid Model for Jalgaon District. The population growth observed in Jalgaon is increased by 25% in last decade which clearly denotes the increase in the demand for electricity generation to meet the needs of the Jalgaon people. To meet these needs there is a requirement of solar farms that can produce the sufficient amount of electricity that is needed. Therefore this paper deals with the hybrid model of solar agriculture. This will also help the farmers to have an alternate source of income especially at the time of droughts.

Keywords: *Solar PV; Owner Entrepreneur Partnership Model; Solar Agriculture Hybrid Model; Jalgaon City*

Automation in the Management of Parking Facility in Office Buildings: Application of Image Processing Technology

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Abstract

The rapid urbanization process has led to a massive influx of urban population, and increased demand for urban facilities, particularly transportation infrastructure to accommodate the growing economic activities. One of the most challenging issues of urban transportation is an effective and optimum provision of parking spaces which require a lot of recursive investment, including maintenance, vehicle management, and security monitoring. This has necessitated the requirement of efficient technology-driven automated solutions for managing parking spaces which can be integrated with smart building management. This paper discusses the applications of computer vision and implementation of video surveillance in parking facilities by enumerating the case of parking space management in an office building. Video processing software working on image processing technique has been applied for continuous monitoring of vehicle movement. The moving object identified has been further analyzed using masking and segmentation techniques to classify the type of vehicle or people in the video. This concept uses contiguous frames of the video to analyze any movement inside the scope of the camera. This technique is found to be cost-effective as it would reduce human involvement for management of parking spaces. The paper gives direction to explore different areas

of application of cyber-physical systems in smart management of infrastructural facilities and building management.

Keywords: *Parking Facility; Image Processing; Video Surveillance; Background Subtraction*

Real Estate Regulatory (Regulation and Development) Act 2016 (RERA) – De - Mystified

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Abstract

The Real Estate Regulatory (Regulation and Development) Act 2016 popularly known as RERA is an latest addition to the framework of construction project management. The construction industry is now regulated by this act, especially the projects where developers / promotors are developing the projects for sale in open market. Therefore, the act proves to be an important feature in the construction scenario which needs to be understood from the point of view of Construction project managers. The traditional methods of developers coming up with projects have undergone a total revamp due to RERA. This makes us necessary to understand the provisions of RERA and device our project management strategies to suit the compliance to the Act as well as to increase the credibility of the developers in the market so that the buyer is not only attracted but is given the deliverables in tangible form thus adding value to the project and to the construction industry.

Aim: To evolve project management methodology/ strategies for developers to comply with RERA.

Objective: 1: To study Real Estate Regulatory (Regulation and Development) Act 2016.

2: To study challenges in the construction industry relating to compliances to RERA.

3: To create guidelines for the developer to successfully deliver the project.

This paper will discuss in detail the provisions of the act as well as the strategies that need to be evolved for successful project management and the benefits that the industry has gained through implementation of RERA. The base document for reference will be the Real Estate Regulatory (Regulation and Development) Act 2016.The the strategies that will be evolved will be based on Project Management Body of Knowledge (PMBOK) from PMI, USA and best practices in the industry.

Keywords: *RERA; Developer; Housing; Flat Owner; Construction Projects; Builder; Project Management; Real Estate; MAHARERA*

Sustainable Energy-Efficient Building

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Abstract

Sustainability is a powerful yet abstract concept. On a small scale, the concept of sustainability plays a vast role. Keeping this in mind our study aims to focus on the minor aspects of a building. Buildings are vital in developing a city as they can influence a person's value and attitude towards the use of resources. Engineers will continue to develop technologies and tools for bettering the economic, environmental, and societal performance of residential and commercial set-up. Information collected on various features of an existing building will give us an idea on the energy it uses. Sustainable design is an approach that promotes the quality of surrounding and indoor environment of a building. This design approach, if followed diligently, serves towards immeasurably improving the performance of the building set-up. Efficient use of this system of approach demands detailed study of the local and global factors governing the design of the building envelope. The approach focuses on orientation, energy efficiency in construction and functioning of the building. This study deals with improving the outcomes in stages of construction, operation and maintenance using the concepts of passive buildings and low energy materials, and thus aims at developing a cost-effective, energy-efficient, environment-friendly construction technique while adhering to the principles of sustainability.

Keywords: *Sustainability; Orientation; Energy Efficiency; Passive Buildings; Low Energy Materials*

Does Acquiring Firm Create Value to the Shareholder: Evidence from Construction Industry

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Abstract

The purpose of the study is to observe the effect of the performance of the acquiring firm of construction industries upon merger announcement. The study has used a sample of 27 construction companies of Indian firms gone for M & A during the study period from 2004-2014. The abnormal returns of the acquiring firm have been estimated by using market model. The study also examine the factors do impact the returns of the acquiring firm by using cross sectional regression analysis. The study reveals that acquiring firm destroy shareholder value to the shareholder in the window period of

[-20,20]. The study also found that PB ratio and size of the bidding firm is significant factor which influence the return of construction industries.

Keywords: *M&A; Construction Industries; Event Study Methodology; Acquiring Firm*

Performance of Concrete with Manufactured Plastic Waste Fine Aggregates

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Abstract

Plastic is used in many forms in day-to-day life. Since Plastic is non-biodegradable, landfills do not provide an environment friendly solution. Hence, there is strong need to utilize waste plastic. This creates a large quantity of garbage every day which is unhealthy and pollutes the environment. In present scenario solid waste management is a challenge in our country. The production of solid waste is increasing day to day and causes serious concerns to the environment. In this study, the recycled plastics are used in the concrete as a partial replacement of fine aggregate in concrete.

The main purpose of this study is to investigate the mechanical properties of concrete such as workability, compressive, flexural and split tensile strengths of concrete mixes with partial replacement of conventional fine aggregate with aggregate produced from plastic waste. The use of plastic aggregate as replacement for fine aggregate enhances workability and fresh bulk density of concrete mixes. The mechanical properties of concrete such as compressive, flexural, and tensile strengths of concrete reduced marginally up to 10% replacement levels.

Keywords: *Plastic waste; Concrete; Mechanical Properties*

Critical Analysis of Mergers and Acquisitions in India: A Case Study of State Bank of India

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Abstract

The case study focuses on the merger all State Bank subsidiaries. SBI have merged all the five associated banks -State Bank of Bikaner & Jaipur (SBBJ), State Bank of Hyderabad(SBH),State Bank of Mysore (SBM), State Bank of Patiala (SBP) and State Bank of Travancore (SBT), and the relatively new branch i.e. Bharatiya Mahila Bank (BMB) with itself. The BMB was formed by the UPA government in the year 2013, and is a public sector lender from the region of Delhi, with around Rs 1,000 crores in capital. The latest merger will create a financial behemoth with assets worth Rs 37

lakh crores ($550 billion), including the fixed assets of associate banks worth about Rs 4,000 crores. The five subsidiaries contain about 6,400 branches and 38,000 employees. As on 2014-15, SBI had additional 14000 branches, which includes 191 foreign offices stretched across 36 different countries, with employee strength summed up to 2,22,033.On 15th February 2017, the Union Cabinet approved the merger of SBI with five associate banks. The part which was overlooked, were different accounting policies and pension liability provisions and bad loans, based on regional risks. This article is divided into four parts. The first part includes introduction and conceptual framework of mergers and acquisition. The second part discusses the historical background of SBI and all its subsidiaries, followed by review of literature. The third part discusses all the mergers, acquisitions, and amalgamations in detail. Finally, the article concludes that a firm must devise a strategy in three phases i.e. Pre-merger phase, acquisition phase and post-merger phase. The article will be helpful for policy makers, strategy makers, bankers, researchers, and scholars.

Keywords: *Mergers; Acquisitions; Amalgamation; Banks' Strategy; State Bank Group*

Studies on Glass Fibre Self Consolidated Concrete Exposed to High Temperatures

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Abstract

The variations in concrete are more when exposed to solar radiation. It was found that deterioration of concrete members deterioration is steady when subjected to various temperatures.

Self Compacting Concrete (SCC) concretes leads to advantages over OPC as the mixes are homogenous and improves the speed of construction in highly conjunction areas. The process of vibration be eliminated while pacing the concrete (Okamura Hajime & Ouchi Masahiro (2003).

Trails were made to study the behavior of SCC mixes on strength when exposed at different temperatures and different intervals. It was observed that glass fiber admixed concretes are more durable and resistance against high temperatures.

Keywords: *Elevated Temperatures; SCC; Strength; Glass Fibres*

Expatriation Experience of Blue-Collar Workers in GCC Countries: A Study in the Construction Sector

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Abstract

Purpose: Asian migrants constitute the bulk of unorganized workforce in the construction industry of Gulf Cooperation Council (GCC) countries. They undertake substantial risks (social, legal and economic) in their international movement for work. However, their expatriation experiences remain largely unexplored in the domain of international human resource management (IHRM). Accordingly, in this research, we seek to investigate the motives of relocation, factors affecting adjustment and reasons of return to home country of these workers.

Methodology: Owing to paucity of studies in this area, we employed grounded theory approach and used semi-structured interviews to gather data. The study was conducted in the state of Kerala, India, among blue-collar workers formerly employed in the construction sector of GCC countries.

Findings: Our research suggests that the primary motive for relocation are financial concerns in the home country, while desire to see new places was the second reason mentioned by the participants. Second, four factors explain the adjustment (or lack thereof) of the blue-collar expatriates: working conditions, living conditions, perception of host country and HR practices. Finally, family issues, visa expiration, medical issues, expiration of visa and monotonous work explain their return to home country.

Originality: To the best of our knowledge, this study is first of its kind exploring the entire cycle of expatriation of Asian unorganized blue-collar workers employed in construction industry in GCC countries.

Value: The construction sector in GCC countries is one of the largest employers of unorganized migrant blue-collar workers. Further, extant research in IHRM suggests that successful expatriate adjustment affects job performance and well-being. Consequently, in case of turnover, it is also likely to reduce costs pertaining to disruption of production activities, recruitment and training. Therefore, our research detailing the experience of blue-collar workers over the entire expatriation cycle is likely to provide managers with valuable insights regarding factors affecting adjustment and turnover of these employees.

Keywords: *Expatriation; Blue-Collar; GCC; Adjustment; Construction*

Perspective Estimation- A Problem in Construction Industry

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Abstract

Estimating the projects budget is always a major concern in the construction process, thus the preparation of reports will be of perspective behavior of respective contractors. Some may figure out the budget in an economical way, some may figure out it in high budget but makes the things in low cost which results in loss of quality. Here in this paper the main objective is to find out the differences between the clients estimated record to the contractor record. Taking a plan of G+1 Individual house and finding out the detailed estimated report using centre-line method, then two abstract reports are prepared one is with full specifications as per SSR of A.P state Government and the other report is with concession rates and allocation less men power to the activities of the project. The difference in cost is checked then later the problems of how it happens are discussed. The quality of project and making it in an economical are two key things in construction industry. Finally, the major thing we need to convey is make aware the clients regarding this type of perspective contractors who only concentrates on money neglecting the quality.

Keywords: *Estimation; Perspective Behavior; Resource Allocation; Centre Line Method; SSR*

Disruptive Technologies for Air Conditioning Application

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Abstract

In recent years, the terms disruptive innovation and disruptive technologies has gone from being a buzzword to the core interest amongst industries and research communities. The present article addresses this concept for air conditioning application. Air conditioning for human comfort has seen a tremendous rise in recent years, due to increased urbanization and industrial development. The current technologies in air conditioning offer better performance, however they are more energy intensive. Therefore energy conservation and sustainability has become the primary reasons towards the need for disruptive technology in air conditioning. The author has classified few of the disruptive technologies for air conditioning into three major categories viz., advances in existing systems, alternatives to existing systems and innovative technologies. The paper covers variable speed chillers, magnetic bearing compressors and advanced sensors under the section advances in existing system.

Alternatives to existing systems include displacement ventilation, district cooling, radiant cooling and geothermal cooling. Thermo elastic cooling system, magneto caloric cooling system and fuel cell combined cooling, heating and power systems are covered in the section innovative technologies. The author highlights some of the interesting aspects of these technologies that have potential to offer promising alternatives in terms of energy conservation and sustainability.

Keywords: *Disruptive Technologies; Air Conditioning; Energy Conservation; Sustainability*

Energy Retrofitting Using Daylighting: A Literature Review

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Abstract

Retrofitting of existing office space for vitality effectiveness has been recognized as a viable measure to lessen the energy utilizations. Currently, numerous administrations and associations have put critical effort towards energy proficiency improvement in existing office spaces.

This paper introduces the potential effect of daylighting in the office spaces that can help in making a better workplace that can add to inhabitant's prosperity. Alongside the significance of energy, the investigations have exhibited the non-vitality related advantages like potential financial reward. Various definitions and systems related with sunlight are seen. It shows a survey of the writing of past research led on daylighting.

Keywords: *Daylight; Energy Retrofit; Office Spaces; Energy Efficiency; Healthy Workspaces*

Study and Development of Dharnai as a Smart Village and Proposal of Smart Region

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Abstract

Smart Cities are indeed breaking new barriers every day in execution, technology and futuristic innovations. Infrastructure growth and interconnection with technology is making work execution and project control more convenient and sustainable for the long term. Regardless of the fact that smart cities are generating better livelihood, there is a desperate need to focus on the development of villages in a smart manner. The major reason behind it being, smart cities solve many major problems except one, migration of rural population to urban localities in search of jobs and a better livelihood.

This condition cascades a burden on functioning of cities and will need further reinforcement in the long run. All of the above can be solved by development of villages in India such that the villages are provided with growth opportunity in their locality itself and a connection to the world with the help of technology and as a result, the nation achieves the goal of universal development. This study focusses on various examples of smart villages in India, how they were developed, their functioning and their model can be replicated in other parts of the country to achieve sustainable development.

Keywords: *Smart Villages; Infrastructure; Smart Cities; Technology*

Non-Destructive Techniques for Identification of Bridge Maintenance Problems

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Abstract

Construction is a cost intensive and time sensitive process. It is a major economic activity that generates direct as well as indirect employment. Along with the construction, maintenance of the constructed asset is an equally important activity in project life cycle. Maintenance of constructed facility also involves resources, time and cost. It needs to be planned so as to ensure that the facility returns back to normal service in least possible time and at affordable cost. Bridges are structures that provide passage over openings. These are an important component in transportation systems. Considering the scale of design, construction, cost and time related to bridges, their maintenance process is also equally challenging. Non-Destructive Techniques (NDT) helps in identifying the maintenance problem related to the bridge. It is a low cost, fast track assessment method adopted for timely diagnosis of maintenance problems in bridges and planning appropriate repair activity for the bridge. This paper presents various NDT instrumentation options available for effective bridge maintenance and repairs.

Keywords: *Bridge Instrumentation; Construction; Maintenance*

Why BOT-Toll Projects Failed In India: A Case Study Approach with a Special Reference to Project Formulation

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Abstract

Infrastructure projects being capital intensive attracts heavy investments in the sector and government alone cannot fund these projects. Public Private Partnership (PPP) with BOT-Toll is one of the

popular models of PPP which bagged many projects under government initiative promotes infrastructure projects with private support.

But in the recent years there is a significant shift from BOT-toll model to BOT-annuity or Hybrid annuity because of the underlying risk of toll framework. In highway sector, the awarding PPP projects on BOT model has come to a near standstill. Today, there are hardly any bidders for highway projects on BOT-toll model. Recovery of past investments with reasonable rates of return has become a difficult task to potential and existing concessionaires. Many are facing financial hardships due to their anticipated toll collections falling way below the expected level.

Keeping this in mind, this study examined features of BOT-toll model and its underlying risks. The study examined the loopholes of the framework and to suggest measures to revive distressed projects based on selected case studies within India. The study also attempted to find out the key parameters during the project's formulation stage that has been overlooked leading to undesirable outcome using case examples where problems were encountered during project preparation phase.

Keywords: *Infrastructure Projects; PPP; BOT-Toll; Project Formulation*

A Firm Level Survey on Budget Awareness in Infrastructure Projects

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Abstract

The paper reports the findings of a survey designed to capture budget related awareness and participation amongst people actively involved in infrastructure projects in various capacities and departments within a specific organization. The survey was administered through a questionnaire and captures the responses from 143 respondents. The results show that participants from non execution departments are more aware of the budget and its process than participants involved in day to day project on site execution. The results also show that there is no statistically significant difference in the budget awareness for most aspects amongst employees with different level of work experience. Although employees perceive budget awareness as being essential to their personal growth, the level of acquaintance with project budget is low.

Keywords: *Budget Awareness; Infrastructure Project; Participatory Budgeting; Project Budget; Firm-Level Survey*

Respond Required by Indian Market to Electric Vehicle Infrastructure

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Abstract

A report by Frost and Sullivan mentions that Indian Electric vehicle market will accelerate by 7% in 2019-20. Hyundai has launched Kona electric vehicle model In July 2019 and has plans to launch a B segment vehicle in India soon. Certainly, Indian Automobile Industry will see many changes and challenges in the near future. Infrastructure industries like electrical grid, road side electric vehicle charging stations among many others will be impacted by Electric Vehicle (EV) technology. EV mobility is the new change that the Indian automobile industry is going through. EV mobility will impact the urban as well as the rural landscape in terms of infrastructure. EV charging load will be random and will certainly impact the grid. Promotion of renewable energy at load centre, such as Solar Photo Voltaic or Wind Mill installation will most likely be observed. Electrical infrastructure capacity has to be increased. Such capacity building is an investment and energy is revenue. As vehicle sharing has been well received by Indians; the Para transit options such as Ola, Uber will be equipped with common charging stations. New smart cities will have to be allocated certain space for vehicle parking and charging stations. This paper reads about how Indian market should respond to the upcoming technology situation, what are the methodologies can be used to analyse the options available.

Keywords: *Charging Stations; Electric Vehicles; Electric Mobility; Infrastructure; Multi Criteria Decision Analysis; Renewable Energy*

Challenges Faced by Green Buildings in Pune City

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Abstract

In the present world, Global Warming is elevating day by day. Usage of natural resources is high and it is seen that availability of non-renewable resources is decreasing at a rapid rate. The Construction industry approximately contributes to50% of the world's air pollution, 42% of greenhouse gases, 50% of all water pollution, 48% of all solid wastes, and 50% of all chlorofluorocarbons to the environment (Griha 2007; Gayatri Vyas et al., 2019). Also recent studies by Albert et al. (2017) say that construction industry uses 40% of the worldwide energy and to control this, the potential solution is Green Buildings. As Green Buildings are energy efficient and environmentally accountable

structures, these projects in recent years are exhibiting a rapid growth. However, in present scenario in the pune city it's not easy to construct green buildings as there are several challenges for the same. Challenges can be briefly listed as economic aspects, lack of awareness in the society, lack of subject matter experts, inadequate policies for adoption of green buildings etc. This paper includes a descriptive research about various challenges that can be faced in adopting green building practices in Pune city.

Keywords: *Green Buildings; Challenges in Construction*

Factors Affecting Commercial Real Estate Valuation of Tier 1 Cities in India

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Abstract

The growth of Indian real estate industry across India was estimated to be 11.2% from fiscal year 2015 to 2020, with contribution to GDP up to 13%. The Indian commercial real estate sector is growing day by day due to emergence of new demand for office spaces and IT parks. The value of any property depends on various factors such as the requirement, health and hygiene of the user. This study identifies the various factors which affect the value of the commercial office properties from investor's point of view and analyzes the contribution of each factor in valuation of the property.

Keywords: *Property Valuation; Factors; Commercial Real Estate; Entropy Analysis; Tier 1 cities*

Smart Farmers an Essential Need of Century- A Review Study

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Abstract

Smart farming involves the incorporation of information and verbal exchange technology into equipment, gadget, and sensors to be used in agricultural manufacturing systems. New technology such as the internet of factors and cloud computing are expected to increase this development, introducing more robots and synthetic intelligence into farming. The studies involved carrying out semi-based interviews with marketplace and researcher experts in India and the use of a bibliometric survey by way of facts mining software. Integration between the special to be had structures in the marketplace turned into diagnosed as one of the major limiting factors to SF evolution. Another restricting issue is the education, ability, and talents of farmers to recognize and manage SF equipment. These boundaries discovered a marketplace opportunity for firms to discover and help

clear up these problems, and technological know-how can make contributions to this process. China, the United States, South Korea, Germany, and Japan contribute the most important range of clinical research to the sphere. Countries that invest greater in R&D generate the maximum guides; this could suggest which international locations may be leaders in clever farming. The use of both research strategies in a complementary way allowed understanding how technological know-how frames the SF and the mains boundaries to undertake it in India.

Keywords: *Smart Farming; Internet of Factors; Smart Farmers*

A Scoping Review on Cloud Computing Applications in Construction Management

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Abstract

Cloud computing is a fast-developing technology adopted by various organizations to allow their digital transformations. The present article reviews the use and research of cloud computing either in the construction industry, construction management, construction projects, or in the construction technology. After a comprehensive search of the scientific literature some recent works are selected for the review. This study identifies and analyzes the advantages and risk. Its aim is to provide an overview of applications of CC in the construction Industry. It explains the technical challenges faced in the area of digital technology. It comprises of Websites and internet data (48%), journals (38%), conferences (7%), report/survey (3%), Blog (2%) and book (1%) and thesis (1%). It provides the capacity to impart data and information smoothly, operating quickly, effectively and is result oriented. Cloud connectivity is convenient and streamlining workflow to help any business to become more workable, efficient, productive, and worthy to note. The companionship of CC with other digital technologies such Artificial Intelligence, Building Information technology, Big Data and others in pertaining to the construction industry are dealt in-depth here with the futuristic role of them for next decade. It is the first kind of scoping review. It covers benefits, drawbacks, use of software and importance of construction management in higher education and future of the cloud computing in the construction business.

Keywords: *Construction Management; Cloud Computing; Information Technology; Construction Industry*

Information Management System for Construction Site

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Abstract

Construction Development has constantly been a standard and work concentrated industry and it is reliably a test to improve advancement productivity completely in development. The quick improvement of data innovation has extraordinary potential to improve development profitability. This paper examines data engagement the executive's philosophy and presents a way to deal with oversee construction data effectively by visual data demonstrating. Furthermore, a creative application structure of data management is created. The mix and interoperability systems of construction information management have been talked about especially with reference to utilize in visual updating & data displaying. All other aspects affecting selection and implementation of adopted process have been studied and system with better performance and cost benefits is identified. Later on research, it is created to fabricate inter operable database that can flawlessly coordinate different development information to improve the executives of development ventures.

Keyword: *Data Management; IOT; IMS; Application Architecture*

Effect of Magnetic Field Treated Water on Performance of Different Grades of Concrete

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Abstract

Increasing the performance of concrete by increasing the strengths is the prime focus of most of the researchers today for which the ingredients of concrete specially cement and aggregates are either modified or materials like admixtures and fibers are incorporated to achieve the strength. The cost of these methods are not comparable with their advantages, thus most researchers concentrate on producing economical concrete with higher strength using new philosophies in design methods and modern techniques. Very less research work is done on improving the strength of concrete by modifying the water used in it, one such method is using Magnetic field treated Water (MW) in concrete for both casting and curing. In this method magnetic field treated water is prepared by exposing potable water to different magnetic fields (0.4Tesla, 0.6Tesla, 0.8Tesla) and is used in

concrete for casting and curing. Using magnetic field treated water can improve mechanical properties of concrete reducing the cement content hence reducing carbon dioxide (CO_2) emission into the atmosphere. In this work the effect of Magnetic field treated water on Mechanical properties of different grades of concrete is studied and compared with conventional concrete. It was found that the concrete cast with magnetic field treated water of intensity 0.8T (water exposed to magnetic field of 0.8 Tesla for 24Hrs) (Magnetic Water Concrete), has higher compressive strength than that of Conventional Concrete cast with potable water (increase in strength up to 50%). This work can lay foot steps to the new era of concrete making materials.

Keywords: *Potable Water; Magnetic Field Treated Water Concrete; Conventional Concrete; Normal Curing; Curing Under Constant Magnetic Field*

Pavement Management System in India- A Brief Review

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Abstract

India owns second largest road network in the world. Being so prominent asset indicates the prerequisite for preserving it. Pavement management system (PMS) plays a crucial role in the maintenance, rehabilitation and restoration of road network system. This paper provides a brief review of PMS including the different pavement performance prediction models used in India stating their importance, along with the method for prioritizing pavement sections and their maintenance. A precise pavement performance prediction modelling and its effective implementation prove to be beneficial for pavement maintenance management in terms of its life cycle cost. The study gives a clear idea of different performance governing and influencing factors and different performance indicators for pavements for which the models have been developed.

Keywords: *Pavement Prediction; Deterioration Models; Distresses*

Local Area Planning as Means of Achieving Smart City Goals

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Abstract

Smart City Mission had followed the ‘Area Based Development’ approach in implementing the projects in smaller area of the city according to the requirements of the particular area. Local Area Plans being formulated under the Amrut Mission also work on similar lines towards upgrading the infrastructure in brown field and managing the built environment. 25 Smart Cities have been chosen

for the implementation of Local Area Plans. Local Area Planning has been conceptually present for some time as means of meeting needs of urban infrastructure and services of local areas of sub city levels. There are understood to be more participatory and closer to the actual requirements and aspirations of the residents of local areas. The statutory route of city planning via regional plans and development plans in practice today view the entire city altogether and may not be able to address smaller issues and might not have many aspects in its legal preview. With Local Area Plans being piloted the local aspirations can be fulfilled, plan implementation can be easier with wider acceptance and many aspects of the development plan like development control regulation can be decentralized.

This paper critically appraises the principles of Local Area Planning, the divergences in the concept of Local Area Plans under Amrut Mission and what they can contribute towards realization of a Smart City. Pune being one of the Smart Cities being chosen for the implementation of Local Area Plans is discussed as an argument case.

Keywords: *Local Area Plans; Participatory; Smart City Implementation; Local Needs; Retrofitting*

Using Block-Chain Enabled Smart Contracts in Indian CRIP Sector: A Literature Review

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Abstract

A construction project process is driven by Construction Value Chain (CVC) that encompasses all or most of the activities of land acquisition/preparation, planning, estimation, resource management, sales & marketing, operations & maintenance, renovation and demolition. Throughout the construction life cycle the works are executed by the contractors/sub-contractors. Past researches reveal that large number of construction projects suffers from time and cost overruns due to improper contract management, disputes and arbitration. Evolution of the concept of Block-chain technology in 1989 has given a hope of using it for implementing Smart Contracts. Smart contracts or a digital contract is a computer based code which is self executable, immutable and secured. This concept is widely used in Insurance, Finance and Healthcare industry. Construction industries world-wide are attempting to implement smart contracts in order to ease up the project execution activities. However, its use in construction industry is still arguable due to factors like legal acceptability, trust between parties, financial settlements, lack of proper information and communication technology infrastructure, etc. No researches so far have been done in analyzing the viability of using smart contracts in Indian construction, real-estate, infrastructure and project companies.

This paper is an attempt to showcase a thorough literature review in order to reveal why block-chain enabled smart contracts is the solution to overcome contracts related issues. Authors have presented a rich review of more than 30 literatures from across the globe, mentioning reasons for construction project delay versus the use of smart contracts.

Keywords: *Smart Contracts; Block-Chain; Construction Value Chain; Contracts Management; Construction Project Management*

High-Rise Mobile Structure – Kinetic Architecture a Permanente Solution for Temporary Migration

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Abstract

Since ancient times till date, we humans keep relocating. Our purpose for migration progressively changed with each upcoming generation. Now we migrate globally for various reasons and conditions such as Tour, Travel, Social & Religious Gatherings, Catastrophic situations (Natural disaster, unstable habitat). However, our structures didn't evolve at the pace we did. In this era of migration, we majorly have permanent and poor temporary structures. To meet the demand of the migrating population our structure needs to evolve to attain flexibility and adaptability. This vision, when combined with mobility, can serve a great purpose. Kinetic and mobile architectural structure is the vision of the future. This paper explores different dimensions of existing temporary mobile structures. Comparative analysis to understand their compatibility with the situation in terms of usages and prerequisite are done. It also enlightens their performance against variable footfall and climatic condition alongside their basic structural stability. Apart from the literature study, a global survey to acknowledge the in-hand experience of residents of such shelters in different situations as users or providers is recorded. Queries on the improvement of present shelter and social acceptance of high-rise shelters are made. Records of more than 5 dozen respondent from diversified sources were noted. And the results were quite astonishing. Amalgamating these literature study analyses and the survey responses, a brief scope of evolution are extracted. Keeping these extractions as a platform of input, a conceptual design is carved as a proposal. A potential and reliable solution to this is a high-rise mobile structure that can withstand migrations and adjust to variable footfall while adhering to all the basic needs of the resident and withstand climatic variations.

Keywords: *Kinetic Architecture; Temporary Mobile Structure; Migration; Disaster Relief Shelter; Social Reformation*

Analysis and Design of Swing Bridge

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Abstract

India enjoys about 14500 Km of navigable water ways and more than sixty percentage of it is used for water transportation. Bridges are constructed across these water ways to bridge the banks. As these bridges are fixed in nature, they restrict movement of big merchandise water crafts beneath it. This reduces the transport volume thus making water transport economically nonviable. One best solution is to construct a movable bridge across the water ways. Balanced cantilever not only avoids heavy counterweights but also provides two opening for more navigation. This project deals with the analysis and design of a three span swing bridge of 40m openings. The bridge considered is a through type truss bridge. This bridge was designed as a combination of central bearing and ring bearing swing bridge. The analysis and design were done using STAAD Pro software. The components were designed for critical load combination. The balanced cantilever swing bridge is suitable for cargo vessels of beam up to 30 – 35m. It can be used over navigational water ways especially in rivers having long and good navigational water stretches like Ganga and Brahmaputra.

Keywords: *Swing Bridge Classification; Method of Analysis; Loading; Method of Loading on Components; STAAD Pro Analysis and Design*

Critical Analysis of Mergers and Acquisitions in India: A Case Study of Tata Steel & Bhushan Steel

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Abstract

The case study involves the acquisition/takeover of Bhushan Steel by Tata Steel. Tata Steel has acquired Bhushan Steel (BSL) through its subsidiary (owned wholly) Bamnipal Steel Ltd (BNPL), resolving the first case under the Insolvency and Bankruptcy Code (IBC), 2016. As per the deal, Bamnipal Steel, (a wholly owned subsidiary of Tata Steel), will get a close to 72.65% stake in Bhushan Steel, while lenders (mostly banks) will own 12.27% in it and the remaining will be received by existing shareholders. The bankrupt company was among the 12 stressed assets that were being referred by RBI for NCLT proceedings last year. After the proceedings, lender banks recovered almost entire principal loan of Bhushan Steel through Rs 36,400 crore transparent bids by Tata Steel. Apart from this they also got 12% stake in the company.

The objective of the study is to investigate whether there will be growth of both companies after acquisitions or not. This article is divided into four parts. The first part describes the debt history of Bhushan Steel. The second part discusses the NCLT process. The third part discusses about the process through which the acquisition process went through and how the Tata Steel took over. Subsequently we look at the post acquisition performance of the companies. The study analysis the first quarter and first year financials of the companies to determine the success of acquisition. The paper also tries to look into the future prospects of this acquisition.

Keywords: *Acquisitions; Amalgamation; Insolvency & Bankruptcy Code; Steel Industry; Tata Steel; Bhushan Steel*

Effective Planning and Scheduling of Escape Tunnel Section of Highway Construction Project Using Sensitivity Analysis

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Abstract

Sensitivity analysis shows the contribution of each task to the overall uncertainty associated with either project completion or an interim deliverable. To estimate the total duration of the project we quantified the uncertainty of the schedule by Monte Carlo simulation techniques to certain sections of the project schedule to estimate a probability distribution of possible completion dates. This study analyses the change in the total duration because of changes in the duration of each activity and helps in mooring the focus of a project manager towards the activities which has more impact (most sensitive) on the output i.e. the final total duration of the project and also provide an insight how the total duration can be reduced. This study also provides a model for allocating quantified slack to the non-critical activities by proper distribution of slack according to the sensitivity of each activity. This model helps in managing near-critical activities so that any delay occurring in any one or more such activities does not have adverse effects on the total project duration and also to see how delays on part of the site may affect work on another and forewarns the project manager about how and where trouble may develop. This helps in the development of a realistic and meaningful schedule which can be practically implemented by implementing proper strategies and planning effective resource allocation that can be changed as the situation changes.

Keywords: *Sensitivity Analysis; Scheduling; Planning; Slack Distribution; Simulation*

Comparison of Bituminous Mixture Properties at Various Stages of Construction of Pavement

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Abstract

Construction of bituminous pavements includes production, transportation, and compaction of bituminous mixtures. The bituminous pavements undergo aging during various stages from production to the end of service life. The initial aging, which happens during production to compaction stage is termed as short term aging and has profound effect on the mixture behaviour. As aged binder becomes stiff relative to virgin binder, it is important to quantify such effects on mixture behaviour. In order to investigate the density, stability and aging in bituminous pavements, mixtures were collected from hot mix plant, at site in front of paver at various distances from hot mix plant, and cores from compacted mixtures at different time periods. Marshall Method was used to compact mixtures in laboratory to determine volumetric and mechanical properties. Further, the bitumen was extracted from representative specimens to determine the rheological properties such as complex shear modulus and viscosity using dynamic shear rheometer (DSR). The rheological properties were used to quantify differences in binder behaviour subjected to different stages of aging. It was found that bitumen extracted from the field core had better recovery characteristics and highest complex shear modulus than the bitumen extracted from the paver and HMA plant mix. The results clearly indicated the variations in the rheological properties of bitumen recovered from different sources during the process of construction.

Keywords: *Bituminous Mixtures; Construction; Aging; Hot Mix Plant*

Improving Performance of Construction Projects by Incorporating Lean Practices

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Abstract

'Lean Construction' is based on a continuous improvement strategy which considers removing all types of waste and improving the construction activities to finally get the best overall results for the project. The Lean Construction processes ensure creation of more stable schedules and higher certainties. They result in reduction of cost, improvement of quality and hence superior value generation. This study envisages – i) determine the site engineer's perception about lean practices and

lean tool used commonly on site, ii) assess the influence of wastes on the performance of construction projects and iii) implement a lean tool on construction site and evaluate its impact on the performance of project. To achieve the set goals, a structured questionnaire regarding Lean construction's perception, application, benefits and factors affecting the performance of construction projects was prepared and circulated among 120 site professionals in varied sites and geographical areas of Mumbai and Thane district. Out of these, 103 responses were received. Based on the quantitative analysis, results were generated and suitable lean tools were applied on two construction projects to assess their performance. This study concludes that i) A noteworthy 58.25% construction organisations use lean practices, since they perceive it as a flexible, cost effective and efficient process management technique. Safety improvement program is the most widely used Lean tool whereas, Greater profitability is the biggest benefit of using Lean tool, ii) Extra supervision is the most common type of waste whereas, Quality of work is the foremost performance indicator to evaluate the performance of a project iii) Two Lean construction methods viz. Continuous improvement program and Last planner system were individually implemented on two different sites in the study area which have resulted in considerable improvement in the performance of those projects.

Keywords: *Continuous Improvement Program; Extra Supervision; Greater Profitability; Last Planner System; Safety Improvement Program*

Construction Method Statement –Way to Realise Project Goals

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Abstract

A method statement is a means of realising a project or a task or activity according to a regular plan as well as systematic or orderly arrangement. The method statement therefore helps the constructor in sequencing the work, assessing the time duration, defining technology, resource calculation, environmental and inspection standards as well as determining the risks /dangers associated and establishing the safety standards to manage these risks. However not understanding the scope of work and describing a method statement not to the effect can also be a concern of contractual claims. This work thus tries to cover case studies associated with such method statement which has led to saving in cost and time and rolling the project on time. The role of method statement in reducing this risk involved is also highlighted in this paper.

Keywords: *Construction; Method Statement; PSC Beam; Pre Cast Slab; Deck Slab*

Development of Model for Analyzing On-Site Construction Waste Generated During Construction Phase of Industrial Buildings in India, Using BIM

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Abstract

The waste generated on construction site is mostly from any excavation, building construction, site clearing or demolishing activities. Lots of issues are faced by many cities due construction waste. It is found by the researchers that the construction waste contributes around 20%-30% of solid waste and 70%-80% from it is concrete. It is estimated that around 12 to 15 million tons per annum of waste is generated by construction industry in India and out of which 7 to 8 million ton is concrete. Researchers have developed many tools to manage the construction waste. Tools like 3R principal, smart waste, BIM. However there is deficiency of analysing framework for managing construction waste in India. Hence there is a need for developing a model to analyse construction waste to manage construction waste in an environment friendly and sustainable manner. This paper aims to develop model for construction waste analysis of RCC work for industrial sector in India based on BIM technology. The case study of industrial project was taken for this work. From the data collected a model structure of the project was developed using BIM and the quantities of RCC for particular item of work were found. These quantities found were compared with the actual RCC quantities used on-site and the tender quantities found by using conventional method. Results and conclusion from this comparison were found.

Keyword: *Construction Waste; BIM; Model Structure; Tender Quantities; Tools*

Reducing Traffic Congestion in Indian Cities – A Review of Methodologies

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Abstract

Road traffic congestion is a major problem worldwide. In old cities of developing nations like India, narrow roads, mixed traffic and mixed land use coupled with rapid urbanization, increased travel demand and use of personal vehicles have increased congestion problems. Congestion reduction may be done by supply or demand management. Supply management involves improving road infrastructures and public transport facilities, which is a major focus of Indian government. However, there are limits of improving infrastructure to match the fast growing pace of travel demand. Demand management through congestion pricing may be used not only to reduce congestion, delays,

emissions and accidents but also provide funding for infrastructure maintenance. In this method, usage of road infrastructure is charged to shift demand to less congested areas or to off-peak hours or to high occupancy public transit systems. Cities like Singapore, London, San Diego, Stockholm and Milan have successfully adopted congestion pricing in various formats, like cordon pricing, usage-based and trip-based tolls or implementing High Occupancy Toll (HOT) lanes. However, worldwide, public acceptability of congestion pricing is low, which makes widespread implementation difficult.

In India, demand management to reduce congestion is tried in some cities like alternate day permission for odd-even numbered vehicles or preferred bus lanes. Road pricing in form of tolls mostly focus to recover cost of infrastructure rather than to reduce congestion. Very few studies have been done to understand proper method to reduce congestion in Indian context. This paper attempts to provide a thorough review of related literature to understand the appropriateness and effectiveness of various methods adopted worldwide to reduce congestion. Also, possible congestion management strategies are suggested, which may be appropriate in Indian context.

Keywords: *Traffic Congestion; Road Infrastructure; Supply Management; Demand Management; Congestion Pricing*

SCATS (Sydney Coordinated Adaptive Traffic System) –An Efficient Tool for Traffic at Intersections

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Abstract

Roads are the pathways which connect one end of the city to another. In the last half-century, the population of Indian cities has drastically grown due to rural migration for the sake of employment. Such drastic growth in the population of Indian cities has led to various traffic problems viz. increased travel time, delay time, long queue at the junction, etc. giving rise to traffic congestion on urban streets at the intersections. To address this issue, it is required to have advanced traffic control system-SCATS (Sydney Coordinated Adaptive Traffic System) to replace the pre-timed signal system. SCATS use an identificatory and evaluator technique to increase the efficiency of the road network by minimizing the overall number of vehicular stops and delays experienced by motorists.

This paper mainly compares two types of signal system viz. Pre-timed signal system and SCATS to study nine MOE (Measures of Effectiveness): travel time, travel speed, fuel consumption, hydrocarbon emission, carbon-di-oxide emission, nitrogen oxide emission, total travel delay, number of stopped vehicles at each intersection and maximum queue length to compare statistical significance in the signal times of the mentioned two types. SCATS implemented in Oakland have

been studied to assess the impact in the Old areas of Indian cities (like Pune). Following this, the three scenarios of normal condition, monsoon times and festival were studied and variations in the values of the above signal systems were tested using ANOVA test. For this, primary survey is conducted during the mentioned three scenarios. VISSIM is used for micro simulation to get the counts for the 9MOEs for the application of SCATS.

This revealed that the incorporation of SCATS would improve MOE of traffic signal system to have better connectivity from junction to junction without congestion.

Keywords: *Traffic Congestion; Pre-Timed Signal System; SCATS; MOE; ANOVA Test*

Development of Optimum Front for Time-Cost Trade-Off in Construction Projects

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Abstract

CPM (critical-path method) and PERT (program evaluation and review technique) scheduling practices have been useful if the resources are unconstrained and the project deadline is not fixed. Additional techniques must be applied distinctly after the primary CPM schedule is determined to incorporate deadline or resource limits. Two significant supplemental methods for scheduling using CPM are TCT (Time-Cost Trade-Off) Analysis and CRS (Constraint Resource Scheduling). Regardless of the abundant models present, no ready to use algorithms for TCT analysis are available in commercial software, let alone TCT and CRS combined. In this paper, Linear Programming Model has been chosen to implement it through a computer program developed for TCT analysis. Ms-Excel software with its LP solver capability has been used to solve the defined time-cost trade-off through linear programming. A case study has been untaken to show the use of proposed approach for resolving constraints in regard to specified deadline. Thus the capability of CPM in project control is appreciably enhanced.

Keywords: *Construction Management; Supplementary Scheduling Techniques; TCT; Linear Programming; Computer Application*

Self -Redevelopment - Futuristic Method to Redevelop Buildings in Mumbai

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Abstract

Mumbai city is witnessing redevelopment of old buildings since decade and half. Current traditional concept of redevelopment is done among two parties one Society and other the builder. However due to various constraints, considerations and changing policies, the process of these projects which is quite complex and becomes much more complicated due to disputes between society and builder. The success rate of projects getting completed is as low as 25 % to 30 % only. Process of the projects either progresses at snail's pace or get disrupted due to disputes and prolonged litigations.

Self-redevelopment is a new trend that is now making its way in Mumbai's real estate market, where housing societies who do not wish to go with the developer and choose to redevelop their own buildings themselves. It is yet uncertain to assert its claim in redevelopment market. Doubts persist about pitfalls of redevelopment of a property from concept to construction without a builder. This study reveals the various benefits, limitations and method of self-redevelopment.

Keywords: *Self-redevelopment; Process; Building Redevelopment; Model for redevelopment; Determinants*

Review of Excavation Hazards and Control Measures in Construction Sites

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Abstract

Excavation work is the first step in the construction process. Excavation activity is described as any job involving the removal of soil or rock from the site to create an open face, hole or cavity using instruments or equipment. Generally, the dimensions of width and length are relatively equal. Depth will vary but is usually lower than the smaller size. Used for basements, underground tanks and pipelines installation or maintenance, piling, culverts and larger spread footings. During excavation, pile driving, and compaction work, workers are at vulnerability to variety of hazards, but the most risky hazard of them is the impact of cave-ins. Workmen may be subjected to prospective cave-ins due to certain factors like lack of sloping or benching the edges of the excavation, supporting the

edges of the excavation, or putting a shield between the excavation face and working space. Any heavy motion near the excavation face will cause the adjacent soil to vibrate. This displacement can lead to failure of soil. Heavy loads may be too heavy for the soil to be supported by big machinery, heavy materials or big spoil piles, leading in a cave-in. In addition to cave hazards and secondary cave in hazards, there are other hazards that need to protect workers during excavation work. Other risks include exposure to drops in height, whether in excavations or excavations, discharge of loads and portable machinery, accumulation of water, unsafe access to and exit from all excavations, operating in confined spaces or underfoot under bad circumstances, and asphyxiation owing to absence of oxygen, dangerous gases, and contact with heavy electrical cables or inappropriate rescue.

Keywords: *Excavation; Hazards; Cave In; Control Measures; Safety Measures*

Application of Quality Control System in Construction – A Study of RMC Plant

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Abstract

Construction in India is traditionally labor-intensive due to cheap and abundant manpower available. However, with an increasing need for speed along with the high quantum of construction, mechanization has picked up the momentum. Mega infrastructure construction projects also need attention to quality with a safe construction environment following international standards. Mechanization of construction projects in India is one of the basic reasons to advent use of Ready Mixed Concrete (RMC). Use of RMC in Indian construction projects is increasing at a slow pace. Concrete is the key material from the cost as well as the quantity point of view for the framed construction. Hence, the quality of the concrete/RMC influences the quality of construction. Various tools are adopted by the different agencies for ensuring quality control in the construction projects. Based on the outcome of these tools, different measures are implemented to ensure the quality of materials and also finally the construction. In this paper, select tools of quality management like fishbone diagram, statistical control charts, quality control models are explained with specific reference to RMC. This will help the RMC plant management in delivering the RMC of desired quality to the construction projects.

Keywords: *Ready-Mix Concrete; Quality Control; Construction*

Design of Multi Storey Hospital Building in Various Sesmic Zones for Earth Quake Resistant and Management

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Abstract

Indian sub-landmass is inclined to normal perils as delineated by the Vulnerability Atlas of India and it has been ordered through Disaster Management Act that India should be master dynamic instead of responsive as to tremors is concerned. It is likewise gained from repetitive quake happened for most recent two decades in Indian subcontinent that so as to have expert dynamic methodology it is essential that we set ourselves up better for calamities by producing know-how, danger situations, maps, helplessness and hazard investigation, retrofitting system and more and in particular structure limits. In order to ensure these objectives are met, an initiative was taken to design a hospital building in seismic prone areas. The earthquake zoning divides India into 4 seismic zones (Zone 2, 3, 4 and 5) Zone 5 being the zone with highest level of seismicity and Zone 2 being the lowest level of seismicity. In this project, analysis, design and comparison of a G+10 hospital building in various seismic zones is done. The total structure has been analysed by using STAAD. Pro V8i.The hospital building is constructed keeping in mind the realistic constraints like economic and environmental constraints and appropriate steps are taken to overcome the constraints. Various IS codes like IS 456:2000, IS 875:1987(parts I-III) and IS 1893:2005 are also referred to overcome the constraints and estimation of the reinforcement of structural members in various seismic zones is done to compare the results. This kind of study will help to develop a data base related to the construction of multi-storey buildings and same guidelines can be adopted in other disaster prone areas too. This initiative will throw some light on important points to be followed on earthquake prone areas while constructing multi storey buildings.

Keywords: *Disaster Management; Seismic Zone; IS Code; Multi Storey Buildings*

Application of Onion Model for Engineering Projects – A Study of Cooling Tower

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Abstract

The engineering project is about developing the production facility for the product. This leads to initiating project feasibility study. The project development is based on principle of “Concept to Completion” of project cycle. The work brake down structure is conventional approach to understand

the scope of supply of the project; the onion model helps in sequencing the project scope and project management activities. The project cycle involves identifying feasibility to operational needs of project. For identifying various scopes and services in project phases, including the operational requirements of project needs mechanism for sequencing. With onion model the process design and plant engineering requirements along with operational and maintains needs can be envisaged. The model helps in detailing civil, mechanical, electrical and instrumentations scope. The process equipment sizing and allied systems engineering is based on it. This paper explains with onion model, process plant design and engineering is core activity in engineering project; secondly a principle of project engineering ensures project scope specifications, deliverables and leads to higher proficiency in project management. In proposed onion model, process and plant design is core. The process has different steps of transformation from raw material to intermediate and final product. Along with this byproducts and waste products are formed. The process materials have varied physiochemical and thermal properties; the onion model helps in detail engineering with process engineering and plant engineering. This leads to defining the scope and specifications in project development phase. The process equipments and auxiliary machinery is sized on process engineering fundamentals. The onion model leads to development of accurate specifications for process equipments as well as auxiliary plant and machinery. The onion model also considers energy requirements for material transformation. This model also envies process safety needs for operation and maintain of process plant. With onion model all requirements are identified during project development as compared to approach of work breakdown structure alone. The project engineering principles leads to development of equipment specification for procurement and also plant layout design. Project scope is represented as different layers around core that is process; as civil, mechanical, electrical and instrumentation scope as design and supplies. The compilation of engineering details leads to project deliverables. The onion model helps in sequencing the specification development of various supplies of equipments as well as construction work activates. The onion model helps to envisages interface activities in project execution. Further the onion model helps in sequencing project execution and resource identification for all construction work including erection and commissioning. Due to better understanding of interface requirements, the inter-dependencies of various activities of the project planning shall be mirrored precisely. This leads to Work Breakdown Structure (WBS) which satisfy the constructability principle. A case study of cooling tower project illustrate onion model and project engineering application through process plant design and engineering.

Keywords: *Onion Model; Process Design; Plant Design; Project Engineering*

An Exploratory Study on Construction and Demolition Waste

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Abstract

Industrialization, economic development, and urbanization play a vital part in the growth of the construction sector. However, this rapid growth in the construction sector stimulates the production of construction and demolition debris, which got an adverse effect on human health and environmental ecology. Construction and demolition (C&D) wreckages form a significant share of municipal waste, but most of the countries lack separate government regulations for the disposal of C&D waste or its management. This paper summarizes the various aspects/levels of construction and demolition waste and its administration by doing an intensive literature investigation. For this purpose, around 30 papers of the last ten years on C&D waste were retrieved, critically analyzed, and synthesized accordingly based on the content: waste quantification, onsite sorting, reduction, recycling, and waste management policies. Additionally, the investigation condenses the current management of C&D debris in the Indian construction sector. Finally, the authors suggest that government should take the initiative to frame policies and regulations to manage C&D debris and, also awareness programs should be organized to educate the stakeholders about the benefits of proper waste management in the construction industry.

Keywords: *Exploratory Study; Construction & Demolition Waste; Waste Management; India; Construction Industry*

Analysis of Tunnel Boring Machine Stuck in Tunnel during Construction of Tunnel: Problems Faced and it's Solution

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Abstract

Tapovan Vishnugad hydroelectric power project is being constructed on Dhauliganga river in Uttarakhand state. The construction of hydroelectric power project began in November 2006 and power plant was expected to begin in 2012, but sluggish tunnel excavation works and flash flood in June 2013 delayed the project. The project commenced operation in 2016. National Thermal Power Corporation (NTPC) is developing the project at an estimated cost of INR 2978 billion. The remaining 3.5 km section will be excavated using road header and will use drill and blast method if required depending upon the geological conditions. Chamoli district is in the north east part of

Uttarakhand , the area of the district is aproximate 7320 sq. km. Chamoli district is the second largest district of Uttarakhand.

Keywords: *Tunnel Project; Tunnel Boring Machine; Drill and Blast Method*

A Case Study Based on Smart Village: Dhanora

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Abstract

The population of rural areas is 68.84% according to 2011 Census. People in search of better jobs and lifestyle starts migrating on a very large amount from rural areas to urban areas which leads to an unbearable burden on the urban areas now a day's affecting the consumption of all the natural resources and increasing the wastage. The vision and aim of the founders of this nation is to be respected and implemented in order to reduce pollution as well as increasing health hazards. We need to understand our responsibility to make not only cities as smart but also our villages smart, which means self-sustainable, efficient, graceful, healthy and education as prime importance. Some of the important topics which are needed to form a village smart include offering basic facilities like sanitation, potable water for drinking, and road connectivity from village to cities in order to increase the trade, education, employment, technology etc. The concept of the smart village is constructed on the image of a developed village of some states or nations.

The Eco Foundation has adopted Village Dhanora, Teh. Bari, District Dholpur, one of the remote village of Rajasthan under the concept of smart Village, to establish it as India's 1st Smart Village. The village is 30 km away from Dholpur district head quarter, 248 Km from the pink city Jaipur. The population of the village is nearly about 2000 having no proper sanitation facility, potable water facility, unemployment affecting the young minds, no proper connectivity of roadways with cities, no basic healthcare facilities which is adversely affecting the health of the villagers.

The study is considering two objectives: To study the smart village model & highlight prospects for future development.

Keywords: *Smart Village; Dhanora; Various Implementation of Schemes & Social Initiative Taken By Villagers*

Identifying the Waste in Construction Activities: A Lean Prospective

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Abstract

The aim of every organisation is to achieve high efficiency in their workflow. The volatility of labour productivity is highly related to performance of project. To address this challenge and achieve considerable productivity we propose the implementation of lean principles in construction projects. The required data was collected at a live project for defined duration of 8 weeks using work sampling method. The observations for each activity were recorded based on the time taken in minutes, for each task performed by the work force. The time taken for various activities such as brickwork, plastering, tiling, waterproofing was noted. The data recorded for each activity was analysed and categorized based on their value addition to the respective activity. The data was visualised through generation of Pie-charts to evaluate the proportions in percentages for value adding and non-value adding activities. From the results it is evident how variability in the work had its impact on the productivity. The importance of this paper is to identity and reduce the non-value adding activities and to focus on achieving better productivity.

Keyword: *Work Sampling; Lean Principles; Productivity; Efficiency*

A Case Study of Impacts on Poverty by Rural Roads

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Abstract

Smart Rural road construction isn't just about making the street sturdy and economical with least upkeep, we should know the premise of developing a country street. From these contextual analyses, we came to know how the street network, improves the work of the individuals all things considered and occupations. The advancement in farming didn't coordinate the desire, developing comparative harvests that are developed customarily and furthermore the social practices rehearsed regardless of the transfer of significant limitations to the progression of innovation with the assistance of good access streets and well-performing vehicle administrations. Cultivating family units have more simple entry to business sectors and contact with purchasers in the market square. They are never again subject to purchasers visiting their territory. Better streets and accessible vehicle administrations

improve the conveyance of different taxpayer driven organizations to poor people. It additionally gives authorities adequate measures of time to proficiently screen the advancement of their projects for poor people.

Keywords: *Smart Rural Roads; Project Site; Poverty; Cash Crop; Transportation Services; Livelihood; Farmland; & Development Project*

Analysis and Development of Solution Model for Constraints in a Construction Project

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Abstract

This project aims to identify the constraints in the construction project, rank them in order of importance and develop a solution model to eliminate the same. Constraints are factors which obstruct from achieving a goal or an objective and mainly lead to time and cost overrun. The project's goal is to find the main constraints in a construction project and the same was done through comprehensive literature reviews and personal interviews of the experts from the industry. The next phase of the project included surveying the stakeholders (contractors, architects, engineers and consultants) and asking them to mark each constraint on a two scales frequency and severity scale. The questionnaire had 69 constraints under 10 categories. A total of 230 responses were collected from around 52 organizations (government and private entities) and the analysis of the same shows that economic constraints, contractor related constraints and the customer connected factors are the most critical factors that affect any construction project. A prototype of construction management software was developed to eliminate these constraints and to improve the overall efficiency of the project.

Keywords: *Constraints; Questionnaire & Survey; Importance Index*

A Case Study on Cost Optimization of Cement and Steel Rebar Supply by a Vendor at Project Locations

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Abstract

A contractor has to erect the building structures as per contract and to procure (during 2018-2019 financial year) the cement, steel rebar materials, contractor has made an agreement with material vendor, to ensure the supply of cement and steel rebar in time at an optimal transport cost from various cement manufacturers, steel rebar dealers from nearby areas. The transportation cost per kilometer per unit (i.e. excluding the profit and overhead charges) has been extracted from Telanagna State Standard Schedule of Rates (T.S.S.R). The main objective of this study is to arrive optimal transport cost by engaging the North West corner method, Least Cost method and Vogel's approximation method. The cost of cement transportation, up on comparing the Vogel's approximation method (i.e. cost) with Least Cost method (i.e. cost) it is observed that there is a saving of 0.073% on transportation cost, where as 1.08% cost saving if Vogel's approximation method (cost) compared with Northwest corner method (cost). But, there is no transportation cost difference has been noted under modified distribution method (MODI) by engaging North West Corner method, least cost method, Vogel's method. In steel rebar transportation calculation, it is noted that there is no transport cost difference among the North West corner method, Least Cost method and Vogel's approximation method and even in the case of modified optimality test too.

Keywords: *Cement; Steel; North West Corner Method; Least Cost Method; Vogel's Approximation Method*

Analysis of Air Pollution Impact on Human Health in Patna City by Questionnaire Method

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Abstract

Air pollution is a major environmental risk to health .It has been estimated that air pollution in the year 2012 caused deaths around 7 million people worldwide. WHO has estimated that 80% of the outdoor air pollutant related premature deaths are caused due to ischemic heart disease and strokes, while 40% of death are caused by chronic obstructive pulmonary or acute lower respiratory infections

and 6% of deaths were due to lung cancer. So as to design suitable safety measures for controlling health hazards of air pollution, it is necessary to understand individual's perception about air pollution as how it is affecting their health. For this, a usual practice is to survey people face to face using a formatted questionnaire. This questionnaire will have socio demographic parameters in first section and the next section will consider the diseases caused due to air pollution. So, this study will develop a suitable chart to conclude about pollutants causing maximum health hazard and the common short term diseases from which people are suffering due to their daily exposure in air pollution.

Keywords: *Air Pollution; Health Hazards; Questionnaire; Short Term Diseases; Exposure*

A Case Study of Traffic Congestion in Bangalore City: Gorguntepalya 'T' Junction

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Abstract

The word Traffic Congestion is now-a-days becoming the most common problem in all the metropolitan cities where there is an unpredictable growth rate of the vehicles because of improper planning of the roads. The roads and highways prior to the development must perform a growth analysis of the vehicular movement and plan accordingly in order to mitigate the risk occurrence of traffic in a particular location and to reduce it. One such real time situation has been observed and considered as a case to solve the problem, which helps in solving the traffic problem in that particular location in which there are lot of constraints involved such as land acquisition, road expansion, government department's involvement and highly populated zones. The identified case finds the problem from past many years in Bangalore exactly near Yeswanthpur Gorguntepalya 'T' junction, with a traffic jam extension of more than 700 m to 1 km, and the time taken to cross the signal is on an average from 25 to 45 min. So, for that initially a traffic survey has to be carried out with all-time record of peak hours and non-peak hours. The details of traffic count will be determined and based on that we identify the possible method to reduce the traffic congestion. The dependencies are analysed and checked for the alternate mode of transport crossing the junction. There are few constraints in the junction which has been selected for the study.

The junction is a T Junction, with a metro rail running along the road where no flyover is possible.

Also, there is a defence land beside the road where it is very difficult to acquire the land. The surrounding area next to the outer ring road connecting to NH75 is under legal conflict since many

years. NH 75 and Outer Ring Road, both are connecting towards the 'T' junction and this makes heavy traffic congestion pressure to the next Ring road Signal Stop. So, by considering all these constraints a suitable and free movement solution has to be determined.

Keywords: *Traffic Congestion; Vehicles; Metropolitan Cities; Peak Hours; 'T' Junction*

Advance Roof Slab Construction Methodology by Top down Construction Method for under Ground Metro Station

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Abstract

Underground metro stations are generally planned below roads in congested city for ease of access to the metro facility. The conventional top-down construction method is used in constructing underground stations at the congested locations. To construct the station by top down, roof slab has to construct first. So during construction of the roof slab whole road has to be blocked and due to that normal traffic movement in the city hampered greatly. So to minimize inconvenience to the ongoing traffic flow the construction has to be undertaken in part wise leaving certain road width for traffic to flow and other part of the width for construction. So there will be a longitudinal construction joint in the roof slab at the location of less bending moment. When roof slab construction completed traffic is moving on one part and the other part kept for removing mucking through some temporary opening provided at certain locations.

Keywords: *Top-Down Method; Excavation; Construction Efficiency; Deformation; Construction Materials and Methods*

A Case Study on Water Management System

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Abstract

The owners of Sonar Bangla Resorts, a hospitality group in West Bengal, India desired to introduce an upscale holidaying facility at Sunderbans, West Bengal. A suitable land parcel of about 8 acres had been purchased and relevant design were made to accommodate about 85 tourists in 22 building units providing state of the art comfort and facilities. But during the construction phase it has been observed that the area does neither have any suitable source to supply adequate potable water nor

does it have a drainage system to discharge the waste and waste water from this resort. It was a challenge to us as the management consultant for them to identify suitable source, feed it to the original project concept and suggest right path of implementation using available resources and construction practices as an economic solution. Sunderban is a designated UNESCO World Heritage site. Hence polluting the environment and disturbing the natural atmosphere by any means are not only objectionable but punishable. It does not have any suitable aquifer in a shallow depth and boring for a suitable aquifer is highly expensive and uncertain. Even treatment of the available saline water is also uneconomic. So we have thought of a 'Zero Discharge' concept for this project. We have worked out a rain water harvesting plan as a source of water, planned a sewage treatment plant on bio degradable system to treat the waste and waste water out of this project and designed a suitable distributary system to use the treated water for various usage within the resort itself. The overall planning including design and construction of this system was a success being the first of its kind in the state. The entire management scheme had been found very economic, cost-effective, user friendly, maintenance friendly and environment friendly.

Keywords: *Project Management; Zero Discharge; Environment Friendly; User Friendly; Economic*

Study of Impact on Groundwater Table in Around Tamilnadu and Remedial Measures

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Abstract

A study was carried out with the aim of assessing the decrease of groundwater table in and around Tamil Nadu. Due to improper urbanization and industrialization the development in the states such as that of Tamil Nadu is happening in a haphazard manner owing to the uncontrolled burst in population in the cities and town and even due to growing migration of population from the villages. Due to improper water management strategies, poor conservation strategies mismanagement of water utilization in agriculture and other sector the ground water table is reducing day by day. To ascertain the situation of the decrease in ground water table this study was initiated. In this study detailed groundwater table data was collected and also depth of the ground water was also observed from several districts in and around Tamil Nadu. Data collected during the peak summer month for a period of March and April 2019 and the same was compared with earlier groundwater data. Based on the analysis it was clear there is a huge variation of ground water table between the different years. By comparing the last year groundwater data and this year data there is an abnormal decrease in the

groundwater table in this particular year. This may be due to failure of monsoon, poor water conservation and water management strategies and improper implementation of Rain water harvesting and storm water drainage system. If the authorities didn't take stringent measures and people are not adopting sustainable water management strategies. The coming years the situation will go very worst and it may leads to drought and desertification. It is high time to take some immediate measures like metering of water utilization in all sector, crack down of encroachment on water bodies and implementing sustainable water management strategies will help to improve the ground water table .

Keywords: *Ground Water Table; Tamil Nadu; Rain Water Harvesting; Sustainable Water Management Strategies*

Managing Stakeholder Dissent Using AI in Project Management

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Abstract

Artificial intelligence (AI) has acquired tremendous visibility and attention in the past few years. Learning and adapting through continuous algorithmic interventions, help create solid understanding of the problem at hand, and deal with harder problems along the way. At the base of AI is the logical conceptualization of cognitive psychology and knowledge-based applications engineering. Complex issues are being resolved through faster computing techniques using AI. At the same time, newer and more complex problems are emerging, which are difficult for the human mind to comprehend and visualize, far from being able to resolve them. Dynamic changes in the technological, economic, political and environmental scenarios, across the globe, present insurmountable questions to business leaders and strategists. Business strategies and governmental welfare objectives are executed within the framework of projects and project management. Project managers deal with constraints throughout the timeline of the project. Irrespective of methodologies, predictive or iterative, the presence of multiple stakeholders and the management of their requirements create multitude of challenges for the project manager and the project team. This paper intends to decode what are the current practices in the industry used by project managers applying the concepts of AI. The author aims to lay down challenges and plausible approaches for new age project managers to use AI in managing stakeholder expectations, resolving dissent and conflicts and ensuring seamless project delivery.

Keywords: *Project Management; Stakeholder Management; Stakeholder Engagement; Artificial Intelligence; Project Management Analytics*

Addressing Risks of Building Redevelopment Projects in Mumbai

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Abstract

Mumbai city is witnessing redevelopment of old buildings since decade and half due to space scarcity, particular geometry and geography and ever persisting demand of housing. There are various constraints and considerations, multitasked holders, changing polices and challenges at site which make building redevelopment projects always susceptible to risks and uncertainties. For projects to get accomplished smoothly and swiftly, risks need to be addressed. Research work is carried out through interaction with stake holders about various risks encountered by them. Tool governing the process of these projects is development agreement. Attempt is made to apply FIDIC (Fédération Internationale Des Ingénieurs - Conseils) conditions to clauses in development agreement, to address possible risks and make the process of redevelopment projects relatively dispute less. This paper depicts the research work based on same analysis. This study is probably first in kind for this segment. Outcome of research work is of immense value in terms of guidance to the stakeholders.

Keywords: *Risks; Process; Building Redevelopment; Development Agreement; Clauses*

Tools and Methodologies Developed For Predicting the Outcomes of Indian Construction Disputes - An Overview

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Abstract

Technology growth and modernization for the past few decades has occasioned an infrastructure boom in India. Construction industry is a technology based industry having traditions, customs and practices differing from area to area. It needs a well-coordinated effort of a project team comprised of inter disciplinary professionals. Majority of the construction projects are carried out through contracts. The parties involved in the contracts have different purposes and interests which eventually gives rise to claims and ultimately construction disputes. With the advent of large-scale construction projects, the number and amount of construction claims and disputes have increased significantly both in magnitude and nature resulting in hindrances in the project progress leading to cost and time overruns. This situation demands an insight in the inclination of claims and predicting their outcome

so that the parties to contract can settle the dispute out of court and avoid the expenses incurred on the arbitration and court proceedings. The paper focuses on the scientific methodologies developed for predicting the outcome of Indian construction dispute resolution processes.

Keywords: *Construction Claims; Construction Disputes; Dispute Resolution; Scientific Methodologies*

Risk Analysis in Highway Construction Projects using Fuzzy-Risk Failure Mode & Effect Analysis

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Abstract

Highway construction projects play very important role in social, economic and cultural development of any country. These projects undergo many risks during construction process, so it is required to analyze these risks before starting any highway construction. This research presents a complete framework for analyzing risks in highway construction projects using Fuzzy-Risk Failure mode & Effect Analysis (RFMEA) system. In this research risk analysis is done through undergoing five major steps: 1. Identification of risk factors through literature review and discussion with highway construction experts result in 61 risk factors are identified, which are categorized in 12 groups 2. Assessment of risk factors in terms of its occurrence, consequences on cost, time & quality and detectability through questionnaire survey. 3. Ranking of risk factors based on Risk Priority Number (RPN, function of occurrence, consequence and detectability of risk) and Risk Score (RS, function of occurrence and consequences of risk) using Fuzzy-MATLAB 4. Risk Allocation i.e. to whom risk should be allocated 5. Treating the risks by designing risk response strategies. On the basis of RPN & RS, risk filtration is done by zoning of scatter plot diagram between RPN &RS, which represents four zones of risks: 1. Risks with high occurrence, consequences & hardly detectable 2. Risks with high occurrence, consequences & easily detectable. 3. Risks with low occurrence, consequences & easily detectable 4. Risk with low occurrence, consequence & hardly detectable. This research also presents a RFMEA table after analysis of risk factors in which each group of risk factors is considered as failure mode and factors of each group are considered as failure causes.

Keywords: *Highway Construction; Risk Analysis; Fuzzy - RFMEA; Fuzzy-Matlab; Risk Filtration*

Adoption Drivers of Building Information Modelling (BIM) in AEC Industries: An Interpretive Structural Modelling (ISM) Approach

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Abstract

Building Information Modelling (BIM) is becoming an important stepping stone in ensuring the accurate, accessible and actionable planning, design, construction and operation of building and infrastructure projects. BIM is a highly collaborative process that allows multiple stakeholders like vendors, suppliers etc. and professionals of architecture, engineering and construction (AEC) industry to work through a common platform. Even though, BIM is useful and offers many significant benefits, it still leaves construction professionals with many BIM adoption related misconception. Many popular studies and literature have discussed the BIM adoption plans in detail; nevertheless there are two important research questions not answered. First, which are the distinctive drivers who drive BIM adoption in construction? Second, how do these drivers relate to each other? The intention of this research is to tackle these two research questions with the application of Interactive Structural Modelling (ISM). This study contributes to the body of knowledge by providing a hierarchical relational model of such drivers for BIM implementation. The findings of this study can work as a practical reference for potential attempts to offer technical as well as managerial solutions for improving and facilitating BIM implementation in AEC.

Keywords: *Architecture; Building Information Modelling; Construction; Drivers; Engineering; Interpretive Structural Modelling*

Design Aspects of Piled-Raft Foundation for Konkan Railway Foot Over Bridge at Madgaon, Goa

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Abstract

Foundations are designed to safely transfer the load of superstructure to soil strata below. While for two similar structures, the super structure design remains same, the foundation of these two similar structures may be different depending geotechnical condition of sites. For soils of low bearing capacity some times while raft foundation is not adequate, one has to consider pile foundation.

However cost and construction aspects of pile foundation are restrictive aspects in its selection. In number of cases it is observed that based on bearing capacity, raft can take significant load but not complete load. In such cases a new combination of piled-raft foundation is employed. In a piled-raft foundation major load is transferred by raft itself to soil and piles serves to transfer excess load and/or to arrest/restrict settlement within permissible limits.

This paper presents design aspects of piled-raft foundation for a Konkan railway Corporation (KRC) Foot-over bridge having 3 m wide carriageway at Madgaon, designed for light vehicles and pedestrians; providing a crossover to double railway tracks at KM 441/057. The sub-soil investigation report indicates a layer of sandy soil to a depth of about 3 m below ground level, soft lateritic rock up to a further depth of about 4 m and then a weak clayey stratum at about 17 m below ground level.

A very limited space on the sides of the double line of railway tracks is available, since a minimum distance of 2.75 m from the centre of track is to be left undisturbed all the time. Driving of medium or large diameter piles to the depth of hard rock (17 m) was therefore likely to be very difficult, if not impossible. Also open excavation in sandy soil, to a depth of at least 3.5 m in order to reach the lateritic rock, with collapsible or flat side slopes was also thought to be risky. Hence the concept of rotary bored piled shallow raft foundation and steel superstructure in limited working space was introduced.

Keywords: *Pile-Raft Foundation; Foot over Bridge; Konkan Railway; Soil Investigation; Design of Foundation*

An Assessment of Key Drivers Influencing Green Construction Supply Chain in India

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Abstract

With growing public and regulatory emphasis on environmental awareness, construction industry is slowly shifting its focus from conventional supply chain to green supply chain. In this context, this paper tries to identify key drivers influencing green construction supply chain in India. Based on extensive review of the literature and practitioner's opinion, fourteen key drivers influencing green supply chain are identified. Considering complex nature of relationship among these drivers, a systematic solution procedure is developed with an objective of understanding these relationships. Using Interpretative Structure Modeling (ISM) approach, a structural model has been developed to establish the relationship. Such a structured approach can aiding identifying critical drivers and help organization direct its resources in building green supply chain.

Keywords: *Drivers; Green Construction Practices; Green Supply Chain; Interpretative Structure Modeling*

Low Carbon Mobility Plan: A Case Study of Public Bicycle Sharing System in Surat City

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Abstract

In 2017, Surat City has less than 1 % passenger trips of a day fulfilled by Public transport, while 48 % trips are made by private vehicles (PV) consisting para - transit and rest of 51 % trips by walking, bicycle and others. As a result, evils such as traffic congestion and subsequently accidents, air quality degradation and low levels of service on roads have escalated. Efforts were made by introducing a bus rapid transit corridor to cope with the issue, but inefficient transport policy could not make significant shift of private vehicle (PV) commuters to BRTS. In this study, policy is targeted to improve public transportation ridership that will ultimately result in reduction of carbon footprint due to pollution via concept of convenient "first mile and last mile connectivity", i.e. connected inter-links of available public transit modes for seamless daily travels. The paper presents proposal on adoption of non-motorized transportation, a public bicycle sharing system (PBSS) approach for promotion of shared mobility to achieve the expected transit ridership. The findings are based on preliminary analysis of well-designed revealed and willingness to shift survey reveals that 2% of existing PV users' are willing to use bike sharing if implemented. It is observed that 42 optimum locations of docking stations proposed for PBSS program can feed the transit stations for an effective integrated transport system to promote green mobility.

Mobility sector has huge potential for low carbon practices. This research is thus a comprehensive study of such a combined system for environmental cause in the delineated study area of Surat city.

Keywords: *Public Transport; Bicycle Sharing; Last Mile Connectivity; Modal Shift; Feeder System*

Development of a Synergistic Framework of PMBoK® Integration Management and ISO 9001:2015 for Indian Construction Industry

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Abstract

The Indian construction industry has consistently been one of the fastest-growing contributors of India's GDP for the last ten years. The sector attracts substantial domestic and foreign investment and generates enormous employment opportunity. However, the sector still suffers from poor project performance and underwhelming benefits delivery capacity. One of the primary reasons for this underperformance is the lack of structured approach and standardization in project and quality management practices in India. Though project and quality management competencies are increasingly being considered as vital attributes for successful project-based organizations, only a handful of organizations show genuine understanding and implementation of established standards in project and quality management in their construction projects. Despite project integration and quality system implementation going hand in hand in delivering the desired project outcome, limited efforts have been put into syncing quality and project management guidelines together to form an integrated management framework. As a result, there is a clear gap in implementing the project management concepts in line with international standard quality management guidelines. The present study tries to fill this gap by proposing a novel framework that integrates the integration management knowledge area of PMBoK® (6th Edition) and ISO 9001:2015 quality management guidelines. To achieve the stated objectives, a detailed review was conducted covering PMBoK® (6th Edition), ISO 9001:2015 and related literature. A questionnaire survey was then conducted based on certain constructs regarding the synergistic practices of project and quality management and their effect on project success. Regression analysis was performed to ascertain the validity of the constructs, and finally, a novel synergistic framework and the best practices guidelines were formulated. The research outcomes are expected to help Indian project managers focus on key areas of project management to integrate various project management sub-domains and align their practices with ISO 9001:2015 quality management guidelines with relative ease and lesser effort.

Keywords: *Construction; PMBoK®; ISO 9001:2015; Integration; Standards*

Construction of Middle Class Houses: Certain Issues of Materials and Management with Special Reference to Some Areas in Guntur Town

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Abstract

The paper makes an attempt to unravel various construction practices in vogue with special reference to Guntur town. It is no gainsaying the fact that the construction practices in India is not up to the mark though the exponential growth of infrastructure. Leaving the mega projects taken up by L &T, Shapoorji Pallonji, GVR, NCC etc., construction in India is mostly carried out by individuals who are mostly either unlettered or their education is not on sound lines in terms of the job of construction they have embraced. Despite quality construction materials by and large being employed, the span of buildings dwindles causing not only moments of anxiety and huge loss but also such practices drains national wealth. In many cases the cost of construction goes up by leaps and bounds. In several cases owing to poor and ill-informed supervision during construction, the quality is not up to the mark. As a result, buildings develop cracks, creeps, shrinkages and many other flaws, which precipitate the life-span of a building as has been enunciated under Material and Managerial Issues in findings. Hence, the purposive study intends to embark upon the present study to shed light on the construction practices in residential buildings of middle class in Guntur so that proper measures will be initiated.

Key words: *Construction; Managerial Issues; Structures; Flaws; Material Issues*

Analysis on Critical Chain Project Management

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Abstract

Critical chain project management is a critical chain method which was introduced by Eliyahu M. Goldratt in 1997. CCPM as compared to other commonly used methods of project management is more focused on optimum usage of resources. The conventional CPM (Critical Path Method) is more focused on tasks/activities. Any delay in the critical activities or the critical path directly results in project delay and there is no scope of completing the project early. Whereas, CCPM uses a different approach. By creating buffers like project buffer, resource buffer and safety buffer, the focus is more on completion of tasks/activities as early as possible rather than waiting for the particular due date. The objective of this research would be to understand and discuss about the factors affecting CCPM. For this, a thorough understanding of CCPM and its key concepts would be done. A comparative

study about CCPM and the traditional scheduling methods would be carried out. Key concepts in CCPM include reduction of time, buffers management and monitoring of the project with respect to buffers. An analysis would be done using research literature and the current scenario of CCPM in the industry. The final conclusion of this research would also include whether or not CCPM should be used as a replacement for the traditional project management methods.

Keywords: *Critical Chain; CCPM; Buffer; Critical Path; Resources*

Critical Analysis of Mergers and Acquisitions in India: A Case Study of Idea & Vodafone

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Abstract

Idea and Vodafone India announced that their respective boards has already approved a merger of the two companies. This got approval from Department of Telecommunications and further by National Company Law Tribunal gave a final nod to Vodafone-Idea merger. The merger was completed on the 31st August 2018, and this newly merged entity is known as Vodafone Idea Limited merger which created the largest telecom company in India by the subscribers and also by revenue. Under the deal's terms, the Vodafone Group holds 45.2% stake in the combined entity and the Aditya Birla Group holds 26% and remaining shares will be held by the public. The case discusses above is about the merger between the 2nd largest mobile operator in the country and India's 3rd largest mobile telephone company Idea Cellular (Idea) , Vodafone India Limited (Vodafone). This merger was announced in March 2017 was valued at around US$ 23 billion. This merger was not aware of the change that the Indian telecom landscape was going to undergo after the launching of Reliance Jio Info Comm Limited that is Jio in the year September 2016. Some of the prominent players of this industry, who were facing the some financial problems due to this high debt burden and huge infrastructure costs, they also faced more challenges with the exodus of customers to Reliance Jio. To handle this problem from a company like Jio, some telecom operators went into the consolidation mode, some started acquisition of spectrum, small players, etc., with Jio becoming stronger day by day with the offers like free of cost instruments, also another competitor companies like Airtel looked at consolidation through the acquisitions. The Idea-Vodafone was facing huge challenges ahead. But still in Indian telecom industry history, it had been seen as the biggest merger ever in telecom sector.

Keywords: *Mergers; Acquisitions; Consolidation; Telecom Sector; Idea; Vodafone*

Pedestrian Risk Assessment Ability and Road Safety Education – A Study of Primary School Children in Patna, India

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Abstract

Road safety is major cause of concern in India. Urban planners have the challenge of designing pedestrian infrastructure, specifically for vulnerable pedestrians like children, women and elderly people. Among them, children are most vulnerable with casualty rate approximately four times that of adults. This is alarming given the relatively low exposure of children to traffic. This may be due to their immaturity and inability to comprehend and assess a risk scenario. Providing Road Safety Education (RSE) to children as focused intervention, to enable them to assess risks over designed traffic composition and pedestrian infrastructure, may be useful in this context. This work attempts to evaluate the impact of RSE on understanding of basic traffic rules and risk assessment ability during walking and road crossing for primary school children. Two, one-hour RSE programmes, through classroom interaction and safety video tutorials, were conducted in two schools of Patna, India involving 82 students. A risk assessment questionnaire, to understand students' perception over different difficulty levels of crossing and walking, was designed and administered. Short term effectiveness of RSE was evaluated using responses of risk assessment of two groups of children– trained and untrained. Long term effectiveness was judged by administering the questionnaire to both groups after one month. Risk assessment capability of children was found to be good for situations related to walking on footpath, but not for road crossing situations. The risk assessment and safe walking rule knowledge was found to be co-related as children who underestimated risk of a situation could also not assess the safe walking scenario. Road safety training was found to have significant positive impact on children with respect to their ability to identify road signs, understand safe road use rules in walking and crossing scenarios and the knowledge was retained after one month of the training.

Keywords: *Road Safety Education; Primary School Children; Safe Walking Rules; Road Crossing Rules; Risk Assessment*

Smart City Mission: A Pilot Study of Awareness of the Perceived Elements among Low Income Group of Dehradun

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Abstract

Smart cities projects are an envisioned solution for the transformation of previous cities and proposing technologically sound ways to build and manage the cities of tomorrow. The smart city mission has been launched to fulfil the aspirations and needs of the citizens. The purpose of this study is to find out how much the common man is aware of the smart city mission and is focused on the Dehradun smart city proposal. Dehradun smart city proposal was awarded almost two years ago and had identified short term, medium term and long term goals. Therefore, this is the right time to detect the awareness of the citizens of Dehradun towards smart city mission in terms of familiarity to its elements, requirement, usefulness and importance. Since smart city missions aim at making an inclusive smart city, this research aims at examining the opinions of low income group citizens regarding the implementation of the short term goals of the smart city elements in the city of Dehradun. The value of this study lies in the fact that it specifically targets the low income group people as these are the ones usually the least informed. For the purpose, questionnaire survey was used as a tool. The questionnaire is presented to the respondents in Hindi for easy comprehension and has ten questions in addition to the basic demographic data. The questions framed were to know the awareness of citizens on the known facts about the city, about the smart city mission, about the criterions of smart city mission, implementation of smart city proposals, requirement and usefulness of the smart city elements. This helped in knowing that since so many days to its inception whether the Dehradun smart city elements have reached among the low economic group of Dehradun or not.

Keywords: *Smart City Mission; User Awareness; Low Economic Groups; Dehradun Smart City Project*

Agile in Construction Project Management – Opportunities and Challenges

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Abstract

Integration of Technology is the need of hour in the construction industry today. This is especially important when huge amount of foreign direct investment is pouring in Indian construction projects.

Only the technologically integrated firms would be more successful and attract collaborations in the higher end businesses those are using elements like Agile, Lean, and Virtual Reality, AI security, BIM (Building Information Modelling), IOT (Internet of Things), Big Data Analytics, RS (Remote Sensing) etc. and transforming the trends today. To remain competitive in this ever changing world, it is necessary that all firms should gear up to be technologically efficient to handle the challenge of technology. This challenge will aggravate not only for technology alone but also lack of skilled manpower. While the modern construction projects are getting more demanding, both in terms of design and functionality, however, the project owners/investors are more selective into what projects they will be able to accept. Since there are plenty of opportunities of Indian construction firms when it's trying to match the global standards, therefore, technology and training will become the key strength to resolve the challenges and to enjoy confidence in its growth. The use of agile first introduced in the computer software development and further expanded its wings into non-software environments such as manufacturing, construction, education, healthcare and other organizations for couple of decades now. Project leaders and its team members are using agile techniques in various forms to ensure that the customer's demand for quickening the project and commitment for delivering the value can be maintained. Agile technologies and approaches manage disruptive technologies more effectively and efficiently. Customer satisfaction is the highest priority for agile project management and is the key element for project success. This research paper will unfold the role of Agile in Construction Project Management and its related issues and challenges, thereafter, draw suitable conclusions and recommendations based on the research findings for the benefits of the construction organizations.

Keywords: *Agile; Construction; Technology; Project; Lean*

4D Modelling of Road Projects – Findings from Case Study

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Abstract

Road projects are unique endeavours as they stretch for kilometers from start to end. Unlike building projects which are limited to a particular location and are influenced by the conditions at that particular location; road projects are influenced by various elements which vary along the entire length. Hence, it is a tremendous work for the construction team to record, monitor and control the influencing elements along the road stretch. With the advancement of technology it is now an easier task to record, monitor and assess the various elements along the road stretch within the comfort of

the office room. This paper investigates into the application of 4D CAD technology for developing a virtual construction model of road project. A project case study is investigated into the potential advantages and drawbacks of practical implementation of 4D CAD for road projects. In the first stage a topographical survey is carried out and used for development of a digital terrain model. AutoCAD Civil 3D and Infraworks are used to design the various elements of road project as per design standards. This is used to generate a 3D model of the project. A detailed project schedule is prepared and combined with 3D model using Navisworks Software. A 4D simulation is carried out to understand the possible pitfalls in the planned design and schedule of the project. The findings are further validated with expert interview. The study finds that 4D CAD simulations are effective in creating a virtual model of road projects and the models can be used for various purposes including risk identification. Further, the study finds that model development and model refinement is a time consuming process and should be used when it can be justified in light of project benefits.

Keywords: *Risk Identification; 4D CAD; Navisworks; Road Projects; Construction*

Critical Analysis of Mergers and Acquisitions in India: A Case Study of Rejection of Indiabulls & Laxmi Vilas Bank Proposed Merger by RBI

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Abstract

The fundamental drive for merger activity is strong competition among companies of indistinguishable businesses that put specialize in economies of scale, cost-efficiency, &profitability. Authorities follow “too big to fail” principle which is one of the issues behind bank mergers. The case study involves the study of rejection of proposed merger of Indiabulls Housing Finance (IHF) and its subsidiary Indiabulls Commercial Credit Ltd (ICC) into Madras based Lakshmi Vilas Bank (LVB) by RBI. It was supposed to be a share-swap deal wherever the shareholders of the IBH will hold more or less 90.5 % and also the shareholders of LVB can hold more or less 9.5 % of the post-merger increased equity capital of the united entity. The second time after Capital First purchased IDFC Bank to make IDFC First Bank in 2018, it was the non-banking financial company (NBFC). The amalgamated entity would have a loan book of Rs 1.23 trillion and a net value of Rs 19,472 crore as of Dec 2018. The target of the study is to analyze whether or not there'll could have been a growth of LVB & IHF through mergers, acquisitions, and amalgamation which got disapproved by RBI in Oct’19. The initial part includes the introduction and conceptual framework of mergers and

acquisitions. The 2nd part discusses the historical prospect of LVB & IHF and followed by a review of the literature. The third part discusses the proposed mergers between Indiabulls and Lakshmi Vilas Bank in detail. All this is followed by a detailed analysis of factors which led to rejection of this proposed merger between this NBFC and Bank by RBI. Finally, the article highlights the usefulness of this study for policymakers, strategy makers, bankers, researchers, and students.

Keywords: *Acquisitions, Mergers; Amalgamation; Lakshmi Vilas Bank; Banks' Strategy; Indiabulls Housing Finance and Bank; RBI*

Analyzing and Evaluating Project Appraisal Methodology for Urban Infrastructure Projects in India

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Abstract

In the Union Budget 2019-20, the Government of India had allocated 4.56 lakh crore for budgetary and extra-budgetary expenditure on infrastructure, with a focus on roads and highways, railways, metro rail, urban development, and airports. As estimated that nearly 60% of the population will shift to cities by 2050, urban infrastructure development becomes one of the most challenging jobs. The government is working in close quarters with consultants to prepare the detail project reports (DPR) to justify the need for a project, to achieve the desired targets by ensuring value for money in public expenditure. The appraisal process of a project is to measure its economic cost and benefits along with social factors to determine whether net profits are greater than net costs. The traditional appraisal process of estimating benefits of the project is overestimated and cost of the project is underestimated due to constant demand factors. Even the projections carried out for appraisal are lacks in accuracy.

So down the line lot of projects leads to cost and time overrun and in many cases actual benefit of the project itself is not fulfilled. Thus, in this study, an attempt is made to identify existing issues in the appraisal framework. Data is collected through primary and secondary data. Interview of 25 consultants was conducted and four case studies of urban infrastructure projects were examined to understand the process of appraisal and identified important consideration in formulating appraisal for the project. The findings revealed that despite mathematical superiority of modified internal rate of return (MIRR), the consultants use internal rate of return (IRR) and financial breakeven point as financial appraisal techniques due to its market acceptability and as they are easy to explain to a client. The consultants find that cost estimation and the predicting the accurate revenue-generating

model are the biggest challenges for them, as the analysis is based on a lot of assumptions, which are driven by market forces and circumstances.

Keywords: *Urban Infrastructures; Appraisal; Feasibility; Development; Methodology*

Relationship between Safety Climate and Organizational Commitment in Indian Construction Industry

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Abstract

In the present study, researchers examined the relationship between safety climate and organizational commitment in the construction industry. Simple regression analysis is performed to identify the most important factors which are, Attitude of Co-workers (N1), Effect of safety training Programs (N4) & Attitude of Higher Authority (N5). Multiple regression analysis is performed to find out relationship between Safety Climate and Organizational Commitment in Construction industry. Study shows that Organisation Commitment is dependent on Safety Climate with .895 R-Square, Organisation Commitment is dependent on N1 (Attitude of co-worker) with .529 R-Square, Organisation Commitment is dependent on N4 (Effect of safety training program) with .573 R-Square and Organisation Commitment is dependent on N5 (Attitude of higher Authority) with .877 R-Square.

Keywords: *Safety Climate; Organizational Commitment; Construction*

Framework for Improvement & Innovation for Construction Projects

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Abstract

The word Innovation has taken the world by storm. Today companies worldwide face a business environment presenting unprecedented challenges and demands. The construction industry has always been among the driving forces of the economy. Every day we live in buildings that has been created by the construction industry. The construction industry overall suffers from sluggish productive growth and relatively low financial returns. Improvements and Innovations are critical not only for growth and competitive advantage, but also to ensure that overlook is sustainable and inclusive. As per McKinsey Global Institute, around $57 trillion will be Investment in the infrastructure industry by 2030. While the investment accelerates the growth in Infrastructure

industry, the projects and contracts are getting more complex and demanding. The construction industry is traditionally seen as a low-technology sector with low levels of expenditure on activities associated with innovation. A systematic framework to lead and implement technology & Innovation becomes imperative for the Infrastructure Industry to sustain bottom-line. With 80 percent of all construction work, still executed at the site, an innovation management approach for construction projects will provide opportunities that different phases of the project life cycle. This paper is a concept on opportunities across the project life cycle for improvement and innovation through a systematic framework for construction projects.

Keywords: *Construction Innovation; Innovation Management; Innovation; Improvement*

Delay Analysis of a Construction Project

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Abstract

Construction industry plays an important role in the economic growth of a country. Construction management is the indispensable aspect of this industry. The main aim of the construction management is to plan and schedule the resources within the frame work of a project. The guidelines and procedures of the construction management direct the managers how to utilise the resources during the construction process. Before execution of the work on the site all kinds of office works such as planning, designing, estimating, negotiating, purchasing, scheduling, controlling etc. In this study, an effort is made in planning, scheduling and delay analysis and updating of various activities which is done using MS project. The methodology followed in this project is Site Investigation, Studying of BOQ's & Drawings, Study on Labor Productivity and Scheduling, Tracking & updating of project using Microsoft Project and working with Delay Analysis to find the solutions and conclusions. On analysing the above project it was found that there was a delay of 66 days in the completion of the project. The critical activities of the project were foundation, casting the floor slab, block work, external plastering, painting and doors. In spite of critical activities, there were some additional activities where the project experienced difficulties in execution and delay in completion, and they are rain, shortage of skilled labor, poor workmanship, inadequate of availability of materials. In this delay analysis an amount of Rs. 62,0200/- was incurred to the project which was an additional loss to the project and simultaneously surpassed the budget allocated to the project. The main causes of the delay in the project were both excusable and non-excusable delays, which were identified by the occurrence and experience. The main delays were recorded and the loss of productivity and cost

loss has been calculated. Delays occur in every construction project, the magnitude of these delays varies from project to project, in some projects delay is in days behind the schedule and some delays may be continued to a year. So, it is imperative to identify and action cause of delay in order to minimize, control and to avoid the construction project delay.

Keywords: *Construction Management; Delay Analysis; MS-Project; Scheduling; Controlling and Monitoring*

Efficiency Study on Agro Waste as an Adsorbent in Treating Industrial Effluent

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Abstract

Industries are one of the major sectors which contribute for economic development, employment opportunity and development of the country. The growth of industries in India was rapid and in some cases it is unplanned. These unplanned industrialization and urbanization leads to several issues like contamination of environment, climate change etc., Discharge of effluents without proper treatment is a major concern. Many of the major industries like Distilleries, Sugar, Tannery, Textile, Paper and pulp, Steel plating, Pharmaceutical, Fertilizer etc., discharge huge quantities of highly organic and toxic substances into the water bodies and environment. To identify a solution for this problem trail study was carried out with agro waste and it was aimed at a systematic comparative evaluation of the potential agro-wastes (conventionally called, although may be of various uses, at presents) with least-pretreatment for adsorption of phenol from a simulated aqueous phenolated solution. For the adsorption studies, the agro-wastes selected were, Rice husk (RH), Green gram husk (GGH), Black gram husk (BGH as well as Commercial Activated Carbon (CAC) for comparison. The effect of various parameters, such as, time of contact, dosage of adsorbent, pH and temperature were evaluated to ascertain adsorption capacity of selective agro-based adsorbents. The outcome data were equated to that attained from phenol-sorption by commercial activated carbon, which are close to the dosage required using CAC (i.e. 0.35g). Based on the several trails and comparing output with commercial activated carbon. It was evident that agro waste are capable of acting as adsorbent and removing toxic compounds like phenol etc., If the same study carried out in large scale it will help in developing commercial adsorbent from agro waste.

Keywords: *Agro Waste; Adsorbent; Commercial Activated Carbon; Phenolic Compound*

Finding Favourable Sea Condition for the Safe Marine Construction Activities

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Abstract

The construction of coastal and offshore projects requires environmental data such as Waves, Currents, Tides, winds, etc. both during planning as well as in the design phase. This data is very essential in planning phase as it is a driving factor in deciding project location for projects such as ports and harbors, off shore oil platforms, offshore wind turbines, etc. we also utilize these data in the next step to calculate the environmental load on structures. But only few research articles have been published so far on how these environmental factors influence the construction and operational activities of marine construction projects. This paper focuses on exploring some of the important environmental factors from construction point of view. Also it emphasizes finding a suitable weather window (favourable sea condition) for safe marine construction activities. One of the popular project "Oresund fixed link" is considered as a case study to demonstrate the weather window analysis.

Keywords: *Marin Projects; Environmental Factors; Waves; Currents; Weather Window*

Blockchain Enabled Construction Project Monitoring

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Abstract

Current construction projects suffer from numerous challenges in terms of project monitoring. Blockchain which is decentralized transaction technology is growing up since past few years. Researchers have studied blockchain applications in variety of ways which includes the integration of blockchain with processes and sub processes on construction projects. This study proposes blockchain linked work performance data to improve current project monitoring practices. Application of blockchain particularly in collecting work performance data will significantly reduce the delays on project. It will also help in maintaining transparency among entire stakeholder due to its distributed ledger feature.

Keywords: *Blockchain; Construction Projects; Work Performance Data; Monitoring; IOT*

Simulation Modeling of Cost Overrun in Construction Project in Ethiopia

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Abstract

Cost is an essential part of any construction project. It was observed that cost overrun is one of the most frequently occurring issues in construction projects of Ethiopia and it is more severe in different parts of the country. The aim of this research has identified the factors that influence cost overruns of construction projects, quantified the percentage of identified factors, established probability distribution of identified factors and develop simulation modeling of cost overrun. The study was conducted based on the desk study and questionnaire survey. Questionnaire surveys were analyzed by using Relative Important Index (RII) ranking and significance of data checked by using a t-test at a 95% confidence level. Based on the desk study of 19 projects, a simulation model of cost overrun was developed by using the Monte Carlo simulation method. Simulation models showed a higher frequency of cost overrun occurring up to 10%. This indicates that the actual cost of most construction projects runs up to 10 % over the budgeted cost of work performed.

Keywords: *Cost Overrun; Probability Distribution; Monte Carlo Simulation Modeling*

Access to Health Care for Rural Medicare Beneficiaries

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Abstract

Patients in rural areas may use less medical care than those living in urban areas. This could be due to differences in travel distance and time and a utilization of a different mix of generalists and specialists for their care. Access to transportation to transverse the large distances between residences and health services in rural settings is a necessary factor to be considered by the policy planners. In all developing countries, it is of greater importance that measures have be taken to help rural people to remain healthy and active. Easy and timely access to quality preventive, and rehabilitative health care services in an integrated manner has a significant impact on the health and well-being of rural people. However, little research has examined directly access to transportation in analyses of rural health care utilization. This analysis addresses the association of trip length to access health care utilization in a rural region. The study area is Kunnam taluk in Permabalur district. The household questionnaire survey was taken from 28 villages. The obtained data were analysed using SPSS. The results reveal

that male respondents are more than their female counterparts. Famers were predominate (63.1%) in the study area. The people in are basically low income group and their prime mode of travel is by walk. The maximum distance travelled to access healthcare is 10km. The main parameters influencing the trip length and travel time are monthly income, travel frequency, driving licence, mode of travel, age, travel cost and vehicle ownership. The aged people are not able to travel more distance to access health center.

Keywords: *Healthcare; Rural Area; Trip Length; Farmers*

'R' Based Tool Approach for Analytics and Predicting the Value of Home for Real Estate Firm Using Linear Regression Model

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Abstract

Analytics has 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 huge amount of data that is being generated now and then. Huge amount of structured and unstructured data is produced in industry and with this data we could help a firm to make a game changing decision. The senior management is keen to capitalize on large volumes of historical real estate data to generate insights on various aspects of this booming market. Insights can range across land size, location, seasonality, price trends, area features, land features, property features and various other aspects. The firm has acquired a large dataset of real estate sales in Melbourne, close to 20,000 records from 2017.The purpose of this paper, is to predict the value of homes using statistical and linear regression modes.

Keywords: *Analytics; R; Real Estate; Linear Regressions*

Possible Ways of Re-Utilization of the Construction and Demolition Wastes in Various Construction Sectors

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Abstract

One of the biggest threats to the environment is solid waste. India being a developed country is facing issues related to inappropriate solid waste management. Although the amount of organic wastes is higher in municipal solid waste, but the management of construction and demolition waste is of main

concern. The studies have revealed the possibility of appropriate reuse of such wastes as various constructional materials. This study elaborates the different characteristic of the problem associated with management of construction and demolition waste, its source of generation and current status. This study also investigates the potential reutilization of construction and demolition wastes in various construction sectors in an economically and environmentally safe manner. It concludes by highlighting the feasibility of establishing a construction and demolition waste recycling facility.

Keywords: *Solid Waste; Construction and Demolition Waste; Reutilization; Recycling Facility*

Minimum Difference in Area Approach for Identification of Water in Radarsat-1 SAR Using IRS ID LISS III Data

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Abstract

Water landcover gives false positive and negative errors when a single threshold value approach is followed for classification in SAR. This research paper overcomes the errors associated with single threshold based approach and presents an alternative method to classify water and other classes in SAR using visible-IR image and minimum difference in area. This work finds application in disaster monitoring and management especially just after a cyclonic storm when visible-NIR images are not available due to cloud cover.

The IRS 1D LISS III and Radarsat-1 SAR images of October 11, 1999 of Kendrapara district of Orissa (study area) were procured. Using Supervised Classification with Maximum Likelihood technique, the IRS image was classified into various landcover classes. After landcover classification, water area was classified as one and other landcover as zero (*i.e.* binary image). The water area was 21.286 thousand hectares.

The SAR image was pre processed for speckle noise removal, data calibration and incidence angle correction. Further, for various thresholds selected in SAR image (in dB) corresponding water and non-water areas were calculated. According to this method, threshold was set such a way that the difference between the water area in IRS and SAR was least (minimum). The range selected for this analysis was from -19.0 dB to -12.0 dB. It was observed the least difference in area between water of IRS and Radarsat-1 SAR was at threshold of -14.5 dB. Hence a threshold of -14.5 dB was selected to

classify water and non water in Radarsat-1 SAR image of October 11, 1999 and water area was 21.262 thousand hectares.

Keywords: *Remote Sensing; Synthetic Aperture Radar; Water; Minimum Difference in Area Approach*

Analysing the Importance of Change Management in Phases of Project

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Abstract

Project changes are inevitable in all phase of project cycle. Very often decisions are made based on insufficient data, improper communication, and assumptions within the organisation. This might lead to a negative impact on the project scope, cost and time. This might end up in breach of contract or uncontrolled changes impacting triple constraints. Organizations have not yet got effective means to manage these changes and eliminate negative impact on the project. The purpose of the study is to understand the importance of change management in the success of the project. To achieve this, the cause and effect of change in scope and procurement during design development and execution is analysed respectively. A literature study is carried out on change analysis techniques, statistics, post change impact, risk analysis, impact on cost and schedule to evaluate the effect on time cost and scope. The Case study is carried on by comparing planned vs actual data. And finally, a questionnaire survey helped to find where an impacting change is most likely to occur. The findings will recommend suitable strategies and process to manage change well in advance before each phase.

Keywords: *Change Management; Scope; Cost and Schedule; Planned Vs Actual; Contractual Changes*

Engineering Performance of Self-Compacting Based Hybrid Fiber Reinforced Concrete with Fly Ash and Colloidal Nano Silica

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Abstract

Cement mortar and concrete are the most extensively used construction materials in the field of infrastructure development and civilization. Fly ash is the waste product of the thermal power plant having pozzolanic properties. Due to more surface area, Nano silica speeds up the rate of hydration of

cement resulting in enhanced particle packing. The unavoidable deficiency of normal concrete is of low tensile strength with limited ductility which can be improved by mixing suitable fibers into the concrete matrix. The aim of the current study is to investigate the fresh and hardened properties of M60 grade of hybrid fiber reinforced self-compacting concrete with a constant water binder ratio of 0.38 and using polycarboxylate ether based super plasticizer of 0.2% of binder. Four additives namely class F type of fly ash, colloidal Nano silica, crimped steel fibers and polypropylene fibers are used. Each of the additives is called as a factor. Each factor has four level of addition. Fly ash with 5%, 10%, 15%, and 20% and 0.1%, 0.2%, 0.3% and 0.4 % of colloidal Nano silica by weight of cement replacement is added. 0.5%, 0.75%, 1.0% and 1.25% of crimped steel fibers and 0.042%, 0.084%, 0.125% and 0.167% of polypropylene fibers by volume of concrete are considered. L16 orthogonal array of Taguchi method is followed to avoid the conduct of huge amount of experiments. Only 16 mixes with one normal control concrete mix without any additive have been considered. The cost analysis informs the cost of crimped steel fiber increases the cost of production of concrete with enhanced serviceability. The developed optimized concrete mix of this study may be recommended for the use as a ready mix type of self-compacting based hybrid fiber reinforced concrete in the field of infrastructure development of the country.

Keywords: *Self-Compacting Concrete; Taguchi Method; L16 Orthogonal Array; Hybrid Fibers: Fly Ash; Colloidal Nano Silica*

Analysing Factors Affecting Valuation of an Income Generating Real Estate Asset

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Abstract

Kurla being one of the most important locations of Central Mumbai, gives us the glimpse of how the region's different Real Estate asset classes perform according to their uniqueness, prominence and demand in the area. On basis of market research and feasibility study of real estate asset classes in the micro market of Kurla, this study aims to derive a realistic value of an income generating commercial asset. This value is derived by studying the impact of multiple factors such as demand-supply gap, pricing, revenue-based performance and the investment benefits an investor would reap from a given income generating property. Feasibility Study of a real estate product helps us in determining the factors which would affect valuation of an income generating asset. It focuses on ensuring whether the property is legally permissible, physically possible, financially feasible and maximally productive. Valuation, as an extension to feasibility, gives an analysis of return on investment over a

period of 15 to 20 years and the exit value of the said property as on date of valuation when the property is subject to competition in a dynamic market like that of Mumbai. Discounted cash flow method of Income Approach to Valuation has been used to derive the unbiased value of a retail asset. This mall, located in Kurla East, is the largest shopping mall in Mumbai City, with an area of 4.1 million square feet distributed over 4 floors and containing 2.1 million square feet of retail space.

Finally, it was concluded that the total valuation of the mall is in line with the market value of similar properties in the region.

Keywords: *Financial Feasibility; Exit Value; Discounted Cash Flow; Income Approach; Valuation*

A Review on the Effective Use of Fiber in Concrete

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Abstract

In the recent past, development of "Infrastructure/Construction Sector" has now become the major source for the tremendous growth of the country. "Concrete Construction" in relation to other ways of construction is commonly considered as major source due to its effectiveness in strength and durability as well as its capability to regain strength after retrofitting. Therefore it was seen that for the value addition in the effective use of concrete had lead to the various researches on Concrete and its components. Concrete a very customary material is a combination of variety of ingredient of different property and structure which when mixed initially forms a paste and after a specified time of setting it attains its shape which can accurately be named as hardened concrete. Management of waste from various sources had increasingly lead to the use of valuable waste in the development of eco-friendly concrete so as to make the environment less polluting and also used to enhance the strength and durability of concrete. Various researches were been done in the historical past with the use of these waste named as pozzolan and fiber. By taking an overview of all the past research on the concrete with reinforced fiber a review is been done in this research paper. Concrete when meshed with fiber of different property and orientation in different proportion is named as Fiber Reinforced Concrete. The paper justifies the incorporation of fiber such as Natural Fiber, Metallic-Fiber and Organic-Fiber in concrete mix and also their effect on the structural as well as durability property of concrete.

Keyword: *Concrete Construction, Retrofitting; Fiber; Fiber Reinforced Concrete; Durability*

Blockchain in Smart Contracts and Supply Chain Management

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Abstract

With a Fourth Industrial Revolution making inroads, encompassing all sectors of the industry with numerous concepts of disruptive technology such as Artificial Intelligence, Blockchain, Virtual and Augmented Reality, Internet of Things (IoT), Robotics and 3D Printing we have barely scratched the surface of its Scope, Implication, and Applications in various branches of the Construction Industry. This study aims to explore the scope of Blockchain technology in the ambit of Smart Contracts and Supply chain management (SCM) applications in the construction industry. Most of the time and cost overruns have been attributed to the sluggish pace of contractual impediments or inefficacy of procurement processes of material and machinery. The executive of material and data stream is a key need for development organizations. Productive execution in these regions can give noteworthy benefits and permit the including of more prominent incentives for customers. The Industry is regularly censured for being delayed to grasp the change it needs and at the same moment has been referred to as ready for interruption, because of the intricacy of work and a sheer number of guidelines and gauges, trust and check issues in regards to consistency to work principles still loom to a great extent. The momentum built by BIM infusion in the Industry could be leveraged to bring Blockchain technology to the fore to mitigate Information Asymmetry by distributing information to generate decentralized consensus building among various stakeholders involved.

Keywords: *Blockchain; Supply Chain Management; Smart Contracts; Information Asymmetry; Disruptive Technologies*

Smart CSR Participation to Promote Citizen Ownership

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Abstract

The purpose of the Smart Cities Mission is to drive economic growth and improve the quality of life of people as per the 2015 Smart Cities Mission Statement & Guidelines of Government of India, Ministry of Urban Development. The success of a city's development can be measured by the sense of citizen ownership as well as the opportunities for economic growth. Globalization has increased multifaceted citizen awareness about issues pertaining infrastructure development, technology

advancement and fiscal management. Multinational companies provide exponential economic growth prospects within the city and also offer opportunities to understand different trends of city planning and management for enhance quality of life. One of the key Smart City feature is making governance citizen-friendly and cost effective. Corporate Social Responsibility can go beyond mere fiscal support to the city administration by becoming the catalyst to augment citizen pride and ownership at all strata of city planning. The paper attempts to identify avenues of CSR participation to encourage Public Information, Recycling and Reduction, and Intelligent Traffic Management to strengthen Smart City Features of creating walkable localities and promoting variety of transport options. The paper puts forth a study of the broad canvas of CSR participation which can promote citizen ownership of the city

Keywords: *CSR Responsibility; Smart Citizen Ownership*

Multi-Criteria Decision Making: Application of AHP Tool - A Review

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Abstract

The article presents review of different methods used by the authors for decision making along with their application for taking decision on problems occurs in construction industry like, for selection of contractor, evaluation of contractor performance etc. This paper represents various methods available for decision making and those were classified as single decision making or group decision making based on operation approaches & types of data. The tools used in decision making process were discussed along with decision making software supported by these tools. The detailed study is done on "Analytic Hierarchy Process" (Bhushan N., Rai K., 2004), used by the authors for achieving their aims i.e. selection of contractor, comparing performance of contractor. The software applications were reviewed and presented in this paper which was supported by AHP tool. The review was done on the various journal papers related to multi criteria decision making process & various tools used for making decision, web based information and thesis.

Keywords: *Evaluation; Performance; Selection; Decision Making; AHP*

Comparision of Time and Cost for Concreting Work Process

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Abstract

Construction industry is one among the prominent sectors which is growing worldwide. The completion of project within the stipulated time and cost are traditionally considered for construction project management. To improve the performance of the construction industry, the new technologies are being adopted. Implementations of new technologies are deviating from traditional to modern approach. There is a need to modify some of the construction practices to improve the time and cost performance. This study aims to develop a modified construction process and provide a comparison of time and cost for construction method. The scope of this work is limited to building construction located in Bangalore.

Keywords: *Time; Cost; Concreting Delay; Construction*

Disruptive Innovations: Empowering Smart Cities

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Abstract

Disruption is a critical element of the evolution of technology that impact the existing technology base or companies that built it. The engineers view disruption as an innovation to solve the problems. The four stages of disruption comprise the innovation pattern for technology products: disruption of incumbent; rapid and linear evolution; appealing convergence; and complete re-imagination. Any technology can be placed in this sequence at a given time that ultimately disrupt and follow a fairly well-known pattern. Smart cities all over the globe have been evolving due to disruptive innovations. It is quite difficult to predict whether an innovation will ultimately disrupt. It can be studied through lessons learnt from those smart cities to understand which area needs to be prioritized, and when. Some of the disruptive innovations like Blockchain Technology, Augmented Humans, Unleashing Spare Capacity, Mobility-on-Demand, etc have the potential for the sustainable development of the smart cities. This paper attempts to study the disruptive innovations that took place in smart cities all around the globe with lessons learnt to pace up the progress of Smart Cities Mission (SCM) in India. The issues of adaptability of the disruptive innovations have been studied to understand their progress and impacts on smart cities and their development. The responses, emotions and feedbacks from the

citizens, experts and innovators play important roles in how the mission progress through innovation. Only the readiness of the disruptive innovations in Smart cities has been discussed. The views of experts and stakeholders have been incorporated in this study through Google forms to reach people from different cities. These people have either worked in Smart Cities Mission or are currently working or are in research field to study more about urban planning strategies. An expert survey of 17 research scholars and 48 experts was conducted in which people from different age groups participated and provided their opinions on the readiness of citizens to adapt the disruptive innovation through the SCM with their future implementation strategies. The average weighted mean was done for the responses. This study can give an idea of where do SCM stand in terms of adaptability of disruptive innovations and which areas need to be prioritised. The changing digital world needs to be monitored throughout the changing phases of disruptive innovation for motivating developers and analysing the need for new disruptions based on the gaps identified within these cities. This research paper can become a base for other researches in future as it is unique and not explored yet in context of Smart Cities Mission in India. The survey could be done on a large scale at different stages in order to deeply analyse the adaptability of disruptive innovation by Indians in their day to day life before building capacity of any department.

Keywords: *Disruptive Innovation; Sustainable Development; Information and Communication Technologies; India's Smart Cities Mission; Sustainable Development Goals*

Enhancing Safety through Mechanised Shifting Arrangement of Cementitious Material

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Abstract

Tata Projects Limited (TPL) is a closely held company by Tata Group companies and has emerged as one among the leading Engineering, Procurement and Construction companies in India. Strategic Business Group – Urban Infrastructure of Tata Projects is executing the Mumbai Trans Harbour Link Project. The foundations will generally be in pile foundation except in land portion where founding stratum is at shallower depth. The major portion of the project is in off-shore location. We need to construct the sub-structures (Pile, Pile Cap, Pier & Pier Cap) deep inside sea and for this we have deployed two nos. of barge mounted floating Batching Plant. All the ingredients of the Batching plant include the Cementitious material (Cement, GGBS & Fly-Ash) needs to be supplied to the marine

plant inside water. As the handling of cementitious material is always a problem because of its low density powder form, which will not only cost us huge losses during handling but also have environmental impact if we don't handle it properly. This paper is the practice approach first time adopted in Indian construction project environment, by us to store, handle and processes these cementitious material without any losses and any damage to the environment and workers for safety.

Keywords: *Cementecious Material; Safety Hazard; Environment; Cost; Technology*

Value Engineering: Case Study on Large Diameter Pile Foundation with Base Grout Technique in Large Span Railway Bridge at Bangladesh

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Abstract

Construction of major Bridge over tidal and mighty river has a potential risk due to complexity in design and execution of bridge foundation besides superstructure. The study shows large diameter pile foundation replaces well foundation approximately more than 70% cases in new adjacent bridges in India. Nowadays it seems the designers have started replacing well foundations in this sub-continent with large diameter pile based on value engineering. Designer often face difficulties to achieve designed pile capacity during initial pile load test in alluvial soil strata even under strict supervision of pile execution. Author shows the base grouting technique improve tip resistance of the bored cast situ pile in alluvial soil (Silty Sand) and improve pile capacity by approximately 30 to 40 % in large diameter pile.The authors demonstrate the sequence of pile execution to eliminate the major risk of settlement in large diameter pile foundation in alluvial soil strata with base grouting technique .These results provide an important reference for the design and construction of large diameter and large depth of bored cast in situ pile in large span bridge foundations.

Keywords: *Major Bridge; Well Foundation; Bore Cast in Situ Pile Foundation; Alluvial Soil; Base Grouting*

Marketing of Information & Communications Technology (ICT) to Smart City Projects

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Abstract

India has planned to develop 100 smart cities by the year 2021, to name a few such as Port Blair, Vishakhapatnam, Tirupati, Guwahati, Pune etc. Smart city is defined as an urban area that uses Internet of things and sensors to collect information about the city including its people and use that information to manage assets and resources efficiently. With people moving from villages to cities in search of employment, the city requires more and more integration of technologies to solve the issues that may arise due to migration. This includes data collected from citizens, devices, and assets that is processed and analysed to monitor and manage traffic and transportation systems, power plants, water supply networks, waste management, crime detection, information systems, schools, libraries, hospitals, and other community services. Smart cities use and depend mainly on Information & Communications Technology **(**ICT). ICT unifies all the technological services and brings it as one single system. ICT will enable the city officials to communicate with the citizens and will help them solve the issue. These ICT solutions are being developed by IT companies which are sold to the client (Government) for various smart city projects. Few of these companies that give ICT solutions are as follows: IBM, Mindtech, Activ Technologies, KPIT etc. This paper will focus on various requirements of ICT solutions needed by the government client for the smart city projects. The paper also attempts to identify marketing strategies that are being used by the IT companies to persuade their clients.

Keywords: *Information & Communications Technology **(**ICT); Smart City Projects; Marketing; Marketing Strategies*

Disposal of Surplus Inventory in Real Estate Sector in Pune Region

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Abstract

This paper consists of a survey of real estate developers of Pune city, to determine the challenges faced by real estate sector due to excess inventory. Material cost has a dominating role in construction

cost as it consists of more than 50% of total cost of the project. Improper management of the material causes great loss in the productivity of the project which leads to massive delays that can indirectly increases the overall project cost. Therefore, proper disposal of surplus material plays a major role in converting these delays into beneficial cost for organisation. This can be done in two ways, first we can generate salvage revenue which is obtained from surplus inventory disposal and second, by saving in inventory carrying cost. As the stock held is reduced. If the material cost is controlled dynamically than the overall project cost will be reduced. This paper is research on the various aspects for controlling the surplus inventory cost and disposing it effectively and to create benefits from the surplus material as well. This survey includes the real estate firms of the Pune city only. As abrupt fluctuation if occurred in demand versus production or change in business condition may led to a situation of excess stock. This paper studies the various alternatives for disposal of surplus inventory.

Keywords: *Excess Stock; Inventory; Material Management*

A Critical Analysis of Organizational Culture and Communication Management in Construction Projects

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Abstract

Organizational culture has a significant impact on the projects as it influences the way people interact, the context within which knowledge is created, the resistance they will have towards certain changes, and ultimately the way they share or the way they do not share knowledge or necessary information. Interpersonal communication within any organization is closely related to culture. Due to the complex nature and presence of multiple stakeholders with diverse backgrounds, management of organizational culture and communication is important for the construction companies. Lack of attention to them may have a critical impact on the performance of people as well as the performance of the overall project. The objective of the present study is to examine the current status of management of organizational culture and communication in construction companies in India and to find out the critical factors affecting them. Also, the impact of these factors on project performance is explored. A structured questionnaire survey was conducted with 128 experienced construction industry professionals in India for this purpose. The results present various problems associated with the culture and communication in construction projects. The factors such as ‘Project Participants' Understanding of Values and Objectives of the Organization’, ‘Clarity about Individual

Accountability in the Projects','Leader's Communication with Subordinates Related to Job Roles and Expectations' are found to be the most critical factors affecting the organizational culture and communication in construction projects. The results of the study would be immensely helpful to the construction industry professionals in implementing sound policies and practices related to organizational culture and communication which can contribute to the sustainability and successful performance of the construction organizations.

Keywords: *Organizational Culture; Communication Management; Construction Projects*

Issues in Implementation of the FASTag Technology at Toll Plazas in India

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Abstract

The National Highway Authority of India (NHAI) launched a FASTag technology project in 2014 in India as part of the Advanced Traffic and Toll Management System in toll plazas across the country. The scope of the project includes design, implementation and operation of electronic tolling (e-tolling). The project is aimed at bringing in transparency and plugging leakages in toll collection. It is now made mandatory for all new four wheelers and bigger vehicles passing through toll gates on national highways. This technology was introduced across heavy traffic highways in order to reduce cash use for toll payment, increase transparency and speed up traffic at congested toll plazas. As per the NHAI data, close to 50 lakh vehicles now use the tag at 275 toll plazas across the country, which allow vehicles to pass through the toll plazas without having to stop. However the project is plagued by teething troubles. The case presents some issues at various toll plazas in the country. It also addressed key questions like What's FASTag ? How does it work? Who are the vendors?, etc.

Keywords: *ITS; FASTag; NHAI; Toll Plaza*

Performance Evaluation of Railway Station: A Case Study of Pune Railway Station

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Abstract

Indian Railways are one of the world's most extensive railway networks catering public and goods transportation across the country. The railway station plays a vital role in management of railway

services. Indian Railways are giving utmost efforts focusing towards running more trains in Indian Railways to meet the increasing demand but improving station's environment to cater that much of demand is neglected. The Pune Junction Railway Station is a part of the Central Zone of the Indian Railways it handles over two lakhs passengers per day with six platforms. The Station faces various challenges on daily basis such has congestion, insufficient parking, inadequate signage, etc. The current Infrastructure of Pune railway station is shabby and least concerned, the station facilities are obsolete. The exponential growth in population modernization and migration activities by means of Railways calls for the upgradation of existing railway station to cater the demand and to be a part of smart cities. To solve the existing problems and to improve the efficiency of railway station, the methodology adopted is in line with the National Transport Development Policy Committee (NTDPC) report and Indian railways manual for standards and specification of the Railway Station. In this paper observations and recommendation for various parameter for the station to be smarter are given after conducting post safety audit, surveys analysis. The project data analysis reflects the station needs upgradation to make it more attractive, accessible, secure and comfortable by offering better services with Artificial Intelligence and making the station self-sustainable. It may be stated that with improvements in above points the railway station can be made smarter.

Keywords: *Smart; Pune Railway Station; Audit; Efficiency; Modernisation*

Execution for Associated Factor of Material Management in Indian Construction Project

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Abstract

Material administration (MM) is an idea which is utilized in all development work, from low spending plan to high spending business, and additionally in the development part. Inappropriate administration of material gives a major impact on the assessed time and cost of the undertaking which prompts time and cost invade. Wastage of material likewise a major issue for the development part. As we probably am aware an immense amount of material was utilized in scaffold and elevated structure, so it was for the most part required to deal with the material at the various stage for appropriate work and to lessen the wastage of material for numbness of TOR and COR. In this exploration work, a poll review was led in two-stage during the whole work. During stage one Approaches, a factor of time overwhelm, a factor of cost invade, variety in cost, variety in time, and

so forth was directed for the survey. After that in stage two, periods of material administration and factor of material administration mostly break down from the commentator. The information has been broke down with the assistance of SPSS instrument (recurrence dispersion test, relationship test, Cranach's test). The poll structure has been handover to 250 respondents inside Surat city. Survey taken from 150 respondents and results was set up as Material calendar, material administration was top three methodologies which were fundamental to deal with. Material administration, Owner related, Finance related, are the main 3 significant causes which were the explanation behind happening time invaded. Material administration, Consultant related, work related, was the most critical factor for happening cost overwhelm in the development business. Material taking care of, Inventory arranging and the executives, PRP top three stages to for the most part handle for material administration in the development business. Most three significant factor like Lead time, Record utilizes the material, improper arranging are limit for increment the efficiency of material administration.

Keywords: *Material Management; SPSS;TOR; COR*

A Case Study on India in Global Economic Perspective

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Abstract

Global growth is 2.4 percent in 2016, 3.1 in 2017 and 3.0 in 2018 and it is expected to growth at 2.9 percent in 2019. International trade and investment are moderating, trade tensions remain elevated, and financing conditions are tightening. When it comes to the top 10 national economies around the globe, the order may shift a bit, but the key players usually remain the same, and so does the name at the head of the list. The United States has been the world's biggest economy since 1871. But that top ranking is now under threat from China.Since it initiated market reforms in 1978, the Asian giant has achieved economic growth averaging 10% annually (though it's slowed recently) and, in the process, lifted almost half of its 1.3 billion populations out of poverty and become the undisputed second-largest economy on Earth.China is estimated to pull ahead of the U.S. steadily in the following years, taking over the lead position as the world's largest economy; in fact, in its October 2012 World Economic Outlook report and the International Monetary Fund (IMF) projected that China's Gross

Domestic Product (GDP) would outpace that of the U.S. as early as 2017. The study is having the objective of finding India's position compared to top 10 economies in the world.

Keywords: *International Trade; Investment; Economic Growth, Gross Domestic Product; Nominal Form; Purchasing Power Parity (PPP)*

Conceptual Framework for Managing Infrastructure Project Risks Using Flexibility Management

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Abstract

Flexibility management, as a theory has been researched, analysed and constructed across several dimensions however its applicability so far has been mainly in manufacturing systems. This concept paper initially delineates the typical characteristics of infrastructure projects and the amenability of the construction industry towards flexibility and thereafter locates points of congruence with the existing body of knowledge on flexibility management. Further, this paper identifies risk as a change factor which influences infrastructure project development across various levels of a firm. Within these parameters a measure of response to change is constructed which acts as an indicator of successful firms which display a 'flexibility propensity' for securing the success of their projects. It is hoped this paper will initiate further research in evaluating the impact of flexibility management in sustaining infrastructure projects.

Keywords: *Flexibility Management; Project Management; Risk Management; Change Management*

Risks Identification in Construction Projects - Contractor's Perspective

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Abstract

The construction industry is associated with a high degree of risks and uncertainties. In the construction Industry, generally new contractors, who are engineers and starts contracting business, are facing problems due to which survival in the industry becomes difficult for them. They have to understand the risk associated in the construction projects and how to cope with those risks to survive in the market. They need to keep attention that what kind of risks they are going to face during execution of the project. For surviving in the industry as a contractor, they need to identify that what

kind of risks they are going to face and how they are going to respond those risks and there should be mitigation plan. In the field of project management, managing risk is very essential and risks needs to identify properly to respond with proper risk management plan. The survival of an engineer as a contractor is challenging & hence it very important to identify the risks associated with contractor's perspective. In this study; risks associated with the construction contracting are identified. These risks are very significant to any new comer as contractor in the industry which will be useful to select strategy to respond those risks. If such kind of risks or uncertainties arises in future; risk management plays important role. It helps to develop proper responses to risks which will be helpful to contractor's perspective to survive in the industry.

Keywords: *Construction Industry; Risk; Contractors; Project Management; Risk Management*

Feasibility Study of Double Storey Elevated Corridor for 4 Lane Road & Metro from the Intersection of NH 12 & NH 112 Upto Kolkata Airport

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Abstract

Efficient urban transport is the key to success of any modern city. Higher population density leading to congested roads and exorbitantly high time taken to travel from one point to another is very common in almost all metro cities of India. Kolkata, the first metro city of India, witnessed high population growth in last few decades resulting expansion of city into suburbs. North 24 Parganas, the adjacent district of Kolkata acts as a feeder of Kolkata and everyday lakhs of people travel to Kolkata. Barasat, the districts headquarter of North 24 parganas, works as epicentre of transport nodes of the district and witness movement of large no. of people through it. The existing transportation infrastructure of the city fails to cope up with the demand result long lead time as well as commuter's dissatisfaction. On this backdrop, in this paper a proposal has been given of double elevated metro and road corridor to cater people in mass and provide efficient transportation means for vehicular traffic. Two alternatives for the proposed metro corridor has been suggested keeping in mind the problems of land acquisition faced by a similar kind of project in recent past in this area. Several scenarios for trip distribution have been developed from the peak hour peak duration traffic of existing east west metro corridor. Further considering all major cost and developing fare box revenue plan, the FIRR of elevated corridor is 7% where FIRR of underground and elevated is 3.55%.

Keywords*: Feasibility; Metro; Land; Traffic; FIRR*

A Case Study on Hyperloop: A Dream Travel Paradigm

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Abstract

Hyperloop is the latest concept in transportation based on the concept of passengers travelling through tubes or tunnels from which most of the air has been removed in order to reduce friction. Hyperloop could be cheaper and faster than train and car travel and at the same time be less polluting. It could be cheaper and quicker to build than traditional high speed rail and could take the pressure off from traditional road and rail travel, making travel between cities easier and potentially unlock major economic benefits as a result. Hyperloop technology is still in development, even though the concept has been around for many years. The technology in case of Hyperloop is very different from traditional rail travel. Hyperloop travel could see passengers travelling at 700 miles per hour in floating pods within low pressure tubes. Rather than using wheels like a train or car the pods are designed to float on air skis using the idea of magnetic levitation to reduce friction. Today, a large number of companies are working on Hyperloop travel to turn the concept into a functional commercial system. A number of companies have sketched out routes in US, Europe and elsewhere. Some of the potential routes include New York to Washington DC, Pune to Mumbai, Kansas City to St. Louis, Vijayawada to Amravati and several others. However, the earliest Hyperloop transportation could be expected to be operational is by 2021. The objective of the study is to find out the prospect and challenges of the Hyperloop projects in India.

Keywords: *Hyperloop Technology; Transport; Commercial System; High Speed Rail; Infrastructure Investment*

Sustainability Assessment for Construction Projects: A Review of Approaches and Frameworks

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Abstract

Sustainability has developed into a concept which all public sector and private sector organizations apparently desire to take by while formulating the growth strategy of any organization. Possible, it could be used to assess the development of any project towards the sustainable development. As a

result, sustainability is used as a tool for the assessment of sustainability. The sustainability assessment is frequently conducted through various approaches and frameworks/models. The aim of this article is therefore, to identify the various approaches and frameworks/models for the sustainability assessment with the perspective of construction projects. The content analysis through literature review is used as a qualitative research method for this study. The research articles, reports, case studies, and online database are used as a secondary data source for the content analysis. Initially, the study concludes through a literature review that the sustainability is normally assessed by using two approaches, namely principle-based approach and triple-bottom-line approach. Finally, the study has summarized various frameworks of sustainability assessment for several types of construction works. This finding could be a useful tool for practitioners and consultants to assess the sustainability of the respective type of construction project using any framework and approach.

Keywords: *Sustainability Assessment; Sustainable Development; Sustainability; Construction Projects*

Selection of Transportation Facility for Bhiwandi-Kalyan at Durgadi Fort, India

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Abstract

Transportation is necessary need of living beings. In today's era for the purpose of employment, meetings, tours, shopping, and entertainment etc. people travel from one place to another place. This is the case study for selection of transportation facility at Durgadi, Kalyan, India by using a multi criteria decision making technique. There is Ulhas River passing between connectivity of Bhiwandi-Kalyan at Durgadi fort. Existing bridge is narrow two Lane Bridge which is a bottle neck for a huge population. And just after ending of the river there is Shivaji Chowk intersection. Most of the time, it has high traffic jam, because of narrow bridge and intersection present just after bridge. This becomes reason for delays, Economical loss, fuel wastage, air and noise pollution, psychological trouble, health hazard, mental stress, accidents and bad ethical values. That's why a good solution should be there for that. There are two possible alternatives available for solution of this problem. First one is "To increase the width of the existing bridge" and secondly "by providing a fly over on intersection" for high daily traffic route (Kalyan-Bhiwandi). But for selecting best possible alternative there are various multi conflicting criteria affecting on alternative with different intensity of action. Those criteria are divided as cost of construction, saving of fuel cost, employment generated, technical feasibility for location, durability, safety of passenger, traffic reduction, disturbance to traffic during construction, more control on traffic, time saving and duration of construction. These criteria are

compared pair wise on linguistic rating and also found out the importance of criteria for alternatives on linguistic scale. For this comparison advice has been taken from three experts and the decision matrix is solved by using Fuzzy AHP method.

Keywords: *Fuzzy AHP; MCDM; Kalyan Bridge; Kalyan Bhiwandi Road Connection; Durgadi Bridge; Flyover Intersection; Traffic Control; Traffic Management Model*

Influence of PPP in Infrastructure on Indigence and Income Distribution: A Review

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Abstract

PPP is a mode of providing public infrastructure and services by Government in partnership with private sector. It is a long term arrangement between Government and private sector entity for provision of public utilities and services. Public-private partnership (PPP) is mutually beneficial relationships that are formed between the public and private sectors. The private-sector partner typically makes a substantial equity investment, and in return the public sector gains access to new or improved services. When properly vetted and structured, PPP allocate risk to the party best suited to handle it. The purpose of this paper is to examine the relationship between income distribution and indigence reduction.

Keywords: *Public-Private Partnership; Infrastructure; Indigence*

Residential Building Construction Using Agile Management

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Abstract

Agile Project Management is an iterative approach to planning and guiding project processes. It is suited for large complex projects where it is difficult to specify the product in advance. This thesis has focused on what opportunities there might be in implementing the agile project management approach on the basis of Scrumban method in the residential building construction. The major advantages found with implementing the Scrumban approach is an improve productivity and resource allocation. The Scrumban approach almost forces the client to increase their participation in the project compared to the situation today. By the use of time management and specific meetings it will also be beneficial for keeping track of the project's progression and status. Visual Scrumban board

used to analyze the progress of work. This project intends to create a methodology for effective communication during residential building construction by agile management software.

Keywords: *Agile Management; Scrumban; Review System; Time Management*

A Case Study on Productivity of Key Construction Activities in a Metro Project

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Abstract

Productivity at construction sites is a critical factor for improving the cost performance of the Project, due to the simple reason that assumed productivity forms the basis of labor requirement and, thus, the cost estimation of a project. In the context of brown-field projects, like that of the metro, the on-site hindrances like delayed access, traffic restrictions, and odd working hours are prominent, productivity is always a matter of concern for a project manager. Hence it is required to be determined for better project management. RCC and finishing works form a significant portion of an entire construction of metro station building, and it is the main focus of the present study. The primary activities in RCC structure construction are formwork, rebar and concrete, and finishing works considered blockwork and plastering. Data collected from one of the metro projects in the southern part of India. The methodology for data collection was a traditional work sampling procedure. The main objective of the study was to identify the proportion of non-supporting work so that the management can take corrective actions and preventive measures. A total of 49 activity workhours and 265 man-hours observed for the five activities, and the data is analyzed to categorize the observations into three categories viz. direct work, supporting work, and non-supporting work. Results reveal that 20% of total observation hours were non-supporting and 43% as supporting work. Together it constitutes 63% of the overall work, which indicates the scope for improvement. Further analysis of the above two categories indicate that idle and waiting for instructions are two significant contributors to non-supporting work, and material shifting and mixing are two significant contributors to supporting works.

Keywords: *Metro; Workmen; Productivity; Work Sampling; Ineffective Work*

Evaluation of Land Pooling Policy, Delhi: Institutional Innovation in Land Development

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Abstract

Institutional innovations in land development and planning process like public private partnership, negotiable developer obligations, flexible zoning regulations etc. have taken center stage of policy discussions. In view of this, Land Pooling Policy has been enacted in Delhi, India to facilitate planning and development by making landowners partners in development. This paper analyzes the policy and found that although the policy proposes a paradigm shift in its approach by empowering private sector and landowners but rigidity in land use distribution and development control regulations at sector level makes it difficult to implement. It was also found that development of large scale city/ zonal level public/ semi-public and commercial facilities is difficult under the rigid framework of the policy. It is being proposed to make these regulations open for negotiations with private developer/ landowners by taking one sector at a time and maintain equitable land use distribution at the city/ zonal level instead of sector level.

Keywords: *Land Pooling Policy; Delhi; Institutional Innovation; Large Scale Infrastructure; Commercial Facility*

Study of Urban Road Tunnel Design with Reference to Aurangabad City

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Abstract

Aurangabad is a city which is undergoing rapid urbanization. Recent studies reveal that the pollution in the city is going beyond the tolerable levels due to the high level of traffic, also causing inconvenience to the public. During heavy rainfall, the city has experienced tremendous amount of water logging at various places. So there is a need to find solution for traffic problems. Therefore it is necessary to connect all the important locations by tunnelling. A complete list of significant locations has been determined by survey and feasibility study of implementation is done. Geology, location, profile, geometric design, pavement design, structural design, lighting, toilets, ventilation, temperature control, Security and communication, electric supply, networking, safety preparedness, water requirement, construction and maintenance are taken into account and are designed as per requirement and specifications. Complete cost estimation and revenue generation forms the important part of this project. Grass GIS, Google Earth, AutoCAD, and Revit are the software used in this

project as per requirement. Implementation of tunnelling can be effective and also profitable in a long run in this place.

Keywords: *Feasibility Study; Solution for Traffic Problems; Revenue Generation; Tunnelling; Cost Estimation*

Relevance of Location of a Metro Station to the Context of the Urban Space- Byappanahalli, Bengaluru

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Abstract

The need for metro station arises when the population exceeds one million and the Metro Transport System (MTS) envisages stations almost 1km length. The justification of location of the station has been studied in the Detailed Project Report (DPR) and then the decision was taken to construct the Metro station. This study was undertaken to evaluate the performance of newly commissioned Baiyappanahalli station of Namma Metro after 8years, since 2011. The influence of metro station on immediate community within 500mts was undertaken in this study and a questionnaire was conducted with the beneficiary to understand the relevance of metro station. This study will assist in identifying critical factors which impacts selection of MTS in the near future.

Keywords: *Namma Metro; Byappanahalli; Metro station; Relevance of Location*

A Study of the Relationship between Self-efficacy and Stress Management Skills of Construction Managers

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Abstract

This study investigates the relationship between self- efficacy and stress management skill among 30 managers who were working in construction projects in and around Chennai in India. The participants were administered self-efficacy and stress management skill questionnaires. The statistical tools such as Pearson Product-Moment Correlation and scatter analyses are used to analyse the data. The result shows significant positive correlation between self-efficacy and stress management skill. Implications of the study are discussed.

Keywords: *Self-Efficacy; Stress Management; Construction Managers*

Effects of Elevated Temperature on Physical Properties of Concrete by Replacement of Coarse Aggregate with Blast Furnace Slag

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Abstract

This test presents the consequences of investigation of the effect of elevated temperatures on the compressive strength of Grade 25 concrete. Cube, cylinder and beam specimens were casted and relieved in the water at encompassing temperature for 28 days and exposed to different temperatures before testing. A concrete mix of 1:2:2 (cement: fine aggregates: coarse aggregates) with water content proportion of 0.44. The paper centers around M25 grade concrete with halfway supplanting of the coarse total with impact heater slag (BFS) by supplanting total through 20%, 40%, 60%. The cubes, cylinders, and beams are tested for compressive strength, split tensile strength, flexural strength. The effect of elevated temperature on conventional concrete was also conducted.

Keywords: *Blast Furnace Slag; Compressive Strength; Flexural Strength; Split Tensile Strength; Concrete*

Impact Assessment of Real Estate Regulation and Development Act (RERA) on Developers

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Abstract

The Real Estate (Regulation and Development) Act, 2016 provides for establishing regulatory authorities at the state level to register residential real estate projects and seeks to regulate contracts between buyers and sellers in the real estate sector to ensure sale of plot, apartment or building, etc, in an efficient and transparent manner. It also proposes to ensure greater accountability towards consumers, and significantly reduce frauds and delays as also the current high transaction costs. It attempts to balance the interests of consumers and promoters by imposing certain responsibilities on both. It seeks to establish symmetry of information between the promoter and purchaser, transparency of contractual conditions, set minimum standards of accountability and a fast track dispute resolution mechanism. Approvals for the construction of real estate projects are primarily given at the local and state level. Certain approvals are given by the central government. Consumer grievances are mainly redressed through forums established under the Consumer Protection Act, 1986. Unfair trade practices may be challenged under the Competition Act, 2012. Several court cases have addressed

issues in the sector such as unfair buyers' agreements and illegal construction. The Competition Commission of India has pointed out that the absence of a single regulator for the real estate sector is partly responsible for poor grievance redresses. This paper makes an attempt to ascertain the developer's perspective by questionnaire method (Ref – Appendix) and primary data was collected, analyzed and inferences are drawn thereof.

Keywords: *Transparent manner; Fast track dispute resolution; Grievance; Consumer*

Review of Smart City Project Proposals in India

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Abstract

The Smart Cities Mission of Government of India is a major flagship programme by the Government of India to develop 100 "*smart*" cities across the country. It is proposed to promote merging of smart solutions in the basic core infrastructure service delivery, making them citizen friendly and sustainable. The Ministry of Housing and Urban Affairs (MoHUA) is responsible for implementing the mission in collaboration with the state governments and urban local bodies of the respective cities. The mission was launched in June 2015 and it is to be implemented in a phase wise manner up to FY 2019-20 (expected completion date). There are about 100 cities which have been selected to be part of this mission. Cities are expected to create a Smart City Proposal (SCP) in tune with the guidelines, and enter the "Smart Cities Challenge" competition. Each selected city is expected to form a Special Purpose Vehicle (SPV) for implementation of the SCP. The total cost of various projects to be undertaken in this mission amounts to Indian Rupees (INR) 205, 000 crore (approx. US $ 29 billion).Although the Mission has been much talked about for its ambitious approach, routine newspaper reports often convey disappointment with the lack of progress of the smart city projects. The aim of this paper is to understand the smart city proposals of various cities, what effect they can have on the quality of life of the citizens, to what degree the projects are technology oriented and how these proposals are going to be funded.

Keywords: *Smart Cities; Urban Local Bodies; Urban Infrastructure; Financing Infrastructure Projects; Project Delivery*

Heritage Management of Vishalgad - Challenges & Opportunities

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Abstract

Heritage Management of any historic place is an endeavor in preserving the historic fabric and in retaining the authenticity of that particular place. In the current scenario preserving the tangible & intangible assets of the heritage sites is requisite. While considering the heritage management of these sites, the systems & attributes prevailing of that site is absolutely pivotal. Vishalgad, a 16th century fort cum pilgrimage centre is located at the foothills of nature. The historic importance of Ghod King Battle during Shivaji Maharaj's reign, the scenic location in the Sahyadri mountain range & most of all the mausoleum & abode of Hazrat Malik Rehan Mira Saheb, helps in retaining the interest of tourists & devotees. This research paper is intended to explore the challenges & opportunities in managing & promoting the heritage site of Vishalgad by reckoning the systems & attributes of the site. Heritage management of Vishalgad will add further in maintaining the authenticity & promoting tourism which will help in generating a significant source of income to manage the site well. The paper highlights the perspective of the challenges faced by devotees & stakeholders. At the same time it highlights on opportunities for managing & developing Vishalgad as a pilgrimage centre & tourist attraction.

Keywords: *Systems & Attributes; Endeavor; Historic Fabric; Fort cum Pilgrimage Centre*

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Mr. Ravishankar Chandrasekaran	Vice President and Head of Strategic Business Units (Buildings, Airports & Smart Cities - Urban Built Form Business) Tata Projects, Mumbai
Dr. Brijesh Dixit	Managing Director, Maharashtra Metro Rail Corporation Ltd., Nagpur
Dr. Noushad Ali Naseem Ameer Ali	Associate Professor and Director Internationalisation & Engagement, School of Built Environment, Massey University, Auckland, New Zealand and Adjunct Professor, University of Science, Malaysia
Mr. Sharath Waikar	Co-founder & CEO, Lean Station Pvt. Ltd., Singapore
Mr. Sudhanshu Mani	Former General Manager, Integral Coach Factory, Urban Rail Expert, Lucknow
Mr. Rana Gupta	Executive Vice President, Shapoorji Pallonji Real Estate, Kolkata
Mr. Satya Narayan Kunwar	Project Manager, Kolkata Metro Rail Project (Underground Stations & Tunnels), AFCONS Infrastructure Ltd., Kolkata
Dr. Hemant Sonawane	General Manager (HR), Maharashtra Metro Rail Corporation Ltd., Pune Metro Rail Project, Pune
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