

NATIONAL CONFERENCE

On

EMERGING TRENDS IN CIVIL ENGINEERING

(ETCE-2021)

(Online National Conference)

Conference Proceedings

Conference-Chairmen

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Dr. Sanjeet Kumar

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Mr. J. D. Chaitanya Kumar

Organized by

**Department of Civil Engineering
KoneruLakshmaiah Education Foundation
(K L Deemed to be University)
Green fields, Vaddeswaram-522502
Guntur District, A.P., India.**

Proceedings of the
ETCE-2021 NATIONAL

NATIONAL CONFERENCE
On
EMERGING TRENDS IN CIVIL ENGINEERING

January 29 - 30, 2021

Editors
Dr. Ch. Hanumantha Rao
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PREFACE

It gives us immense pleasure to bring out this publication as a part of the Proceedings of the ETCE 2021 NATIONAL. The conference being held in an academic and research environment at K. L Deemed to be University, Guntur, Andhra Pradesh, India. Conference provided an ideal opportunity for the young and experienced engineers, researchers, academicians working in civil engineering sector to meet and deliberate on various current problems and advance solutions in the field. The conference is organized by Departments of Civil engineering, K. L Deemed to be University, Guntur, Andhra Pradesh, India during 29-30 January 2021.

The Proceedings of the Two day online National Conference on Emerging Trends in Civil Engineering contains a total of 62 full length papers that was presented and discussed by delegates through online from different part of the country. The paper span over different themes covering Structural Engineering, Construction Technology and Management, Concrete Technology, Water Resources Planning and Management, Geo-Informatics, Pre-cast & pre-fabricated Structures, Structural Health Monitoring, Earthquake engineering, Geo-Technical Engineering, Transportation Engineering, Sustainable practices in construction & buildings. The main theme of this conference was Emerging Trends in Civil Engineering, for the sustainable development of society..

The conference has come to a reality due to the untiring efforts of a large number of individuals as well as organizations. In particular, we place our sincere gratitude to the efforts of the members of Organizing Committees. The contributions made by the delegates through online presentations and discussions are greatly appreciated.

Dr. Ch. Hanumantha Rao
Dr. Sanjeet Kumar
Conference-Chairmen
ETCE-2021 National

January 28, 2021
K L University, India

PREFACE

We are delighted that being the organizing secretary on “Two Day Online National Conference on EMERGING TRENDS IN CIVILENGINEERING” (ETCE -2021) which is to be held on 28th and 29th January 2021 at the K L Deemed to be University.

Professionals from various institutions are sharing the platform to discuss and deliberate on the Emerging Trends in Civil Engineering. ECTC -2021 will garner the effectiveness of experts in the field such as the researchers, scientists, faculty, students, technocrats etc. through their ideas and sharing knowledge. We are sure that the knowledge of the latest developments provided in Emerging Trends in Civil Engineering would enable further development in the area.

We hope this conference would conclude memorably and productively for all the participants who are looking forward to the technical outcomes resulting from various papers.

We would like to convey my sincere thanks to management, Chairperson HoD for their encouragement and support in making ETCE-2021, a majestic victory. We would like to express my appreciation to the organizing faculty and students for their devoted efforts to materialize the conference.

Mr. K. Hemantha Raja
Mr. J. D. Chaitanya Kumar
Organizing Secretaries
ETCE-2021 National

January 28, 2021
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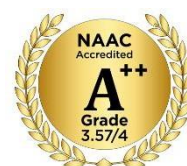
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Er.KoneruSathyanarayana
President, K L E F



Message

Warm and Happy greetings to all,

I am immensely happy that Department of Biotechnology of our K L University is organizing a **National Conference on Emerging Trends in Civil Engineering (ETCE-2021)** during January 28-29, 2021 and is going to discuss on a collection of technical papers in the proceedings.

Department of Civil Engineering, K L University continues to march on the way of success with confidence. On this occasion, I wish all the very best.

I congratulate HOD, staff members, students of Department of Civil Engineering, Delegates and Participants from different parts of the country and nations for their efforts in participating in this conference and wish the conference all the success.

K. Sathyanarayana

Sri Koneru Raja Hareen
Vice-President



Message

I am glad to learn that Department of Biotechnology, K L University in collaboration with Association of Biotechnology and Pharmacy is organizing a **National Conference on Emerging Trends in Civil Engineering (ETCE-2021)** during January 28-29, 2021.

It is heartening to know that the national Conference-ETCE-2021 is being organized with the objectives to strengthen the current national and international scenario of Biopharmaceuticals; scaling up from research to production and their usage; thereby prevention and protection from many deadly diseases/disorders.

I wish the conference all success.

K. Raja Hareen

Dr.L.S.S.Reddy
Vice-Chancellor



Message

I am delighted to know that the Department of Civil Engineering of our K L University in collaboration with Association of Biotechnology and Pharmacy is organizing a **National Conference on Emerging Trends in Civil engineering (ETCE-2021)** during January 28-29, 2021. It gives me an immense pleasure that a souvenir is also being brought out.

I am sure that it will provide a platform to discuss the research in Civil engineering happening throughout the world. I hope that the participants from all over the country and abroad would interact on the subject for upgrading their knowledge and skills to enhance their utility to the Biotechnology sector.

My best wishes for the success of the conference.

Dr. L.S.S. Reddy

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Experimental Study on Mechanical Properties of Polypropylene Fiber Reinforced Concrete with Silica Fume

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Abstract:

In this research, the mechanical properties of polypropylene and silica fume are examined with the 0.40% water-cement ratio of M40 grade concrete. The synthetic polypropylene fibers of length 12mm short fibers. In this study, the polypropylene fibers are used up to 0.3% (0%, 0.1%, 0.2%, 0.3%). And the silica fume is being utilized as a substitute for cement with a 4% mass of cement in all the mix proportions. The addition of silica fume to the cementitious matrix strengthened fibers scattering, resulting in a substantial decrease in the absorbency of the polypropylene fiber reinforced concrete (PPFRC). Superplasticizer is also added to these concrete mixes to increase workability. The concrete samples are prepared and cured for 7, 28 days. After completing the curing duration, samples were tested. After that finally, the mechanical properties, as comp. strength, split tensile, bending strength and mode of failure and ultimate load are determined and all proportions of the mix are compared to traditional concrete.

Keywords: Polypropylene, Silica fume, PPFRC, M40, Mechanical properties.

Analysis and design of fly over

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Abstract:

Bridges are the key elements in any road network for infrastructure development. Use of prestressed girder type bridges become popular because of its stability, economy, serviceability, aesthetic appearance and structural competence. The grillage analysis method for analysing bridge structures has been in use. An attempt is made in present paper to provide guidance on grillage idealization of the structure, together with the relevant background information. Guidance is provided on the mesh layout. Analysis and design of prestressed concrete bridges are carried out using relevant IRC codes and IS codes. The bridge deck is analysed by grillage analysis. The present work is carried out for exterior girder of span 28.2 m, width 12.5 m and with thickness of slab as 0.225m. The members are designed for maximum shear forces and bending moment. Losses of stress due to friction, anchorage slip, elastic shortening of concrete and relaxation of stress in steel are also considered. The analysis has been carried out using STAAD PRO software

Keywords: *Prestressed girder, Grillage analysis, Bridge deck, super structure, STAAD PRO*

Soil Loss Assessment for Palair Reservoir Catchment Area Based on Geoinformatics Approach

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Abstract:

This study has attempted to quantify the soil loss rate in the Palair reservoir catchment area, Khammam district, Telangana, India. A Digital Elevation Model (2.5 m by 2.5 m spatial resolution), rainfall data over 16 years, soil and land cover/land use extracted were used as an input to compute soil loss rates. GIS-based USLE factors were integrated and analyzed in the ArcGIS 10.8 platform. The large spread of soil loss is mainly associated with a change in the R-factor. The results showed that yearly soil loss in the study area ranges up to 11591.91406 t ha⁻¹ year⁻¹ with a mean annual soil loss of 1095.242479 t ha⁻¹ year⁻¹. The overall yearly soil loss in the study area is 12695956.6 tonnes. Approximately 111.2 ha of the area is within the extreme and very extreme erosion clusters that demand immediate controlling measures. The primarily responsible factors for soil loss are identified as LULC and terrain characteristics.

Keywords: GIS, Palair reservoir, Soil Erosion, Soil loss, USLE

Forest Fire Monitoring of Wildlife Sanctuary using Geospatial Techniques

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Abstract:

Forest fires are the most destructive element in the ecosystem, and it is the critical environmental issue. Geospatial technology provides various techniques for fire monitoring across the globe. The present study uses various indices like dNDVI and dNBR for creating burn severity mapping of Sri Venkateswara Wildlife Sanctuary (SVWS) which can help identify the fire risk zones and monitor vegetation activity for the year 2020. This study collects various Active Fire data products like MODIS and VIIRS to do overlay analysis to compare the Burn severity mapping. The study identifies various high and moderate fire risk zones along the study area which effects the biodiversity in the region.

Keywords: *Fire-Forest, Geospatial, MODIS, VIIRS*

Study on Use of PMD in Bituminous Concrete

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Abstract:

In late occasions there is an issue of garbage removal. Since the materials don't break down effectively, removal of waste has been an ecological issue. A lot of polymers based manufactured elastic are utilized as tires for planes, vehicles, trucks, bikes. After a while quite a while ago run the tires are not functional and disposed of. Synthetic elastic measure of elastic is disposed of, which again need extremely lengthy timespan for normal debasement. The recovery of elastic crude materials can be utilized in the black top. This would help in the profound investigation of the advanced adjustments in the asphalt laying. What's more, this creative strategies in the transportation, lately this method has been utilized at extraordinary potential for black-top folios. With the adjustment in cover, we can notice the radical change in thickness, glimmer and fire point, flexibility and mellowing point. It would be embraced in the exhibition investigation of bitumen including cost examination. The best reasonable changed bitumen is utilized for asphalt development. It like wise helps in decreasing the waste which can't be diminished. As the improvement is the critical part where Roadways are viewed as perhaps the main module of framework, and they assume an essential part in our day by day lives. Manufactured elastic from polymers modifier has been utilized in the black-top blend to improve result. Asphalt has been utilized as the essential material for asphalt designing. The waste material that are broadly accessible on the lookout for the alteration of bitumen. In the current investigation a modifier in the bitumen with various rates of change. Manufactured elastic from polymers is a side-effect of waste tires. India's arranged tires address around 6-7% of the worldwide in an entirety. With the close by manufactured elastic industry creating at 12% per annum, waste volumes are rising. India has been reusing waste tires for forty

years, although it is evaluated that 60% are disposed of through illegal unloading. This technique embraced in reusing these disposed of material stackle the issue of littering and can guarantee a lesser toxin into climate. The bituminous cover functions as a waterproof, thermoplastic paste. The utilization of manufactured elastic Rubber Powder as modifier of black-top fastener can improve the folio properties, increments solidness of asphalt, and decrease in garbage removal issue. It was seen that expansion of manufactured elastic powder upgrade the properties of adjusted cover. Expansion in the level of engineered elastic powder causes an increment in rutting and lessening in exhaustion showing high opposition against rutting, weakness breaking. The utilization of elastic powder to alter black-top fastener is an answer for improve natural, manageability of asphalts.

Key Words: *Asphalt, Bituminous binder, Synthetic rubber from polymers, Bitumen modifier, synthetic rubber from polymers modifier.*

Review on Use of Recycled Materials in Pavement Subgrade

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Abstract:

The long-term performance of a pavement structure largely depends on the underlying soil foundation. When the subgrade is poor many highway agencies employ chemical stabilization techniques to strengthen the subgrade. So as to increase the performance of the subgrade stabilization, we use different recycled materials and their uses such as cement, lime or lime/fly ash are extensively studied. These recycled materials not only economical but also alleviate landfill problems in subgrade stabilization. Previous studies on these recycled materials have demonstrated the immediate benefit of their usage in building a stable platform for construction of upper pavement layers. However, the long-term durability of subgrades stabilized with recycled materials has not been completely studied. This study examines the review on use of recycled materials such as preliminary results of the short- and long-term benefits and risks of using recycled materials for subgrade stabilization and examines the preliminary results of laboratory testing program to determine the benefits of cement, lime or lime/fly ash and risks of using recycling materials as Cement Kiln Dust (CKD), Lime Kiln Dust (LKD), Fly Ash (FA) and Concrete Fines (CF) for subgrade modification as well as stabilization.

Keywords: *Cement Kiln Dust (CKD), Lime Kiln Dust (LKD), Fly Ash (FA) and Concrete Fines (CF)*

Life Cycle Assessment on Tire Derived Fuel as Alternative Fuel in Cement Industry

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Abstract:

Alternative fuels (AFs) have a number of benefits in the cement industry, including lower greenhouse gas emissions and reduced use of non-renewable fossil fuels are replaced with materials that would otherwise be degraded or incinerated, leading to emissions and final residues. As a result, identifying the most significant environmental impacts involved with clinker processing, and using the best available production techniques are essential for environmental sustainability. The lifecycle evaluation of clinker production using traditional fuels (tire derived fuel) was also developed, as well as a comparative life cycle assessment (LCA) analysis also developed.

Keywords: *Alternative fuels, Tire derived fuel, Coal, Life cycle assessment, Open LCA*

Seismic Analysis of Tall Concrete and Steel Diagrid Structure Using Response Spectrum and Time History Method in E-Tabs

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Abstract:

In the recent years due to lack of land the construction of high-rise buildings widely increases and these buildings are affected by lateral loads due to wind or earthquake. To resist these horizontal loads lots of construction methods are available. Here in system peripheral columns of the building are eliminated. To resist the seismic forces, we arrange the diagonal columns. In this study seismic performance of 20-story concrete and steel diagrid structures are assessed using response spectrum methods. Only for concrete diagrid structure using time history method. The present work is made for studying the response and time period with acceleration of high rise building with concrete and steel diagrid structural system. To this aim response of two different diagrid structures of G+20 storeys are carried out to obtain optimized position of diagrid. E-Tabs software mainly focus on seismic analysis of response spectrum and time history method. As per IS456:2000 and IS800:2007 all structural members of diagrid model are designed and IS1893:2002 and ASCE7-10 is considered for seismic analysis for concrete and steel diagrid structure. An evaluation of constraints storey shear, storey drift, storey displacement, Time period and Structural weight is done to determine the efficient and cost-effective structure. The analysis of the building is carried out by using ETABS software.

Keywords: Concrete diagrid, Steel diagrid, High rise structure, Response spectrum method, Time history method, Seismic analysis, E-Tabs Software

Bio-Gas Production from Different Organicwastes

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Abstract

As our metropolitan zones seek after development and eat up enormous amounts of energy and produce monstrous measures of waste, we are confronted with the test of dealing with the present circumstance in a manner which is both capable and economical. One practical urban waste-to-energy technology is anaerobic digestion. Anaerobic absorption (AD) has been a useful fuel hot spot for more than 100 years and is of now being occupied with nations over the world in rustic territories to create electricity and heat, however it presently can't seem to make an enormous movement to the urban environment how- ever it is a practical and mature process. Applied to the organic waste that is generated in the urban environments, anaerobic digestion could provide an evaluative solution to the increasing garbage problems while simultaneously decreasing external energy necessities. The cost of transporting waste outskirt of cities to landfills will keep on rising and if a considerable portion of this waste could be held, digested, reduced, and transformed into useable energy in the urban environment, then this is something to be seriously considered. The present paper is to investigate the practicality of power and energy generation through the use of anaerobic digestion of organic waste in the urban environment.

Keywords: *Biogas, Anaerobic digestion, Acidification, Methanogenesis*

Comparative Study of Pressure Variations in Water Distribution Network Due to Change in Location of Elevated Service Reservoir

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Abstract

This paper compares the pressure variations in a water distribution system due to a change in the location of an elevated service reservoir with an intermittent type of supply for a continuously increasing demand. For this study Water Gems connect edition software is used for the design of a water distribution network. This study is conducted in the Eturnagaram habitation of Mulugu district. The Water Distribution Network is designed for 30 years with PVCaspiematerialandintermittent typeofsupply.Further,thiswaterdistributionsystemis analyzed for pipe bursts and proposes a framework for the operation and maintenance of the water distributionnetwork.

Keywords: *Water distribution system, Water Gems, Pressure variations, Operation and maintenance, Pipe networking.*

Performance Parameter Analysis of Magnesia Based Cement Products-A Review

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Abstract:

Magnesium oxide (MgO) based cements finds its way active in current researches where diverse range of applications and characteristics such as production process, reactivity and physical properties are essentially focus with the perception of individual expansion objectives. In general, relativity between distinctive MgO characteristics is examined in conjunction with the impact of MgO embodiment on the resources of cementitious materials is further considered. MgO is a key to develop the construction industry thereby mechanical strength and durability performance of cement paste, adhesive and concrete composites impose of MgO need to be explored. Subsequently, this research paper explicitly defines the investigation of MgO cement composites in terms of compressive and flexural behaviour, toughness, tensile and durability performances, flexibility, water susceptibility, porosity, carbonation, chloride ion diffusion, shrinkage and degree of hydration. In this regard, to application of magnesia-based cement products is influenced by various factors such as raw material, composition, performance. The review provides a detailed information of current research available related to magnesia-based cement products based on its properties.

Keywords: *Materials, Magnesium oxide, Chemical properties, Physical properties, Environmental applications, Construction products.*

Status of Agro-Industrial Waste Used to Develop Construction Materials in Andhra Pradesh Region – India

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Abstract:

In today's world concrete is one of the major construction materials. With the growth in industrialization and urbanization the demand for the concrete has taken a new pace. Therefore, to fulfill the demand huge amounts of natural resources have to be exploited for the production of the cement because natural resources and raw materials are major constituents in the production. At the same time huge quantities of industrial and agricultural wastes are generating in developing countries and are posing serious risk to the environment as well as human health. So, by utilizing these wastes as a supplementary material in construction reduces the usage of natural resources in the cement as well as decreases the threat of wastes in the environment. Many researchers have proved the effective utilization of wastes in the construction industry as they are more reliable and promote sustainability. This paper reviews waste generation and its statistics as well as environmental implication caused by wastes. It also highlights the possible ways of wastes that can be used in construction, preparation of blocks, insulators etc. This study also provides summary of existing research about usage of Agri and industrial wastes in the construction industry. In addition, paper shows application of wastes in real time construction

Keywords: *Keywords: industrialization, urbanization, supplementary, environment*

An Empirical Case Study and Approach on TQM in A Stipulated Construction Firm

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Abstract

In comparison to other sectors such as manufacturing and service, the construction sector is perceived to impose a low value on performance. TQM is implemented by very few construction companies in this world, and the top-down technique is widely used. To incorporate TQM in a company, top management must contribute to a "bottom-up" strategy by creating a "Quality Circle." According to this study, the first and most important criteria for introducing TQM in construction firms is top management involvement, other obstacles that companies must overcome include a lack of education, lack of confidence, lack of common trust, a lack of skilled staff, market competition, weak strategies and requirements, bad behavior, the availability of experienced field managers, and so on. In this approach, one case study is analyzed to show how Total Quality Management (TQM) is efficiently applied by using a "bottom-up" approach and creating a PMO in an Indian construction company. After some study of the Pareto graph, and identifying root causes using Root Cause analysis, experience is applied in the provided studied construction firm to apply TQM. Following that, a method for applying TQM in a building company is suggested.

Keywords: Total Quality Management (TQM); TQM Gurus, TQM Implementation; TQM tools; Quality Circles; Pareto analysis

Adopting Combination of Passive Design Strategies to Optimize Building Energy Needs

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Abstract:

The purpose of the paper is to analyze the efficiency of roof and wall systems based on varying insulating material layers in the tropical climatic region of Vijayawada, Andhra Pradesh, India. This research is carried out on “e-QUEST” software for energy analysis which is determined on monthly basis and the results gave evidence about energy consumption of building as well as life cycle costing. The roof system and the wall system have been studied based on energy consumption and carbon emissions in the concept of sustainability. The materials identified for insulating roof are vacuum insulated panels, wool glass, Phenolic foam, expanded polystyrene, polystyrene, and for wall are cellulose, fibreglass, mineral wool, polystyrene, aero gel. Due to the insulation in both wall and roof systems the passage of heat is minimized which reduces the cooling load on building and ultimately leads to lowering of energy consumption. Hence this study is crucial to understand the resident indoor air comfort, environmental and long-term economic benefits.

Keywords: Carbon-Emissions, Insulation Materials, eQUEST, Energy-Efficiency, Long-Term Cost Benefits.

Recent Trends in Delay Factors in Construction Projects: A Systematic Literature Review

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Abstract:

During the construction process, the delays due to various causes are very common in nature. While the delay problems have been researched through decades, the complexity and methodologies are also being developing. An up-to-date literature review is required as delays are unique and complex in nature. The paper focuses on the various literatures and tries to analyze the factors of the delay using content analysis process. The purpose is to study research articles published by various researchers from different countries and identification of the delay factors in the construction. The categorization of delay factors is divided into nine groups namely project-related, consultant-related, contractor-related, owner-related, design-related, material-related, labor-related, equipment-related and external factors depending on their nature and mode of occurrence and visualized using the Ishikawa (fishbone) diagram. This article will help to guide the construction professionals to understand the importance of causes of delays.

Keywords: *Delays, Delay factors, literature review*

Analysis of BIM Application Trends in Construction Industry for Waste Reduction and Sustainable Outcomes

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Abstract

The examination has built up a structure for BIM-based authoritative abilities advancement for upgraded appropriation and compelling utilization of Building Data Demonstrating (BIM) inside the Indian engineering associations. In the past examination, a requirement for changing the conventional practices in Indian development areas has been more than once communicated. A near concern has moreover been showed up to advocate for the use of lean and sustainable concepts to boost productivity and lead a group of development projects in India; to minimize flaws in the exercises and increase the hold subsidizes related to capital, electricity, and cost. As a result, this review aids the plan partnership by recommending the use of BIM as a system that encourages them to consider lean and sustainable changes. BIM was identified as an empowering agent and a cycle for achieving lean and sustainable results on development projects to meet the examination objective. Examination was led through a successive blended technique method zeroing in on gathering and breaking down together subjective and quantifiable information. The examination was isolated in quaternion stages: Poll study information assortment and experimental investigation of information including partial Least Square (PLS-SEM) examination to comprehend the ebb and flow status of BIM selection, its drivers, inhibitors and suggestions inside compositional associations in India; Semi-organized meeting and center gatherings for interpretive examination of local BIM capacities and BIM abilities

through Interpretive structural modelling(ISM); broad writing audit to contemplate and recognize the lean and sustainable results; and contextual investigations examination through quantitative comparative analysis (QCA) to approve the proposed structure.

The exploration discoveries demonstrate that BIM appropriation venture for designers is in experimentation phase and the contemporary use of BIM which is not investigated to maximum capacity. Structure was created by way of a component of this investigation bequeathempowerdesignassociationstoeffectivelyacceptBIMontaskshadedforacquiring sustainable and leanadvantages.

Keywords: *Building information modelling (BIM), lean and sustainable.*

Evaluation and Development of Management Model for Sustainable Value Chain in Indian Construction Industry

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ABSTRACT

The 'Value of the building' and 'Value of Sustainability' together yield 'Sustainable Value to a Building'. This research explores the varying value propositions of the clients; identifies all those areas in the project development life cycle (PDLC) where the value loss can occur in the 'Value Chain' and assesses building industry challenges & constraints that affect value proposition in value chain. The impetus to this research began when researcher observed the clients modifying their building eventually after their occupation in the building. Even the most enthusiastic client during the project initiation seemed dissatisfied with the progress of the project.

Few are dissatisfied after occupation of the building and few during progress of the project. Only a small percentage of them remained satisfied but did not follow any pattern. Among the developers, only the properties of top-notch developers remained unaltered rest of developers faced tough challenges. The wide variation in acceptability of constructed built values led researcher to transcend deep into the very structure and functioning of building industry value systems and explore the value design & delivery processes. Not all clients have same understanding of value and value proposition; hence expecting this framework and models to completely free the industry from value-based problems would be exaggeration. Value is a vast subject and understood differently. This research considers only intangible values to understand the factors that affect the overall Architectural values of the building. This research considers the value chain of contemporary mainstream building project only. It

touches upon the heritage value in general terms, without diving into the roots of heritage values or suggest any solution to the value chain of Restoration, Conservation, and Preservation practices though heritage and cultural conservation values are integral to “building values.” The outcome of this research is set of architectural management models as adoptable for minimizing value gaps in the process management. These models are applicable for project as a whole or independently for any stage of project. This research can be furthered by going into the designing criterions for all the values identified by this research, and that can be a ‘design research in the area of values’, and requires to fall in line with the value chain by suggesting the ingredients for each value and methods to enable it enhance and reach the client thereby improving the building values for higher satisfaction levels of the clients/users/stakeholders and delivery team. The data from this ‘PDLC research’ can be used to further ‘design research’ and ‘supply chain research’ as well.

Key words: *Value of sustainability, value chain management, PDLC*

Numerical Investigation Cold-form Profile Under Gravity Loading.

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Abstract:

This paper investigates the strength (ultimate load) of the cold-formed steel by consideration of the buckling profile of the member. For different support conditions the member can claim different profile. This shape commemorates the numerical mathematical model, which will outrage the basic aim of the study. Using direct strength method makes it more ambiguous and complex with different terms to remember and by empirical formulas. As the mathematics is the integral part of the engineering so this paper largely relies on the mathematical equations and formulas, which makes the solution by better appropriation.

Key words: *Ultimate load, Buckling profile, Direct strength method, Gravity loads*

Investigation Cold-form Steel Stub column Buckling Profile Under General Loading.

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Abstract

The analysis is carried out by finding different buckling modes for different half sine (or) cosine wave to find the highest and least buckling modes that a member is going to subject due to the application of the load the main easiest way to calculate the buckling mode is by applying the root finding methods which enhances the efficiency of the solution. In contrast to this we can find the buckling mode and ultimate load by simulation technique for different support conditions, which gives distortional buckling properties, and the ordinates that are engaged along the length of the column. For this condition we can assume a harmonic wave equation and corresponding curvature. By load-moment the desirable properties can be obtained.

Keywords: *Buckling Profile, General loading, buckling failure, Ultimate load, load- moment relation.*

Study on Analytical and Experimental Analysis of the Structural Member

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Abstract:

Analysis of the structural component or material plays an important role in the aspect of civil engineering as it helps in understanding the response of any components under various conditions. Nowadays we can develop various components which are composite and unique in dimension to meet industrial demand due to the advancement in the construction industry, this increases the usage of various analysis methods for a better understanding of their behavior. To analyze these components, we require some analytical methods which are useful for solving a problem with complex geometry, material properties, and loading conditions. To solve these complex structural numerical problems, we require the help of some computational software like ANSYS, ABACUS, MATLAB. In the present paper, a comparative study is made on results obtained by different experimental procedures and analytical methods conducted on identical structural components, these analytical methods include some numerical analysis. This study helps in the assessment of the reliability of these numerical methods in the comprehensive use of analysis for the structural components in the construction industry.

Keywords: *Analytical methods, Experimental analysis, cracked beam, modal, ANSYS, ABACUS, MATLAB.*

Comparison of Modelling Strategies of R.C Walls for Seismic Analysis

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Abstract:

Reinforced concrete walls are being widely adopted as lateral load resisting systems for high rise structures. The current practice among design engineers for modelling of such walls (shear walls) is by idealizing the same as 'wide' columns, which is questionable from safety as well as economy point of view. The most efficient modelling strategy of RC walls involves use of shell elements. Such an approach can be computationally much intensive, especially from a seismic analysis perspective. The present study utilizes an equivalent strut approach for modelling RC walls. The modelling strategy is demonstrated on a G+15 storey residential apartment located in Calicut city. The proposed methodology will be compared with the traditional 'wide' column approach as well as the one with shell element discretization. Comparison of modal properties such as frequencies and vibration modes from the various models are initially made to assess the model accuracy. Various seismic analyses viz. Equivalent static approach, Response spectrum approach and Time history analysis were performed to assess the storey shear, inter storey drifts as well as computation times using various models. From preliminary results, it is observed that the modelling strategy could serve as an efficient alternative to more robust and computationally demanding scheme involving use of shell elements.

Keywords: *Seismic analysis, Response Spectra, Time history analysis, Storey drift, Base shear*

Finite Element Analysis of Composite Beams

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Abstract:

In Finite Element analysis the size of mesh plays a critical role. It is closely said that accuracy and number of mesh required for the meshing of the element. This paper presents the effect of the von mises and various constraints on the accuracy of the result. On the basis of the papers referred and guidelines obtained for choosing the appropriate mesh size in finite element analysis has been provided and explained about the von mises stress occurred in the model. The web reinforcement should be strengthened enough to carry tension forces as well as compression forces so that the compression wrinkling is avoided. Von mises proves to be the perfect safe value for the designing of composite structures which involves various stress theories and failure criteria.

Keywords: *Finite element analysis, von mises, Mesh size, Compression wrinkling*

Three-dimensional finite element analysis on the flexural behavior of composite beams under linear displacement

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Abstract:

This paper presents a three-dimensional finite element model for reinforced concrete beams to study their flexural behavior under linear displacement with different mesh sizes. The model was assessed in terms of failure modes and ultimate strength of composite beams with three different mesh sizes. This was found to be accurate in taking the linear displacement of the specimens. The analysis was further carried out to study various parameters like the percentage of horizontal and vertical web reinforcement, bending moment, shear strength, compression damage, and tension damage. Based on the results of this study optimum mesh size was proposed for further analysis.

Keywords: *Mesh size, shear-moment interaction, horizontal web reinforcement, composite sections and linear displacement.*

A review on characteristics of pond ash stabilised with Cementitious materials

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Abstract:

In India an increase in industrial waste materials are a major drawback which is very harmful to the earth's environment. In order to avoid that, depending on their physical, chemical and mineralogical characteristics we can use those waste materials for construction materials based on environmental conditions. Thermal power plants produce a large quantity of coal ash as a by-product from the combustion of pulverized coal. A small quantity of total coal ash produced is currently being utilized, whereas unutilized coal ash is deposited in the vicinity of thermal power plants as waste material which covers several hectares of useful land. The utility of coal ash in various applications related to geotechnical and geo-environmental fields has been increased. There are not many studies that deal with the study of the effect of spatial distribution of pond ash within the ash pond on the geotechnical characterization of ash. This paper presents the review of characterization of pond ash stabilised with various materials.

Keywords: *Coal, Thermal, Earth, Waste, Pond.*

Service Life Prediction of RC Structure Incorporated with Fly Ash Subjected to Chloride ion Penetration

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Abstract:

Durability plays a major role in R.C structure which represents the service life of structure. We can improve service life by replacing cement with secondary cementitious material (FLY ASH). Here we determine the chloride content in RC structure which leads to corrosion when exposed to 3.5% of NaCl solution by using immersion test. Firstly, we cast cubes (150x150x150mm) for conventional mix and mixes with different percentages of fly ash (30%, 50%, 70%) for testing in the spans of 6 weeks and 12 weeks and we determine the chloride content (%) by using an empirical formula of Fick's law and also determined the compressive strength for 28 days, 56 days and 90 days. Service life prediction can be helpful to estimate remaining life of structure and can plan the repair strategies and to make critical decisions in practice. We can make during the design phase of new structures such that the life cycle cost can be optimized.

Keywords: *service life prediction, fly ash, chloride ion concentration, corrosion, Fick's law*

Strengthening of Subgrade Clayey Soil in Road Construction Using Fly Ash (C) and Coir Geotextile

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Abstract

By using local materials including neighborhood grounds for the constructions of the lower layers of the pavements, in precise the subgrade, the construction costs of road can be extensively reduced. 20% of the land is clay ground in India and is expansive in nature. These lands are observed to be steeply priced to construct and maintain roads. The use of coir fibre materials in the field of civil engineering has led to new techniques for stabilisation of soils in particular. A certain find out was carried out in this paper about enhancing the stability, strength and sturdiness of soil clay through the use of fly ash-C and coir fibre mat. The sample of the soil was taken from the high clay region in Andhra Pradesh. The stabilisation was performed with class C fly ash and grade H2M9 coir fibre mat. The plasticity of clay fly ash mix is decreased as fly ash content is increased. Adding fly ash therefore lessens expanding soils and increases their working ability through a colloidal reaction and changing grain size. The CBR-values of clay with fly ash mixtures were examined and determined under run soaked and soaked conditions. The supplementation of fly ash led to full size increase in soil CBR. The results show substantial improvement in compaction and CBR of composite containing clay, fly ash and coir mat. The CBR value obtained for virgin Andhra Pradesh clayey soil was 6% which was increased to 12% of optimum fly ash (15%) - clayey mix. The CBR value was obtained by placing coir mat at various depths in optimum fly ash clay mix. The maximum CBR value obtained was 44% for coir mat placed at combination of h/4th and h/2th depth from top in the optimum fly ash - clay mix.

Keyword: Flyash, plasticity, grain, colloidal

Experimental Study on Flexural Strength of Beams and Low Shrinkage Concrete Mixes With Quarry Dust and Natural Fibre

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Abstract:

In this modern age, Civil Engineering constructions have their own structural and durability requirements, every structure has its own intended purpose and hence to meet this purpose, modification in traditional cement concrete has become mandatory. Fiber-reinforced concrete (FRC) is concrete containing fibrous material which increases its structural integrity. It contains short discrete fibers that are uniformly distributed and randomly oriented. In addition, the character of fiber-reinforced concrete changes with varying concrete, fiber materials, geometries, distribution, orientation, and densities. Generally, fibers do not increase the flexural strength of concrete, and so cannot replace moment-resisting or structural steel reinforcement. The rising cost of construction material is a matter of concern. The reason for increase in cost is high demand of concrete and scarcity of raw material. Hence the concrete technologists must search for some economical alternative to the coarse aggregate. It has been found that different type of fibers added in specific percentage to concrete improves the mechanical properties, durability and serviceability of the structure. It is now established that

one of the important properties of Fiber Reinforced Concrete (FRC) is its superior resistance to cracking and crack propagation. Fibers include steel fibers, glass fibers, synthetic fibers and natural fibers of which lend varying properties of the concrete. In addition, the character of FRC changes with varying concretes, fiber materials, geometrics, distribution, orientation and densities. The weak matrix in concrete, when reinforced with fibers, uniformly distributed across its entire mass, gets strengthened enormously.

The objective of the paper is to experiment and compare the compressive, tensile and flexural strength of Quarry dust in concrete and addition with Natural fibers with M30 grade concrete and to study the workability properties of natural fibers. In this, the effect of inclusion of coconut fiber on compressive, tensile, flexural strength of FRC was studied. The experimental test results demonstrated at considerable increases in compression, tensile and flexural strength of specimen with partial replacement of quarry dust 30%, 40% and 50% at 14 and 28 days with addition of 2%, 3% and 4% of coconut fibers.

Keywords: Quarry, Fibres, Strength, Concrete, aggregate

Importance of Structural Health Monitoring System for Identifying the Seismic Characteristics of Structures- In South India

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Abstract:

Structural Health Monitoring (SHM) system information can be used for a quick building safety assessment, and to help decisions for necessary repairs, replacements, other maintenance, and rehabilitation process. It also helps the current Indian design and construction practices to reduce damage to buildings. In this paper, the necessity and importance of the Structural Health Monitoring system in India and especially in the peninsular part of the country is discussed to develop our perceptiveness regarding the behaviour and potential for damage of construction under the earthquake loads. The main aim of this review is to point out the value of inference of the seismic hazard associated with the total peninsular region and highlighting the need of detailed regional seismic micro-zonation studies. If the zone is underestimated, it causes to the questionable safety and overestimates leads to uneconomical design.

Keywords: Structural Health Monitoring, Earthquake, Seismic load, Sensing, micro- zonation.

Optimization of bentonite modified cement mortar parameters at elevated temperatures using RSM

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Abstract:

The inaccessibility of industrial wastes necessitated the search for natural pozzolanic materials. This paper deals the optimization of bentonite utilization in cement mortar at elevated temperatures using response surface methodology. Microstructure of calcined bentonite was analysed by scanning electron microscopy (SEM) and X-ray diffraction (XRD). The substitution of calcined bentonite (0%, 5%, 10%, 15%, 20%, 25% and 30%) and temperature exposure (24°C, 200°C, 400°C and 600°C) were taken as variables. The compression strength, strength activity, and sorptivity tests for all mixes were carried out for bentonite. Design Expert 11.0 version was utilized for modelling using RSM. The peak compressive strength was displayed by 20% replaced bentonite calcined at 200°C cement mortar after 28 days curing. Strength activity was improved upon increasing the percentage of bentonite calcined at 200°C. The generated models from RSM are significant in all the factors considered. Optimum solutions were proposed with more than 0.90 desirability.

Keywords: *Bentonite, compressive strength, elevated temperatures. Response Surface Methodology and optimization*

Trend Analysis of Annual and Seasonal Rainfall data for Andhra Pradesh

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The study mainly focuses on analyzing the precipitation trend for the period of 36 years from 1981 to 2016 which has been analyzed to find out the annual rainfall variability using non-parametric test. Mann-Kendall (MK) and Sen's Slope estimator is also used to determine the trend and slope magnitude. Annual precipitation trends have been drawn using historical rainfall time series for all the thirteen districts of Andhra Pradesh. The Z-Value of Mann-Kendall (MK) test represents significant trend in the rainfall data while the Sen's slope estimator shows a magnitude of decrease or increase trend in the rainfall. In the analysis Mann-Kendall is used for sign test and change in magnitude using Sen's slope estimator. The test results depicts that there is a significant positive trend in rainfall distribution, thus, increasing trends for the annual and seasonal rainfall observed.

Keywords: Rainfall, Mann-Kendall, Sen's slope, Trend, Statistical.

Spatial Temporal variability of Rainfall for Krishna District Andhra Pradesh

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Rainfall is a crucial component of the hydrological cycle and is severely affected due to Global warming. In the present study, Spatio - Temporal variability of rainfall for Annual, Winter, Summer, Monsoon and Post Monsoon seasons is done for Krishna District, A.P. Spatial interpolation technique (Inverse Distance Weight) for five-year interval (1998-2003, 2003-2008, 2008-2013, 2013-2018) is considered for the study. It is observed that Upper portion of the district shows higher amount of rainfall as compared to lower. Rainfall occurrence is more in Northeast portion of the district during Monsoon for all years. These findings suggest the importance of selecting the spatial distribution of rainfall magnitudes at the chosen time scales.

Keywords: *Hydrological, Rainfall, Monsoon, Spatial, Temporal.*

Trace Metal Composition of Airborne Particulate Matter in The Non-Mining and Coal Mining Areas of SCCL Mandamarri Region, Mancherial, India

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Abstract

The ambient concentrations of trace metals (in PM₁₀) in the coal mining and non-mining regions of Mandamarri region, Mancherial, India are reported in this study. Filter paper was used for trace metal analysis, which was followed by acid digestion, extraction, and analysis using an Atomic Absorption Spectrophotometer (AAS). The mean trace metal concentration was determined to be in the order Fe > Cu > Zn > Mn > Cr > Pb > Cd > Ni. Mean Pb values ranging from 0.023 g/m³ to 0.31 g/m³, Ni from 0.002 g/m³ to 0.02 g/m³, Cu from 0.06 g/m³ to 6.31 g/m³, and Mn from 0.13 g/m³ to 1.8 g/m³. Fe, Zn, Cd, and Cr values ranged from 1.42 to 28.47 g/m³, 0.16 to 2.55 g/m³, 0.03 to 0.07 g/m³, and 0.11 to 0.42 g/m³, respectively. Univariate (correlation study) and multivariate statistical analysis are two types of statistical analysis.

Key Words: Trace metals, AAS, PM₁₀, Multivariate analysis

Stabilization of Slopes of Sandy Soils By Using Geosynthetics

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Abstract:

This study is focused on the interactive behaviour of geo-synthetics in the stabilization of the slopes of non-cohesive soils. Now-a-days geo-synthetics are playing crucial role in geo-technical applications for strengthening of soils for slope stabilization, soil reinforcement for foundations, RE walls for flyovers on highway constructions, high retaining walls and water conveyance structures etc. Generally, cohesion less soil is preferred for backfills of the embankments because of its excellent drainage properties, low hydrostatic pressure built-up on slopes / backfills and high internal resistance due to friction and interlocking. But when we encounter a situation, where we have low strength or poorly graded sandy soils available for back fills and for the cost matrix to be within the budgetary provisions, alternative techniques like soil reinforcement or soil stabilization have to be adopted. To study this property of geo-synthetics, relative density and direct shear tests are conducted on the soil with and without geo-synthetics for analysis of shear parameters of soil under study. On application of mosquito net as reinforcement on non-cohesive soils, the sliding friction of the soil is enhanced by 22% that impacted the shear strength to be increased by 26.5%. Hence the soil's lateral load resistance or load transfer capacity increased to prevent the slope failure thereby saves the entire structure. So the use of geo-textiles or geosynthetics will enhance the shear strength properties of the sandy soils and will reduce overall cost of the project.

Keywords: *Geo-synthetics, soil-reinforcement, interaction behavior, back fills, direct shear test*

Strengthening of Expansive Soil by Using Coir Fibre and Flyash

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Abstract:

Soil is very important in civil engineering for the construction of any structure. Soil is generally categorized in four types like Gravel, Sand, Clay and Silt. As per IS Sieve analysis Soils are divided into three types namely Coarse-grained Soil (Gravel, Sand), Fine grained soil (Clay, Silt) and organic Soil (peat). Expansive Soils are soil that expand when water is added and shrink when dry out. The continuous change in soil volume causes settlement the swelling and shrinkage property in clays is mainly due to montmorillonite. By using the coir fibre and flyash the strength is increasing. Expansive soil properties can be improved by various testing method by using coir fibre and fly ash. In this paper the main objective is to find the physical and Engineering properties of Expansive soil by using coir fibre and flyash.

Keywords – Expansive soil, Engineering Properties, Physical Properties, Coir Fibre and Flyash.

Experimental study on mechanical properties of Graded glass fibre reinforced concrete

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Abstract:

Plain concrete possesses very little tensile strength, inadequate ductility, and minor resistance to cracking. Internal micro cracks are intrinsically present in concrete and its less tensile strength is due to propagation of such presence of micro cracks results in very less tensile strength. When fibers are added in definite percentages in the concrete results in improving the strain properties such as crack resistance, flexure strength and toughness. Different types of materials are available such as Glass fibres, steel fibres, polypropylene fibers etc. The present paper outlines the experimental study conducted on the use of glass fibers with structural concrete. Glass fibers of different sizes 3mm, 6mm, 12mm and 20 mm were used in this work different experiments are conducted on Glass fibre reinforced concrete such as Compressive strength, flexural strength, and split tensile strength.

Keywords: Glass fibres, GGFRC, Micro cracks, Flexural Strength, Tensile Strength

Effects of Polyvinyl Alcohol Fibers in Engineered Cementitious Composite Concrete

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Abstract:

The present work majorly focused on the effect of Polyvinyl Alcohol fibers (PVA) in Engineer cementitious composite concrete. However, PVA fibers are used as added to the ECC concrete with proportion of 0% to 2% of weight to cementitious materials. All the concrete samples are prepared with mix proportion of 1 cement: 1.1 silica fume: 0.36 ratio of sand /binder: 0.30 ratio of water/binder: 0.01 water reducer. whereas compressive, flexural, split tensile, water absorption and rapid chloride permeability tests are evaluated in order find out the performance of ECC with addition of PVA fibers. thus, the results, ECC concrete has better mechanical and durability performance than conventional concrete and also its high early strength. From this study concludes that upto 1.5% of PVA fibers can be used in the ECC concrete, which has 60.21MPa and 18% of strength increment than the reference mix.

Keywords: *Mechanical properties, Silica Fume, Polyvinyl Alcohol fibers, water absorption, Engineered cementitious composite.*

Influence of palm oil fuel ash on strength properties of concrete

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Abstract:

Cement which produces tremendous amount of heat of hydration and also the cost of cement which makes it uneconomical. The only way to deal with this kind of challenge is by introducing different products to replace certain amount of cement. Palm oil fuel ash is one of the products that can replace cement in concrete. This paper mainly focuses on change in the strength properties of concrete by incorporating palm oil fuel ash (POFA). It is very much efficient in reducing not only the cost but also enhances the strength when engineered in technical aspects. When palm oil fuel ash is added, very less quantity of CO₂ emission takes place with reduction in liberation of heat from concrete. With the addition of palm oil fuel ash in proportions of 10%, 20%, 30%, and 40% by weight of cement, this paper exhibits variation in concrete strength parameters such as compressive strength, split tensile strength, and flexure strength. M30 grade of concrete is used for this study and it shows that 10% of palm oil fuel ash with cement replacement gave high strength compared to conventional concrete. All the results generated are compared against control mix which gave an impression of improvement in strength of concrete in a positive way which helps balance the environment and also achieve sustainability of the concrete.

Keywords: *Palm Oil Fuel Ash; Mechanical Properties; Cementitious Replacement; Strength Parameters.*

Status of Agro-Industrial Waste Used to Develop Construction Materials in Andhra Pradesh Region – India

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Abstract:

In today's world concrete is one of the major construction materials. With the growth in industrialization and urbanization the demand for the concrete has taken a new pace. Therefore, to fulfill the demand huge amounts of natural resources have to be exploited for the production of the cement because natural resources and raw materials are major constituents in the production. At the same time huge quantities of industrial and agricultural wastes are generating in developing countries and are posing serious risk to the environment as well as human health. So, by utilizing these wastes as a supplementary material in construction reduces the usage of natural resources in the cement as well as decreases the threat of wastes in the environment. Many researchers have proved the effective utilization of wastes in the construction industry as they are more reliable and promote sustainability. This paper reviews waste generation and its statistics as well as environmental implication caused by wastes. It also highlights the possible ways of wastes that can be used in construction, preparation of blocks, insulators etc. This study also provides summary of existing research about usage of Agri and industrial wastes in the construction industry. In addition, paper shows application of wastes in real time construction

Keywords: *Keywords: industrialization, urbanization, supplementary, environment*

Effects of Hybrid Fiber Reinforced Geopolymer Concrete Stabilized with Gypseous Soil-Experimental and Simulation Approach

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Abstract:

Geopolymer concrete is established to have brilliant designing properties with a decreased carbon impression. Geopolymer with fibres has gained prevalence in recent years for use in concrete, for the most part, inferable from their low cost and outstanding individuality. In this examination, Fiber Reinforced Geopolymer Concrete (FRGPC) is utilized as a binder with the impacts of the intrinsic sulfate solution in gypseous soil. GPC blend is included with alkaline activators, for example, NaOH and KOH with molarities [8, 10, and 12] and hybrid fibers (steel and polypropylene) with the fiber content of 0-0.16%. Fibers are added to upgrade the strength of the concrete to meet given functionality necessities. The gypseous soil is taken with the percentage of G13%, G25% and G54%. To assess the effects, compressive strength, ductility, collapsibility potential and coefficient of penetrability tests were performed with a soaked and unsoaked solution. These outcomes are validated with the assistance of an Artificial Neural Network (ANN) optimization algorithm. The validation results played out that ideal precision and high strength of the activated solution. At long last, the simulated outcomes give better execution compared with existing papers.

Keywords: Fibre Reinforced Geopolymer Concrete, alkaline activators, ANN, NaOH and KOH.

Dynamic Analysis of Soil-Structure Interaction Effect on Buildings using Trained Network Model with ICSO Algorithm

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Abstract:

Soil– Structure Interaction (SSI) is an essential issue, particularly for solid and monstrous structures built on the moderately delicate ground, which may change the dynamic qualities of the structural response extensively. The research work aims to develop the models for predicting both dynamic characteristics and dynamic responses of SSI problems. For reducing complexity and improving the prediction accuracy of dynamic responses in SSI modelling, we will consider the Neural Network along with the Scaled Conjugate Gradient (NN_SCG) approach for the prediction analysis which will give more accuracy compared to ANFIS. The training of the network is accomplished by adjusting the weights and is carried out through a large number of training sets and training iterations. When compared to existing work, the proposed NN_SCG with Improved Crow Search Optimization (ICSO) algorithm attains maximum performance in terms of dynamic characteristic and its response analysis.

Keywords: SSI, dynamic characteristics, dynamic response, NN, training algorithm SCG and ICSO.

Distributed Hydrological Modeling of Konar Catchment Using SWAT Model

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Abstract:

Natural resources and their conservation play important role to reverse the process of land degradation to increase sustainability of land. In this study physically distributed soil and water assessment (SWAT) model was used to assess the catchment response of the Konar catchment. The model was calibrated (1997-1999) and validated (2000-2001) for the monsoon months (June-September) for runoff and sediment yield for Nagwan watershed. The calibrated parameters were upscaled to ungauged watershed, then calibration of Konar reservoir was done for both monsoon and non-monsoon season. The statistical indicators Nash-Sutcliffe efficiency, Percent bias, Coefficient of determination and Root mean square error show close relation between observed and simulated values of runoff, sediment yield and reservoir inflow. Moreover, the statistical indicators revealed that the SWAT model simulated sediment yield with slightly less accuracy at monthly step than the monthly runoff.

The calibrated model was tested for its appropriateness by comparing the simulated reservoir sedimentation rate with surveyed reservoir sedimentation rate for Konar reservoirs by CWC. The average annual reservoir sediment deposition rate calculated from the SWAT model for the period 1997-2001 was found as 1.44 Mm³/yr, for the Konar reservoirs, whereas the average annual sedimentation rate reported by CWC for Konar reservoir in 1998 was 1.73 Mm³/yr, which was lightly overpredicated by the model. Overall study indicates the SWAT model perform well for the Konar catchment and can be used to assess the catchment response in ungauged watersheds to save time compared to field methods.

Keywords: Calibration, Validation, SWAT, Runoff, Sediment, Konar

Service Life Prediction of RC Structure Incorporated with GGBS Subjected to Chloride Ion Penetration

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Abstract:

Durability plays important role in structures that represents the service life of the structure. Most of the structures are built by using concrete as main construction material. We can improve the service life of structures by substituting cement with secondary materials which contain cementitious properties such as GGBS (Ground Granulated Blast Furnace Slag). Here we determine the chloride content in reinforced concrete structure which leads to deterioration, when exposed to 3.5% of NaCl solution by using immersion test. Firstly, we cast cubes (150x150x150 mm) for conventional mix and mixes with different percentages of GGBS (30%, 50% and 70%). Present in this paper we considered 0.30, 0.40 and 0.50 water binder ratio (w/b). Later on we find the percentage of chloride ion penetrated is tested at 6 weeks and 12 weeks. We determine the compressive strength for 28 days, 56 days and 90 days and the chloride content (%) at 5mm, 10mm, 15mm, 20mm and 25mm depths of specimens, by using an empirical formula of Fick's 2nd law. Service life prediction can be helpful to estimate remaining life of structure and can plan the better repair strategies and to make critical decisions in practice. We can design new structures such that the life cycle cost can be optimized.

Keywords: Chloride ion concentration, Corrosion, Fick's law, GGBS (Ground Granulated Blast Furnace Slag), Service life prediction

Application of Time and Motion study for Brickwork activity in Residential building

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Abstract:

Construction industry is one of the largest industries in any economy whether gauged in currency volume or workforce quantity but still it is not attentive in appealing it. Human resource plays a vital role in increasing economy and enhancing productivity. Labor productivity is the key driving factor in burgeoning thrift. Various labors possess distinct productivity levels, thus ultimately affects time and profit of construction. Construction activities performed by workers are usually repetitive and demands physical attention, which can be examined by time and motion study followed by evaluation through statistical analysis. A time and motion study is a work measurement technique that involves recording the time spent on a specific job. A time keeping system can be used to record time, while a motion study can be used to eliminate waste. In this research work, a total of seven residential building sites were selected for performing time and motion study considering brick masonry work as main domain where vision-based approach is followed to collect data, i.e. video record study followed by statistical analysis applied to the observed and collected data on site to determine the time parameters, work efficiency and labor productivity construing to the hassles and its reasons. This study focused on only residential buildings limiting the crew designation to mason and helpers aged 25-35 years with 10-16 years of work experience working under traditional method with conditioned tools like hand trowel, mason square, spirit level, plumb rule, etc.

Keywords: *Brick Masonry Work, Time and Motion Study, Efficiency, Productivity and Statistical Analysis*

Effects of Fillers on Stability Properties of Stone Matrix Asphalt Mix

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Abstract:

Harm in adaptable asphalts occurs because of the development of overwhelming vehicles tends to increase in usage of automobiles which results in use of rut resistant Bituminous mixes in the surface course. The primary parameters that cause the damage of the asphalt layer are fatigue cracking and rutting. Cracking can be prevented by maintaining specified temperature during the process of preparation of mix to the laying of bituminous mixes. To prevent rutting, the grooves blends like Stone lattice black-top also known as Stone Matrix Asphalt (SMA) must be utilized as a part of the bituminous layers. In this study SMA is chosen to check its execution in all viewpoints such as stability (kg), deformation (mm), volume of voids in mineral aggregates (VMA), with the usage of different types of Non-Conventional fillers which enhances the properties of the mix. Fillers play a vital role in improving the stability and durability, whereas reduction leads to increase voids in the mix. Distinctive fillers like glass powder, magnetite (iron pellets), cement kiln dust and fly ash have been used in the mixes. Twelve sets of test samples were set up by utilizing distinctive sorts of filler having diverse sum in the mixture. Samples prepared at different bitumen contents (4.5%, 5.5%, 6.5%) respectively varying fillers. The Marshall properties obtained for the conventional filler fly ash has been found to display higher stability contrasted with glass powder, cement kiln dust, magnetite but has satisfied the minimum requirements. Magnetite filler indicated least deformation at 5.5 % bitumen content and the rate of air voids were observed to be diminished with the expansion of bitumen substance.

Keywords: Stone matrix asphalt, filler, stability, deformation, Cement kiln dust, magnetite, glass powder, fly ash

Groundwater Contaminant Transport Analysis and Numerical Solution of Diffusion in Saturated Aquifer

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Abstract:

At an industrial site on a sand aquifer overlaying clay silt aquitard, contaminant transport is due to diffusion. Groundwater diffusion plays a significant role in solute transport in a saturated aquifer system predominantly in sand and silt. Diffusion is considered as analogous to permeability considering horizontal direction. But the analytical solution is difficult to apply either to a composite boundary condition or a higher order solute transport problem. This study has used an analytical result of solute transport in an aquifer with a Dirichlet and Neumann boundary condition. In the subsurface of groundwater movement, contaminant concentration is affected by sand, silt, and gravel. The diffusion analysis of groundwater flow and contaminant transport using numerical modeling and finite difference method is used for the case of the saturated aquifer. The graphical solution is obtained with the help of MATLAB software.

Keywords: Numerical Modeling, Groundwater Flow, Solute Transfer, Finite Difference Method, MATLAB.

Mechanical Performance and Acid Resistance of Self Compacting Concrete with Fly Ash and Rice Husk Ash as Cementitious Materials

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Abstract:

Self-compacting concrete (SCC) is a highly flowable, non-segregating concrete that fills every corner of formwork evenly and absolutely by its own weight and encapsulates reinforcement without vibrating, all while retaining homogeneity. SCC's mechanical efficiency can be enhanced by using by-products or waste materials as cement replacements. Rice husk ash (RHA) and fly ash are highly reactive by-products. Because of its high silica content, Fly ash and RHA have strong pozzolanic properties and can be used as a supplementary cementitious material in SCC. In this study, the mechanical properties and acid resistance of self-compacting concrete is determined. Mainly the cement is replaced with fly ash and rice husk ash with three different percentages variations (10%, 20%, 30%). In each percentage of replacement, the fly ash and RHA has equal percentages. For example, in 10% of replacement 5% of fly ash and 5% of RHA is replaced. In general, fly ash is an industrial by-product and having the pozzolanic properties. And the RHA (rice husk ash) is also a pozzolanic reactive material. Compared to the cement, fly ash and RHA have more silica content. This self-compacting concrete is designed for M₃₀ and specimens are cast. The mechanical properties like compressive strength, split tensile, flexural strength and durability (acid resistance) tests are performed for 7 days, 14 days & 28 days.

Keywords: *Self-Compacting Concrete (SCC); Fly Ash; Rice Husk Ash (RHA); Mechanical Properties; Acid Resistance.*

Influence of Lime for Enhancing Characteristics of Expansive Soils in Road Works

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Abstract

Expansive soils are found in black cotton soils, which swell or shrink in volume when presented to changes in moisture content. Lime treatment is exhaustively used to increment the properties of sensitive and fragile soils. One of the biggest clarifications behind using lime is to decline the developing presentation of the earth soil. The arrangement of extra safeguards improves the reaction of quicklime (CaO) with water, structures hydrated (slaked) lime (Ca(OH)₂), and thus earth characteristics. The vast inadequacy of employing lime is growing the deficiency of lime offset earth. Following that, the goal of this study is to see how re-establishing time affects the geotechnical qualities of settled Black cotton soils with lime. These discoveries recommend that adding Lime as a stabilizer works on the strength of black cotton soil. Some of the characteristics of the soil likely to be increased by using stabilizer in this work are UCS (Unconfined Compressive Strength) at different curing periods (7, 14, 28 and 56 days), CBR (California Bearing Ratio) value at unsoaked and soaked and MDD (Maximum Dry Density) decrease at different lime percentages (%) like 2, 4, 6, 8 and 10. The results showed here untreated soil got stabilized by using the stabilizer in certain extent. In this adjustment various rates of cementitious material is added to black cotton soil and directed tests like plasticity, compaction, swell pressure, free swell index (FSI), Coefficient of permeability (k) and CBR (soaked and unsoaked) at various conditions like OMC, OMC+2% water and OMC+5% water, UCS (Unconfined Compressive Strength) was performed. From the test results, it is identified that the stabilization agent decreases plasticity and improves

strength characteristics. Addition of stabilizing agent makes the black cotton soil tonon-plastic, non-swelling and attains increase CBR values which are greater than 25% for a dosage of 10% lime at OMC but remaining OMC+2% water & OMC+5% water CBR values are not various much difference as per test results. With the addition of lime, the black cotton soil becomes non-plastic, non-swelling, and has high strengths. Treated soils are used as a development material, for example, a subgrade layer in the development of adaptable asphalt pavements for roads.

Keywords: *Black cotton soil, Lime, CBR, Unconfined Compressive Strength (UCS), plasticity characteristics & MDD and OMC.*

Applications of Geospatial Technologies in Land Capability Classification of a Macro Watershed

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Abstract:

This study deals with the estimation of the land capability and generation of different classes on Chevella watershed area, Ranaga Reddy dist., Telangana state. The land capability was estimated with the land capability classification technique where the land is classified into 8 classes based on the characteristics associated with each of the classes on certain parameters that affect the soil and the water as well, which are the two most important factors of the cultivation. The classes of land capability are broadly classified into 2 i.e., cultivable and non-cultivable. Based on the land capability the land resource development Plan was generated which gives the in-sight of the crops and the precautions that need to be grown in the region which was compared to 3 classes. Thus, proving that due to the increasing population growth and the demand, the pressure on the land is increasing and immediate serious action need to be taken in order to conserve the land for the future generations. All the information that was used and the output of the study were used to generate the land capability map and therefore it is understood that which class is suitable for cultivation and non-cultivation. The open-source GIS platform is used for the distribution of the information to the local people so that they can correct or change their agricultural practices based on this and better production could be possible.

Keywords: Capability, Cultivation, Mobile Mapping, GIS platform.

Comparison of Modelling Strategies of RC Walls For Seismic Analysis

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Abstract:

Reinforced concrete walls are being widely adopted as lateral load resisting systems for high rise structures. The current practice among design engineers for modelling of such walls (shear walls) is by idealizing the same as 'wide' columns, which is questionable from safety as well as economy point of view. The most efficient modelling strategy of RC walls involves use of shell elements. Such an approach can be computationally much intensive, especially from a seismic analysis perspective. The present study utilizes an equivalent strut approach for modelling RC walls. The modelling strategy is demonstrated on a G + 15 storey residential apartment located in Calicut city. The proposed methodology will be compared with the traditional 'wide' column approach as well as the one with shell element discretization. Comparison of modal properties such as frequencies and vibration modes from the various models are initially made to assess the model accuracy. Various seismic analyses viz. Equivalent static approach, Response spectrum approach and Time history analysis were performed to assess the storey shear, inter storey drifts as well as computation times using various models. From preliminary results, it is observed that the modelling strategy could serve as an efficient alternative to more robust and computationally demanding scheme involving use of shell elements.

Keywords: *Seismic analysis, Response Spectra, Time history analysis, Storey drift, Base shear*

Mapping of LULC change detection using Remote Sensing and GIS in Kalaburagi district, Karnataka, India

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Abstract: India

Land use and land cover (LULC) change has become crucial in understanding and managing changes in natural resources along with environmental issues. Kalaburagi district is well known for most extensive producer of pigeon peas (toor dal) in the Karnataka state. However, in recent years there has been substantial growth in the industries such as cement, and chemical. This growth has led to depletion in the surrounding environment as a result of this urbanization. The study has been done to understand the land use and land cover (LULC) changes over Kalaburagi district, Karnataka, India for a period of 20 years (2000 -2020). A combination of remote sensing and GIS approach was considered in this study. Satellite images of Landsat 7 (ETM+) and 8 (OLI) for 2000, 2005, 2010, 2015, and 2020 were analyzed using a pixel-based classification technique for producing LULC maps and detecting the associated changes. The dynamic nature of waterbody, forested areas, agricultural lands, increase in build-up land, and barren lands were analyzed during the study.

Keywords: Landsat image, LULC, classification classes, change detection

An Experimental Study for Identification of Glass Powder as An Alternative to Cement in Concrete

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Abstract:

Cement manufacturing industry is one of the carbon dioxide emitting sources besides deforestation and burning of fossil fuels. The global warming is caused by the emission of greenhouse gases, such as CO₂, to the atmosphere. Among the greenhouse gases, CO₂ contributes about 65% of global warming. The global cement industry contributes about 7% of greenhouse gas emission to the earth's atmosphere. In order to address environmental effects associated with cement manufacturing, there is a need to develop alternative binders to make concrete. Consequently extensive research is ongoing into the use of cement replacements, using many waste materials and industrial byproducts. Efforts have been made in the concrete industry to use waste glass as partial replacement of fine aggregates and cement. In this study, finely powdered waste glasses are used as a partial replacement of cement in concrete and compared it with conventional concrete. This work examines the possibility of using Glass powder as a partial replacement of cement for new concrete. Cement replacement by glass powder in the range 10% to 50% in increments of 10 percentages has been studied and tested for its compressive strength upto 7 days and 28 days of age and were compared with those of conventional concrete; from the results obtained, it is found that glass powder can be used as cement replacement material.

Key Words: *Glass powder, Partial replacement, Cement, Strength, Concrete*

Redesigning of Water Treatment Plant: A Case Study on Pamarru Village

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Abstract:

In this study we focus on real time problem faced by the Pamarru village people, due to conventional water treatment method and poor quality of groundwater. Major thing was that they were using source as ground water which was depleting day by day. To overcome the present challenge we propose to change the source to surface water i.e, Pulleru canal which is nearer to Pamarru i.e, less than 1km. Which was passing through Vijayawada to Gudalavalleru via Pamarru. We analysed the quality of Pulleru canal i.e, physio-chemical characteristics using standard procedure. We propose to redesign the existing conventional water treatment to suit for considered source. Redesigning is based on design period, per capita demand & population forecasting. We have started design from intake well, screening, aeration, primary sedimentation tank, rapid mixing unit, coagulation tank, rapid sand filter & chlorination. As existing OHSR's & clearwater sumps are sufficient and which meets the future demand. We aimed to redesign the conventional water treatment plant which can be implemented by the government bodies to supply adequate quantity and quality of water.

Keywords: *Surface water, ground water, OHSR, water treatment plant design*

Risk Matrix for Factors Affecting Time Delays in Road Construction from Contractor and Consultant Prospective

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Abstract

Now a days most of the projects are facing major problems in construction industry. The inability of completing the projects in given time is the major issue for the professionals in present day scenario. The main aim of this study is to identify the causes of the delays and to offer remedial measures. some of the factors causing delays in road construction are: change in scope of the project, inadequate planning, complexity of project, inappropriate project schedule, in accurate engineering estimates, variation in design, inefficient material and equipment management, inadequate post execution phase management, financial issues related to owner. The main objective of this paper is to identify the crucial delays in the road construction and especially from contractor and consultant prospective. For this purpose, the documents published in the conference of international groups and main journals were reviewed.

Keywords: *Construction, Project, remedial, material, management*

Studies on Strength Characteristics of Concrete By Partial Replacement of Cement with GGBS

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Abstract:

Concrete is the most widely used construction material in civil engineering industry because of its structural strength and stability. Concrete is a matrix consisting of basic ingredients namely, fine aggregate, coarse aggregate and water. Conventional binding material cement has now become expensive and its production involves undesirable environmental consequences such as heavy production of carbon dioxide (CO₂).

Ground granulated blast furnace slag which is by product of steel production, has been used to partially replace the cement. This paper presents an experimental study of Compressive and split tensile strength of concrete prepared with Ordinary Portland Cement, partially replaced by ground granulated blast furnace slag in different proportions varying from 0% to 40%. This research evaluates the strength and strength efficiency factors of hardened concrete, by partially replacing cement by various percentages of ground granulated blast furnace slag for M30 grade of concrete at different ages. From this study, since the grain size of GGBS is less than that of Ordinary Portland Cement, its strength at early ages is low, but it continues to gain strength over a long period. It is observed from the investigation that the strength of concrete is inversely proportional to the percentage (%) of replacement of cement with ground granulated blast furnace slag. It is concluded that the 20% replacement of cement is possible without compromising the strength with 28 days curing. The optimum GGBFS replacement as cementitious material is characterized by high Compressive strength, low heat of hydration, resistance to chemical attack, better workability, good durability and cost-effectiveness.



Keywords: GGBS, Workability, Durability, Compressive Strength and Tensile Strength.



Review of Materials used in Low Density Concrete as Eco-Friendly

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Abstract:

Light weight concrete is most popular type in constructional activities to get low density for the concrete as well as to reduce the dead weight of structure. There are different types of lightweight concrete based on type of lightweight material used. As considering eco-friendly materials like waste tyre, waste steel fibres, plastic waste, agricultural waste, waste glass can be used in concrete by replacing coarse aggregate and fine aggregate. Light weight concrete is preferable in constructional activities because of low thermal conductivity and improves fire resistance. In general light weight concrete ranges from 1440 to 1840 kg/cu.m. The main aim is to conclude the high-performance light weight concrete by using different type of materials in the same way to achieve low density for the concrete. By this study we understand that high performance can be achieved by adding steel fibers to improve ductility and for low density waste tyre rubber by partial replacement in coarse aggregate and to improve durability by adding bacillus subtilis JC3 crack formation can be reduced.

Keywords: low density concrete, high performance concrete, light weight concrete materials.

Flowability and Compressive Strength of Lime Stone Calcinated Clay Cement Based ECC

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Abstract:

This article helps to find out the exact flowable behaviour and compressive strength of Lime stone calcinated clay cement based engineered cementitious composite. To make more sustainable and flowable ECC, cement is replaced with limestone calcinated clay cement and PVA fibres are replaced with polypropylene fibres. Incorporation of fibres improves the toughness of the hardened specimen. Compressive strength was performed to evaluate the hardened property of ECC. In addition, flow table test was performed to investigate the green properties of LC3 based ECC. Experimental studies showed higher flow ability of the LC3 based ECC with PP fibre was at low fibre content. This article suggests the use of LC3 based ECC with the pp fibre in case of self-compactable ECC with little modifications. Looking forward, further attempts could provide quite beneficial to the literature.

Keywords: LC3 based cement, ECC, Metakaolin, Lime stone powder, fly ash.

SEISMIC FRAGILITY ANALYSIS OF MULTI SPAN HIGHWAY BRIDGE

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Abstract:

This paper represents the seismic behavior of multi-span highway bridges subjected to different PGA. There are many techniques of seismic assessment using computer technologies of which fragility analysis is one of them. Fragility analysis is a system reliability analysis to evaluate the seismic loss in a built environment. The methods used in this paper involve modeling the bridge using SAP2000 and using the peak ground acceleration from past earthquake data as input data to the software to examine whether the structure could be further affected by horizontal or vertical ground movement. In this paper, SAP2000 is used to conduct non-linear static analysis and non-linear dynamic analysis subjected to different PGA's that represent 12 historical earthquakes. The main objective of this study is to determine conventional and unconventional fragility curves. Finally, by considering different structural parameters, the fragility curves with the assumption of a log-normal distribution are obtained based on the capability and demand of the bridge structure.

Keywords: Multi span Highway Bridge, system reliability, fragility analysis, SAP2000, Unconventional fragility curves.

Effects of Pier and Deck Flexibility on the Seismic Response of Isolated Bridges

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Abstract:

The seismic response of bridges isolated by elastomeric bearings and the sliding system is investigated under two horizontal components of real earthquake ground motions. The selected bridges consist of multispan continuous deck supported on the piers and abutments. Three different mathematical models of the isolated bridge are considered for the analytical seismic response by considering and ignoring the flexibility of the deck and piers. The mathematical formulation for seismic response analysis of various mathematical models of the bridges isolated by different isolation systems is presented. The accuracy and computational efficiency of various mathematical models of isolated bridges is investigated by comparing their responses under different system parameters and earthquake ground motions. The important parameters selected are the flexibility of deck, piers, and isolation systems. There was significant difference in the computational time required for different models, but it was observed that the seismic response of the bridges obtained from different equivalent mathematical models is quite comparable even for an unsymmetrical bridge. Thus, the earthquake response of a seismically isolated bridge can be effectively obtained by modelling it as a single-degree-of-freedom system i.e., considering the piers and deck as rigid supported on an isolation system in two horizontal directions.

Keywords: Isolation; Bridge decks; Seismic effects; Mathematical models; Earthquakes

Optimization of Calcined Bentonite Clay Utilization in Cement Mortar Using Response Surface Methodology

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Abstract

Discovery of alternative to the pozzolanic materials generated from industrial wastes was needed because of its unavailability when the industries was shutdown permanently. This paper deals the optimization of calcined bentonite clay utilization in cement mortar using response surface methodology (RSM). Microstructure of calcined bentonite was analysed by scanning electron microscopy (SEM) and X-ray diffraction (XRD). The calcination temperature (room temperature, 700⁰C and 800⁰C) and substitution of calcined bentonite (0%, 5%, 10%, 15%, 20%, 25% and 30%) were taken as variables. The normal consistency, setting times, workability, compression strength, strength activity, and sorptivity tests for all mixes were carried out to assess the fresh and hardened properties of cement mortar. Design Expert 11.0 version was utilized for modelling using RSM. Workability was decreased upon increasing the calcined bentonite content in cement mortar. The peak compressive strength was displayed by 20% replaced bentonite calcined at 800⁰C cement mortar after 28 days curing. Strength activity was improved upon increasing the percentage of bentonite calcined at 800⁰C. The generated models from RSM are significance in all the factors considered. Optimum performance was observed at 15.25 % bentonite substitution calcined at 800⁰C.

Keywords: *Calcined bentonite, workability, compressive strength, Response Surface Methodology (RSM) and optimization.*

Comparative Study on Effect of Various FRP Wrappings with Varying Patterns on Load Bearing Capacity of Confined Concrete Columns

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Abstract:

Retrofitting of concrete structures has become an alarming need considering the hazards to which they are exposed these days. The age of the structure is directly proportional to the vulnerability towards damage and this calls for immediate care to be taken. Strengthening of key structural members like columns is one of the methods which can affect the overall strength on a large scale. Among the various retrofitting and strengthening methods available, Fiber reinforced polymer (FRP) wrapping is considered to be easily workable and also affects the structural integrity on a very minimal scale. In this experimental study, RCC columns are wrapped using Carbon fiber reinforced polymer (CFRP), Glass fiber reinforced polymer (GFRP) and Polypropylene fiber reinforced polymer (PFRP) with varying configurations of wrapping to check their efficiency in improving the load carrying capacity and deflection under the application of axial load. The fibre fabric employed in this study is bi-directional. It has been concluded that the concrete columns wrapped with CFRP have higher load bearing capacity and better resistance against deflection compared to other columns deployed using the remaining two fibres.

Keywords: *Retrofitting, Wrapping, Fiber reinforced polymer, Carbon, Glass, Polypropylene, CFRP, GFRP, PFRP, Deflection*

Modelling and Design Analysis of Light Gauge Steel Systems Against Conventional Structural Systems

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Abstract

The paper tries to focus on the importance and necessity to adopt new advanced construction techniques to attain fast and sustainable development in construction industry. Concrete frame construction and hot rolled steel erection are regular conventional methods which are time consuming, requires heavy manpower, machinery, and high fabrication cost. Recent developments in the field are focused to attain eco-friendly sustainable and economical construction. LGS (Light gauge steel) system is one of those which is a dry construction and can be carried out in remote locations with greater feasibilities. LGS system is a construction technology which uses cold formed steel as the construction material, is formed by compressing the steel at very cold temperatures and are made to thickness varying from 0.5 _ 3 mm. The paper tries to analyze, design for the structural stability, compares the time and cost effectiveness of LGS system to conventional systems. Vertex Bd is used for modelling, STRAP 2018 for analysis of Light gauge steel sections, Staad pro is used for modeling, analysis, and design of conventional Structures. The studies signify that LGS system proves to be a better solution for mid-rise structures and best suitable option for construction at remote locations.

Keywords: LGS system, HRS system, Concrete system, Cost analysis, Time analysis, Structural stability.

Evaluation of the effective mechanical properties of palm oil fuel ash-based fiber reinforced concrete

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Abstract: Cement concrete is one of the utmost regularly used building materials next to water. But one tonne of cement produces 1.25 tonnes of CO₂ and pollutes the environment. To keep that in mind, in this study the cement is partially replaced with POFA up to 30% (5% equal intervals), and steel fibers are added to the volume of concrete by 0.5% apart from normal concrete. Generally, POFA is one of the Agro-Industrial garbage materials which is coming as of the palm oil industry, with the growing amount of waste produced from the different processes there has been an increasing the waste generation. Increasing intrust in the use of agro – Industrial waste to achieve the potential advantages. Comparing with cement, POFA contains a high silica content. specimens are cast with M40 grade of concrete. The prepared POFA based Fibre reinforced concrete (FRC) was tested for all types of mechanical properties, as compressive strength, split tensile strength, bending strength, and load-deflection curve. All these properties are compared with the nominal concrete.

Keywords: POFA, Steel Fibres, FRC, Mechanical properties, and Agro-Industrial waste