VELAGAPUDI RAMAKRISHNA SIDDHARTHA SCHOOL OF ENGINEERING

SIDDHARTHA
ACADEMY OF HIGHER EDUCATION

An Institution **DEEMED TO BE UNIVERSITY**
(Under Section 3 of UGC Act, 1956)
(Sponsored by Siddhartha Academy of General & Technical Education), Vijayawada, A.P.

DEPARTMENT OF
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About the University:

In 2024, VR Siddhartha Engineering College was declared as a deemed-to-be university under Section 3 of the UGC Act, 1956 by Ministry of Education, Government of India. With a legacy of educational excellence, the institution's UGC-granted autonomy, renewed through 2027-28, provides a strong foundation for its transformation. Guided by a detailed 15-year strategic vision and a 5-year rolling implementation plan, Siddhartha Academy of Higher Education focuses on key areas such as academics, faculty recruitment, student admissions, research, ICT infrastructure, and administration, with specific annual milestones and measurable outcomes.

SAGTE, as a responsive educational trust, aligns with the Government of India's target of achieving a 50% GER in higher education by 2035. Siddhartha Academy of Higher Education, Deemed-to-be University, offers diverse undergraduate and postgraduate programs through its specialized schools, including Velagapudi Ramakrishna Siddhartha School of Engineering (B.Tech., M.Tech.), School of Management (MBA), School of Law, School of Science (B.Sc., M.C.A.), and School of Arts & Commerce (B.Com.). Envisioned to support interdisciplinary and multidisciplinary education for students' holistic development, the university aligns with the aspirations and requirements of NEP 2020 to equip students with the skills and knowledge essential for future growth and societal contributions.

About the Department :

The Department of Civil engineering of Velagapudi Ramakrishna Siddhartha Engineering College was established in 1977 at the inception of the college. The under graduation program was started with an intake of 60 later increased to 120 in 2007 and further increased to 180 in 2011. The Department started offering Postgraduate courses Structural Engineering from 1999 and Geotechnical Engineering from 2016 with an annual intake of 18 each. At the postgraduate level, we offer M. Tech. degree in Structural Engineering. The number of sanctioned students for B. Tech., and M. Tech. SE. are 120, and 18, respectively, per year. Currently, the department has 16 Ph.D. scholars. The department has state of the art advanced laboratories to cater the needs of students, research and consultancy. The department has total faculty of over forty-five, with fifteen doctorates and seventeen more pursuing PhD. The department takes pride in its highly experienced faculty specialized in all major specializations of Civil Engineering.

Department Vision :

To impart teaching, research and develop consultancy that serves the society and to strive continuously for excellence in education.

Department Mission :

To provide quality education for successful career and higher studies in Civil Engineering that emphasizes academic and technical competence in profession and research, effective communication, team work and leadership to meet the challenges of the society.

Table of Contents

1. PAPER PUBLICATIONS OF THE FACULTY

Effect of Perforation Geometry, Number and Pattern on the Seismic Responses of Steel Plate Shear Walls

Hanuma Kasagani, Chava Srinivas, K. Anjaneyula Naik, S. R. R. Teja P. & S. Sai Phani Swethaswari

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This study aimed to investigate the corrosion rate, corrosion resistance, and bond behaviour of stainless steel (SS) bars in comparison to carbon steel (CS) bars. Concrete specimens (M30) were cast using SS (grade SS550) and CS (grade Fe550D) bars and then immersed in NaCl medium with varying concentrations (0%, 3%, and 5%). Accelerated corrosion and pull-out tests were conducted to determine the corrosion resistance and bond behaviour of the concrete, while the Natural Corrosion Rate test was performed to determine the corrosion rate. The test results revealed that CS bars failed three times faster than SS bars and exhibited a corrosion rate approximately 6 times higher than SS bars. Furthermore, the limit of corrosion initiation and propagation ratios for CS vs. SS rebar was found to be 1:1.8 weeks and 1:1.7 weeks respectively. Consequently, the bond strength of CS bars after corrosion was found to be 30% lower than that of SS bars. SEM analysis indicated that the presence of a chromium oxide film on SS steel exhibited better protective properties than that of CS steel. The chloride threshold value measured by using potentiometric titration showed that SS bars had a higher resistance against the chloride penetration approximately two times higher than that of CS bars. From this experimental study, it can be concluded that corrosion resistance, bond behaviour, protective properties and service life of SS steel bars suggest its potential superiority over CS steel bars in concrete structures.

A recent catastrophic submarine slope failure in the Krishna- Godavari basin, Bay of Bengal, India

P. Dewangan · G. Sriram · V. P. Mahale · V. K. Gaddam

Submarine mass wasting in continental margins poses a significant threat to offshore installations, submarine communication cables, and coastal communities due to tsunamis. Based on the analysis of time-lapse geophysical data, we report a very recent submarine slope failure and associated mass transport deposit (MTD) in the Krishna-Godavari (KG) basin, the Bay of Bengal that occurred between January 2009 and December 2015. The head scarp shows erosion of ~ 160 m thick sedimentary strata with an estimated volume of ~ 11 km^3. The fan-shaped MTD, located at water depths of 950 to 1100 m, shows a spatial coverage of ~ 70 km^2 (volume is ~ 2.2 km^3) with a maximum thickness of ~ 60 m. This is one of the largest submarine slope failures reported from time-lapsed geophysical surveys. We analyzed potential triggers such as floods, earthquakes, and cyclones that could have caused the slope failure. We believe that Cyclone Helen, a category-1 storm, may have contributed to the observed slumping in unstable shelf/slope regions of the KG

Basin in November 2013 as the Cyclone eye traversed over the head of the slump. However, we cannot rule out other factors such as the extreme flooding events (2010 and 2013) and a 6.0 magnitude earthquake in the Bay of Bengal in May 2014. The study shows that pre-conditioning of sediments is an important factor in the assessment of deepwater geohazards, and areas with relatively moderate external triggers are also at high risk.

Comparative study of with and without stiffeners in perforated steel plate shear walls for high rise steel buildings

Vinay Kumar Gaddam, Sree Lakshmi ELE, Anil V. Kulkarni, Rakesh Ranjan, Soniya Bhandari, Sriram Gullapalli, Helgi Björnsson & Sundara Kumar Kusuma

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Snow cover and glaciers are the major sources of freshwater from the Polar Regions, Antarctica, Himalaya and the Arctic. Melt from these glacial components forms the supply of water to the downstream communities for various socio-economic and industrial activities. Due to climatic change, they are observed retreating and melting at a higher rate. Monitoring the changes that occur in these glacial components is thus essential to evaluate the water budget. Studies carried out in the Himalayas suggest monitoring the glacial components on a large spatial scale using in-situ field measurements poses challenges in assessing their spatio-temporal variability, mainly the mass balance. The mass balance of a glacier can be estimated using any one of the six methods from the literature (Garg et al. Polar Science 31:100786, 24; Azam et al. 2014), owing to their advantages, limitations, and applicability. Among the six methods, the AAR method is well-suitable for glaciers' mass balance estimation on a large scale, but the accuracy of measurements by this method depends on the reliability of the regressions developed using field mass balance and satellite-based AAR. Hence, the present study's aim is to develop a suitable regression relationship to derive the mass balance of glaciers in the Baspa basin, by utilizing the accumulation area ratio (AAR) obtained from Sentinel and Landsat satellite imagery, with modeled mass balance from the temperature index method, where lapse rates and precipitation gradients are well established. The model is applied for 27 glaciers representing regional scale. The analyses suggest that the mass balance of 27 glaciers with an area of 131.43 ± 3.28 km2, located between altitudes of 4300 and 6100 m.a.s.l have experienced a mass loss of -0.76 ± 0.35 m w.e per annum. At the glacier scale, the mass balance is observed to be varying between $+0.26 \pm 0.35$ m.w.e and -1.47 ± 0.35 m.w.e. A comparative analysis is performed for the mass balance estimated using the developed regression relationship with the in-situ field measurements of Naradu glacier available between 2014–15 and 2017–2018 hydrological years. This suggests a good correlation ($r > 0.8$) between modeled and field measurements. Also, a rise of 85 m in the mean ELA of the basin is observed in the basin during the study period. All these results indicate that glaciers in the Baspa basin are losing mass continuously, in line with previous studies. However, continuous loss of mass at this rate would increase the vulnerability of the villagers living downstream and emphasize the

need for better development of water resource management strategies to be implemented to improve the living conditions of the Himalayan communities.

Prediction of retrogressive landslide in sensitive clays by incorporating a novel strain softening law into the Material Point Method

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Andhra Pradesh consistently ranked in the top 10 Indian states with the highest number of traffic accidents over the past ten years, according to statistics made public by the National Crime Record Bureau. Andhra Pradesh saw a 20 percent rise in road accidents in the year 2021, totaling 21,556 accidents, of which 8,186 resulted in fatalities. Future accidents can be decreased by comprehending the causes affecting road accidents and using the insights gained from them. When analyzing the causes of traffic accidents, driver's behavior is a crucial component to take into account. Inappropriate driving behaviors can lead to abnormal circumstances that may result in traffic accidents. The proposed methodology uses an integration of Gaussian Mixture Modelling and Machine Learning classification algorithms on the data of road crashes in the Vijayawada region to predict accidents in the future and notify drivers of impending danger. The Road Transportation Authority (RTA), Vijayawada, provided data on road accidents, including three accident classifications and variables influencing accidents. Firstly, the data has been preprocessed and then the proposed methodology is applied to classify the black spots. The developed model can potentially classify accidents based on severity into three classes: fatal, severely injured, and generally injured. Then the developed models are integrated with an Android mobile application through the Google Cloud platform. The mobile application keeps a database of all the crucial user information, including the user's age, gender, vehicle type, and age, and it uses GPS to monitor the user's location. The driver inputs his source and destination addresses to check for any susceptible blackspots before beginning the drive. He is also given the option of real-time safety support, which, when activated, warns the user when he is approaching a blackspot that would have serious repercussions.

Synergistic effects of graphene oxide and limestone calcined clay cement on mechanical properties and durability of concrete

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This study investigates the synergistic effects of graphene oxide (GO) and limestone calcined clay cement (LC3) on the mechanical properties and durability of concrete. Various concrete mixes were prepared, including a reference mix, conventional concrete with 0.04% GO, and LC3 mixes with different clinker to calcined clay ratios (50:30, 45:35, and 40:40), both with and without GO. The mechanical properties were evaluated through compressive strength and split tensile strength tests, while durability was assessed using rapid chloride permeability, rapid chloride migration, water absorption, and corrosion rate measurements. The results revealed that the incorporation of GO in conventional concrete significantly improved both mechanical and durability properties. Among the LC3 mixes, the 45:35 clinker to calcined clay ratio exhibited the best performance. The combination of GO and LC3 resulted in remarkable enhancements, with the LC3 mix containing 0.04% GO and a 45:35 clinker to calcined clay ratio demonstrating the highest strength and durability performance. A strong positive correlation between compressive strength and split tensile strength was observed, and a power function equation was derived to predict split tensile strength based on compressive strength. The findings highlight the potential of combining GO and optimized LC3 for the development of sustainable and high-performance concrete with enhanced mechanical properties and durability.

Water Distribution Network Leakage Analysis Using Watergems: A Case Study From Westmooring, Trinidad And Tobago

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Water distribution is a critical system that involves engineered hydrologic and hydraulic components to provide water supply to a continuously growing population. Ensuring a sufficient and uniform water supply through a well-designed network is essential to meet the increasing water demand. The present study focuses on analyzing the water demand of the public water supply to facilitate effective planning, development, and operation of water supply and distribution networks. The main objective of the study is to analyze the existing water distribution network at West Moorings using the Watergems Software. To conduct this analysis, various data points are needed, such as the population of the area, water demand, distribution network layout, and water pump information. Additionally, details regarding the length, nodes, and diameter of the pipes are essential for the analysis. These data are input into the Watergems Software to perform analyses related to pressure, head loss, and elevation. The results of the analysis provide valuable information on pressure and flowrate at different nodes and head loss along various pipes in the network. By comparing the results obtained from the Watergems Software with actual data, the study aims to locate the leaks within the water

distribution network at Westmooring, Trinidad and Tobago. In conclusion, Watergems identified leakage nodes within the West Moorings Network, and data analysis helped narrow down the leak's location in the field. This process involved model calibration using field pressure and flowrate data from WASA, and emitter coefficients were categorized by the Darwin Calibrator function. Accurate boundary inputs, such as the number of leakage nodes, Initial Emitter Coefficient Spacing, and time intervals, were essential for precise data assumptions.

Estimates of Glaciers Mass Balance and Volume in Baspa Basin, Indian Himalaya

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Monitoring changes in glacier mass distribution is crucial for evaluating the availability of meltwater for downstream communities and managing the reservoir storage, particularly in the Himalayas, where many reservoirs support hydropower generation and irrigation. This study assesses the mass and volumetric changes of 42 glaciers in the Baspa basin. Mass changes were estimated using a temperature-index melt model, with inputs from weather records at the Chitkul meteorological station, while volume changes were derived using the Highthim model, based on surface velocity, slope and ice flow. The meteorological data was collected over 9 years (2014–2022) from Chitkul, located at an altitude of 3,423 m, by the Bhakra Beas Management Board in Chandigarh. The study estimates annual mass balance over the observation period, showing variations at the glacier scale, ranging from $+0.44 \pm 0.33$ to -1.47 ± 0.33 m.w.e., with a total ice loss of 3.8 megatons (3.8×10^6 m^3). Regionally, the glaciers experienced an average mass loss of approximately -0.76 m.w.e. per year. A correlation analysis of the estimated mass balance of Naradu glacier with in situ observations (2014–2017) showed a strong correlation ($r^2 > 0.90$), with an error of ± 0.35 m.w.e. The volumetric analysis revealed surface ice velocities of glaciers ranging up to 68 m per year, with a total ice volume of 22.45 gigatonnes water equivalent (Gt w.e.)in the basin. Individual glacier volumes range from 0.14 to nearly 5 Gt w.e. Comparisons with national and global mass balance studies indicate that glaciers in the Baspa basin are in retreat. This trend suggests future challenges for local communities regarding water supply for various socio-economic purposes and hydropower generation. It highlights the potential for artificial recharge structures as a solution for the sustainability of people in the valley.

Investigation On Enhanced Concrete Performance Through the Incorporation of Nanomaterials and Natural Fibers

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This study delves into the realm of M70, high-performance concrete (HPC) with a focus on enhancing its mechanical and sustainable properties through the incorporation of nanomaterials, specifically nanosilica, and organic composites derived from abaca fibers. HPC is pivotal in contemporary construction for its superior durability, strength, and resistance to environmental factors. The integration of nanosilica aims to refine the microstructure of the concrete at the nanoscale, enhancing its strength and durability. Simultaneously, the introduction of organic composites from abaca fibers seeks to impart eco-friendly characteristics to the concrete mix, addressing sustainability concerns. The research methodology involves systematically varying the proportions of nanosilica (0%, 0.5%, 1.0%, 1.5%) as a partial replacement for cement in the concrete and additionally, abaca fibers (0%, 0.25% and 0.5%) were used to enrich the durability. Mechanical testing will be conducted to assess the impact of these additives on the concrete's structural performance, while durability testing will focus on resistance to environmental factors such as moisture and chemical exposure. The outcomes of this study enriching the concrete performance and optimization of high-performance concrete (1% of nanosilica and 0.25% of abaca fiber) is the superior quality compared to all other mixes.

2. CONFERENCES ATTENDED BY FACULTY

Performance based evaluation on strengthening of flexible pavement using sbr and rice husk ash as filler material

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This research paper explores the performance-based evaluation of flexible pavement reinforcement through the incorporation of Styrene-Butadiene Rubber (SBR) in bitumen and the utilization of rice husk ash as a filler material. The study aims to assess the impact of these additives onthe mechanical and functional properties of flexible pavements, considering factors such as durability, stability, cracks and rutting resistance. The research contributes to the existing body of knowledge by providing insights into the effects of SBR-modified bitumen and rice husk ash on the pavement's response to various load. With the addition of the SBR in bitumen and rice husk ash in aggregate improve the properties like stability, flow value and amount of voids. The findings are expected to aid in the development of sustainable and cost-effective pavement solutions with enhanced mechanical properties and extended service life. The paper concludes with recommendations for the practical implementation of these modifications inpavement construction, emphasizing the potential benefits for long-term performance, environmental sustainability, and cost-effectiveness. This research addresses the current challenges in pavement engineering and offers a valuable contribution to the optimization of flexible pavement materials.Optimal site selection for establishing solar power plant based on solar radiation using GIS

Low cost water purifier using natural and waste material

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The initial exploration of an affordable water purification system led to the creation of a novel water purifier crafted from natural and discarded materials, along with a budget-friendly filtration unit. Velagapudi Ramakrishna Siddhartha Engineering College in Kanuru, Vijayawada, innovatively designed this low-cost filtration device. The primary objective is to diminish the reliance on potable water by establishing a new source through the reuse of wastewater. The wastewater treatment process involves the utilization of coconut shells, corn cobs, sugar cane pulp, charcoal, intact sea shells, pebble stones, aiming to enhance the quality of treated wastewater. Employing recycled wastewater for activities like gardening and flushing emerges as an effective strategy for water conservation and the promotion of sustainability.

Experimental investigation on partial replacement of coconut shells as coarse aggregate and rubber as fine aggregate in concrete

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Concrete is the most widely used artificial material worldwide, and its production depends on the availability of components like sand, granite, and cement. The prices of these materials have significantly increased in recent years. This study investigates the effect of using coconut shells (12mm – 16 mm) as the coarse aggregate and rubber (4.75 mm) as the fine aggregate in concrete. The concrete was intended to achieve compressive strength of 40 N/mm^2, with coarse aggregate replacing coconut shells and fine aggregate replacing rubber at 5%, 10%, and 15% by weight. According to the study, 5% is the optimum amount of coconut shell to replace coarse aggregate with. The optimal replacement percentage of fine aggregate with rubber is 5%. Therefore, tests will be conducted on all of the aforementioned samples to determine their different characteristics, including compressive strength, split tensile strength, RCPT test, and sorptivity test.

Effect of Granite Slurry Powder on Characterization of Geopolymer Concrete

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Geopolymer concrete, with its high compressive strength and low permeability, is ideal for sturdiness and environmental resistance in construction projects. It can lower greenhouse gas emissions compared to conventional concrete. India has abundant quantities of effluent from factories, namely Glass powder (GP), Ground granulated blast furnace slag (GGBS), and Granite slurry powder (GSP). The GSP is an environmentally friendly substance that has no recognized applications, is usually disposed of in landfills, and pollutes the air and creates infiltration issues in nearby communities. The mechanical characteristics of geopolymer concrete (GPC) with different ratios of GSP, GGBS, and glass powder were the main focus of this investigation. Moreover, finalized the optimum mix from strength criteria and studied the durability properties by maintaining a constant molarity of 16M in ambient curing. Initially five mixes (G0-50, G50-0, G25-25, G30-20, G20-30) were prepared and determined their compressive strengths based on that identified an optimum mix G-30-20. Optimum mix was prepared with 50% GGBS, 30% GSP, and 20% GP as binder content. The compressive, splitting tensile, flexural and bond strengths at the age of 28 days of optimum mix was 91 MPa ,4.72 MPa, 6.96 MPa and 10.08 MPa respectively. Furthermore, observed a very low rate of water absorption of 0.28%, sorptivity 0.4 mm/√ . and UPV value is 4.8 km/s, it indicates geopolymer concrete has superior quality. Based on the results obtained from several mix proportions, the combination of 30% GSP, 20% GP, and 50% GGBS can be used as a sustainable concrete, which offers better results in durability and mechanical properties.

Sustainable Development of 3D-Printable Quaternary Geopolymer Concrete

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The construction industry has been looking a cost-effective way to build structures with unique and intricate designs, mass customization, and reduced labor costs, material consumption and environmental impact. One promising possibility is geopolymer 3D printing concrete(3DPC). The interlocking that takes place when materials are bound in an alkaline environment is known as geopolymerization. A potential utility for pozzolanic materials as GPC binding agents is their high silica and alumina content. The primary objective of this research is to determine the viability of quaternary blended 3D printing geo polymer concrete (GPC). As "quaternary" means "fourth in sequence (Since "quaternary" implies "fourth in sequence,)," the four binder components that make up Geopolymer Concrete are glass powder, silica fume, ground granulated blast furnace slag (GGBS), and fly ash. The paper describes mix design methodologies and emphasizes various aspects of mixture compositions and how they affect the features of 3DPC. The results represent that printability, extrudability were satisfied for the mix proportion of 1:1.3 with 40% Fly ash, 40% GGBS, 10% glass powder, 7% silica fume, 3% Viscosity modifying agent (VMA) including 1.5% of Auramix 200 and 2% of CAC hyper fluid plus. Further, buildability was attained by replacing 40% river sand with M sand. Mechanical properties like compressive strength, flexural strength and split tensile strength are studied for the ideal mix. The obtained results for compressive strength, flexural strength, split tensile strength, are 91 MPa, 5.93 MPa, 4.5 MPa, respectively.

An experimental study on the effect of a Viscosity Modifying Agent on the rheological and strength behaviour of 3D Printed Concrete

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Automatic construction technologies have become the primary focus of the global construction sector. 3D printing is one of the disruptive technologies emerging from Industrial Revolution 4.0. 3D printing has grown increasingly popular in concrete construction due to its architectural freedom, speed, formwork-free printing, lesser waste creation, eco-friendliness, affordability, and safety. There were issues with the printing process when manufacturing 3D-Printed Concrete (3DPC) mixes, such as poor extrusion and buildability issues. This study investigates the use of Viscosity Modifying Agents (VMAs) in 3DPC to improve printability as well as structural integrity. VMAs, known for their capacity to change the rheological properties of concrete mixtures, are used selectively to optimise the material's flow behaviour throughout the 3D printing process. The study compares the effect of VMA concentrations on the workability and buildability properties of 3DPC mixtures.

Comparative examinations of VMA-enhanced and traditional 3DPC specimens indicate that an optimised VMA dose improves structural performance. The findings of this study hold significant relevance for the advancement of 3D printing technology in construction, offering a more nuanced understanding of the role of VMAs in optimising concrete mixtures for additive manufacturing.

Comprehensive review on fresh and hardened properties of self -compacting concrete with industrial wastes.

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With the advancement of the construction industry towards bigger and taller buildings in modern times, there is also a need for concrete that possesses superior strength and durability. Traditional concrete used in such type of structures consumed more reinforcement quantities and also placed at close spacing's. This impact the performance of concrete as one of the reasons might be vibrator issues for consolidation process. Such type of situations needs a relaxation in terms of placing the concrete without or less vibration techniques. Self-Compacting Concrete (SCC), which flows and settles on its own under self-weight, could represent the solutions. Additionally, utilizing SCC can minimize the workforce needed for tasks such as vibration, segregation, and consolidation, ultimately resulting in a reduction in project expenses. Utilization of GGBS and Fly-Ash has become extensive in production of SCC as they found to be similar in properties of Cement. Hence, employing industrial wastes in place of cement has an impact on the characteristics of concrete both before and after it has hardened. Self-compacting concrete's (SCC) Physical and Mechanical characteristics in both states are examined in this work in relation to earlier research. The utilization of waste products to enhance sustainability and benefit the environment is also encouraged by the paper's analysis of SCC.

Redefining Sustainability in Building Practices in Circular Construction Process

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This chapter explores the connection between circular construction principles and energy-efficient design strategies to examine the impact on environmental stewardship and resource optimization. It also discusses the economic viability, regulatory frameworks, and case studies of circular construction and energy-efficient design. Sustainable architecture trends, including smart technologies, circular economy principles, and public policy, are also explored. The interdisciplinary collaboration and innovation transforming architectural practices are illustrated to meet current needs and promote environmental and societal well-being. A comprehensive sustainable architecture approach, focusing on circular construction principles and energy-efficient design strategies, is empathized with to tackle environmental issues and create resilient communities.

Application of Google Earth Engine NDVI Trend to Study Yield of Sugarcane Crop Using Sentinel 2 Data

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Increasing global food demand and the effects of climate change further indicate a need for proper ways of monitoring crop health. This chapter has demonstrated the importance of normalized difference vegetation index (NDVI) as a non-invasive means of monitoring crop health. A review of the literature indicates that NDVI is useful in determining crop stress, diseases, and performance, especially if considered on a long-term basis. This study is based on sugarcane in Vuyyuru Village, Andhra Pradesh, considering NDVI to analyze crop health for the five-year period of 2018-2022. In this chapter, pre-processing Sentinel satellite imagery through atmospheric correction and image registration was carried out to ensure that data accuracy is ensured. The computation of NDVI values each year involves assessing any patterns or variations that are found in crop health spatially. The work sets out to enhance the understanding of the dynamics in crop health through time, thus giving valued insights for any future agricultural management.

Sustainable mix design for 3D printable concrete

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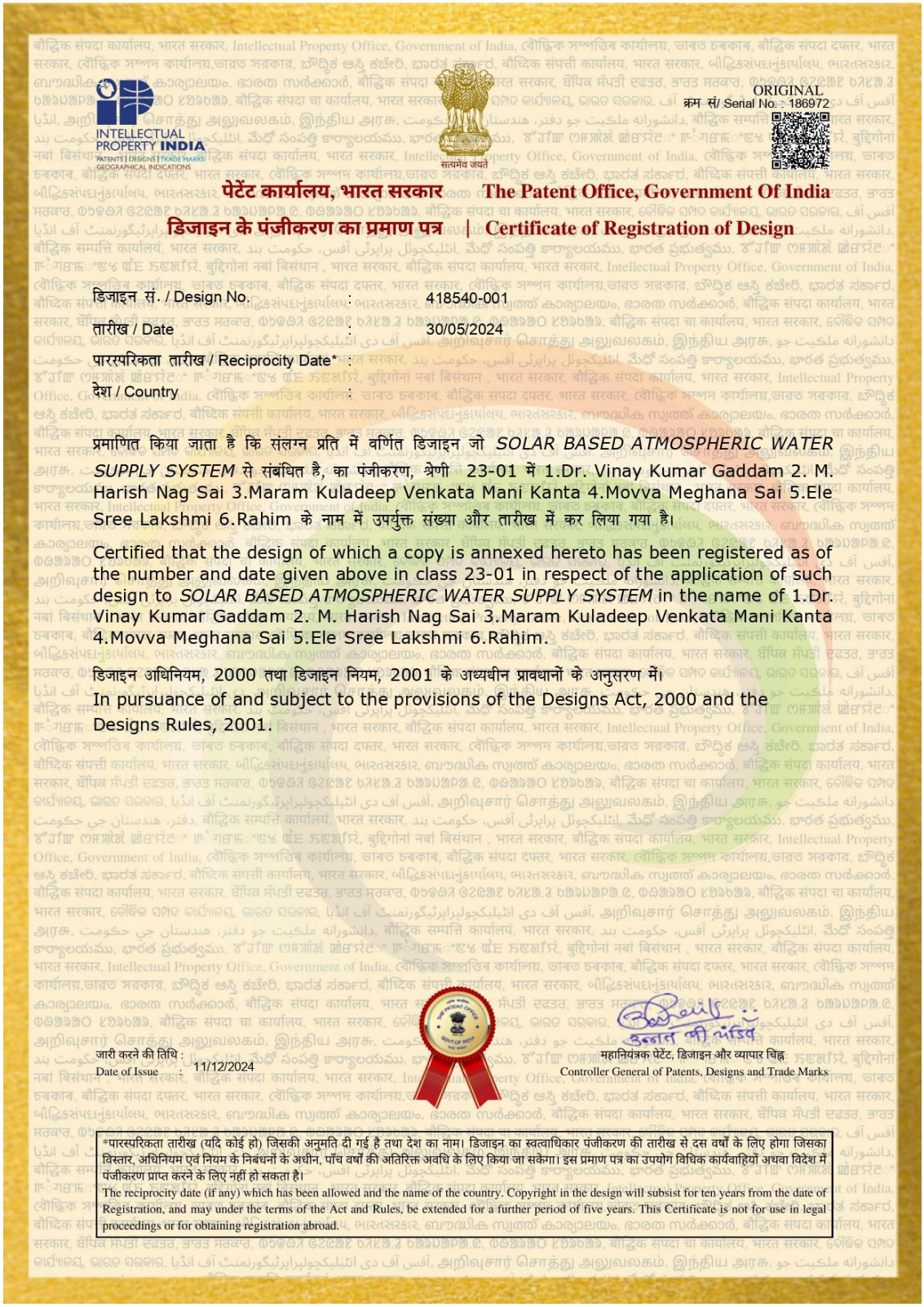
3D concrete printing is a new building process that has great potential for the construction industry in terms of optimizing construction time, cost, design flexibility, error reduction, and environmental factors. The most influential factor that determines successful printing is the concrete mix. This study focuses on designing a sustainable 3D printable mix and further examining its fresh and hardened mechanical properties. This study concentrated on the performance requirements for 3D printable concrete, which include printability, extrudability, and buildability. The trail mixes are conducted using cement, fine aggregate, and water. Crucial components like GGBS, fly ash, and crystalline silica are replaced with cement to improve the performance of the concrete mix. The mechanical and fresh properties of the 3D printable mix are examined using compressive and unconfined uniaxial compression tests. The early-age strength of the trail mixes was assessed using the unconfined uniaxial compression test. The findings showed that the best mix could withstand deposited layers for 60 minutes after adding water to the binder. The mix containing cement, fly ash, GGBS, silica, sand, and water is the optimal mix. The compressive test of the printed specimen revealed that it attained 44.5% and 23% more strength compared to other mixes. The inclusion of crystalline silica is the reason behind increased compressive strength and an inter-layer bond between the layers.

3. Patents granted



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डिजाइन के पंजीकरण का प्रमाण पत्र | Certificate of Registration of Design

डिजाइन सं. / Design No. : 418540-001

तारीख / Date : 30/05/2024

पारस्परिकता तारीख / Reciprocity Date* :

देश / Country :

प्रमाणित किया जाता है कि संलग्न प्रति में वर्णित डिजाइन जो *SOLAR BASED ATMOSPHERIC WATER SUPPLY SYSTEM* से संबंधित है, का पंजीकरण, श्रेणी 23-01 में 1.Dr. Vinay Kumar Gaddam 2. M. Harish Nag Sai 3.Maram Kuladeep Venkata Mani Kanta 4.Movva Meghana Sai 5.Ele Sree Lakshmi 6.Rahim के नाम में उपर्युक्त संख्या और तारीख में कर लिया गया है।

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डिजाइन अधिनियम, 2000 तथा डिजाइन नियम, 2001 के अध्यधीन प्रावधानों के अनुसरण में।

In pursuance of and subject to the provisions of the Designs Act, 2000 and the Designs Rules, 2001.

जारी करने की तिथि :
Date of Issue : 11/12/2024

उन्नत की पांडेय

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