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Department of *Civil Engineering* Presents

4th Online/Offline Mega International Conference on "Revolutionary Technology in Civil Engineering"

on 17th & 18th December 2024

(ICRTCE-2024) **PROCEEDINGS**

ISBN:
978-93-94246-26-3

Editor in chief
Dr.P.Santosh Kumar Patra

nirf Ranked Institute

: 8096945566, 8008333876, 8008333886 : www.smec.ac.in
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Department of Civil Engineering

4th International Conference on

"Revolutionary Technology in Civil Engineering"

(ICRTCE–2024)

17th & 18th December 2024

Patron, Program Chair & Editor in Chief

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Head, Dept. of CE, SMEC

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Mr. G. Vamshi Prathap
Asst. Professor, Dept. of CE, SMEC

ISBN: 978-93-94246-26-3

Sri Marri Laxman Reddy Garu

Chairman

MESSAGE

I am extremely pleased to know that the Department of Civil Engineering, of SMEC is organizing "3rd International Conference on Revolutionary Technology in Civil Engineering" organized by the Departments of Civil Engineering on 17th and 18th Dec 2024. I understand that the large number of researchers have submitted their research papers for presentation in the conference and also for publication. The response to this conference from all over India and Foreign countries is most encouraging. I am sure all the participants will bebenefitted by their interaction with their fellow researchers and engineers which will helpfor their research work and subsequently to the society at large.

I wish the conference meets its objective and confident that it will be a grand success.

M. Laxman Reddy

Sri Marri Laxman Reddy
Chairman

Sri Chandrashekar Yadav Garu

Executive Director

MESSAGE

I am pleased to state that **"3rd International Conference on Revolutionary Technology in Civil Engineering"** organized by the Departments of Civil Engineering on 17th and 18th Dec 2024. For strengthening the "MAKE IN INDIA" concept many innovations need to be translated into workable product. Concept to commissioning is a long route. The academicians can play a major role in bringing out new products through innovations.

I am delighted to know that large number of researchers have submitted the papers on Interdisciplinary streams. I wish all the best to the participants of the conference additional insight to their subjects of interest.

I wish the organizers of the conference to have great success.

Sri Chandrashekar Yadav

Executive Director

Dr. P. Santosh Kumar Patra

Group Director

MESSAGE

I am delighted to be the Patron & Program Chair for **"4th International Conference on Revolutionary Technology in Civil Engineering"** organized by the Departments of Civil Engineering on 17th and 18th Dec 2024. I wish with strong desire that the conference to unfold new domains of research among the Civil Engineering fraternity and will boost the knowledge level of many participating budding scholars throughout the world by opening up plethora of future developments in the field of Civil Engineering.

The Conference aims to bring different ideologies under roof and provide opportunities to exchange ideas, to establish research relations and to find many more global partners for future collaboration. About 70 research papers have been submitted to this conference and this itself is a great achievement and I wish the conference a grand success.

I appreciate the faculties, coordinators and Department Heads of Civil Engineering for their continuous untiring contribution in making the conference a reality.

Dr. P. Santosh Kumar Patra
Group Director

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Dr. M. Sreenivasa Rao
Principal

MESSAGE

Contemporary Society is technological and relies on technology for various aspects of daily life. There is no life without digital platforms, Internet, apps, codes, etc. Navigating the complexities of a technological society requires a balance between embracing innovation and addressing the challenges that come in the way. Considering the immediate needs of the technical Society, SMEC has been organizing International Conferences every year which really help a candidate in acquiring technical skills and making themselves familiar with the new inventions.

International Conferences are a Perfect Platform for enthusiastic researchers to come up with their innovative ideas, and I am delighted that Department of Civil Engineering is organizing **4th International Conference on "Revolutionary Technology in Civil Engineering" (ICRTCE-2024)** on 17th and 18th Dec 2024 to enhance the skills of desiring participants. The showcase of new ideas and the latest technological advancements through this Conference would facilitate the transfer of technology, helping participants to get updated with the latest tools and methodologies. I firmly believe that this Conference serves as the catalyst for change by bringing attention to pressing issues in different fields, encouraging discussions, fostering collaboration, and promoting initiatives that address different challenges on a global scale. It is an excellent opportunity to broaden our knowledge, establish meaningful connections, and contribute to advancing engineering research. I assure you that the commitment to excellence in education and research is reflected in this Conference, providing a unique platform for learning and growth. Around 70 research papers were submitted to this Conference. I wish the authors a promising future and the Conference a grand success.

I appreciate the continuous efforts and dedication of the HOD, CE and faculty members for their invaluable contribution to advancing global discourse. My most profound appreciation to the organizers and coordinators for organizing a conference of such caliber.

Dr. M. Srinivas Rao
Principal

Dr. Sanjay Kumar Suman

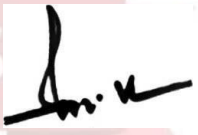
Dean R&D

MESSAGE

Research, curiosity and discovery has been in existence ever since man's presence on this planet millions of years ago, civilization has been characterized by curiosity and discovery. Therefore, the curiosity to explore what will happen, how it happens, is there a better way to do it, has been the driving force behind all research efforts. During the past few decades, the engineering faculties have taken a number of initiatives to reorient the engineering machinery to play leading roles in the industrial development process.

I am delighted to acknowledge the 4th International conference on **"Revolutionary Technology in Civil Engineering"** organized by the Department of Civil engineering. I appreciate organizing team for showing their keen interest in organizing a successful conference to provide a platform for contributors to explore new ideas and exchange research findings among researchers. I thank the support of all students, authors, reviewers, conference team, faculty members, and conference Convener for making the conference a grand success.

Best Wishes



Dr. Sanjay Kumar Suman

Dean R&D

Dr. S V S Rama Krishnam Raju

Dean Academics

MESSAGE

It gives me immense pleasure to know that St. Martin's Engineering College, Department of Civil Engineering is organizing 4th **"International Conference on Revolutionary Technology in Civil Engineering"** ICRTCE-2024. I am sure that this conference will provide a forum to national and international students, academicians, researchers and industrialists to interact and involve in Research and Innovation. Such academic events benefit the students, teachers and researchers immensely and widen the horizons of their knowledge and work experience in the field of Building Materials, Water Resource Engineering, Geotechnical Engineering and Innovation.

I sincerely appreciate the humble efforts of the Institute in providing a platform for students, academicians, researchers and industrialists to share their ideas and research outcome through the forum of this Conference.

I give my best wishes to all delegates and organizing committee to make this event a grand success.

Best Wishes

Dr. S V S Rama Krishnam Raju

Dean Academics

Dr. D V Sreekanth

Dean Administration

MESSAGE

The 4th International Conference on "**Revolutionary Technology in Civil Engineering**" ICRTCE-2024 has concluded its work successfully on 17th and 18th Dec 2024 in St. Martin's Engineering College (SMEC), Hyderabad, India. The ICRTCE-2024 was organized online by the Department of Civil Engineering, and the objective of this conference was to bring together experts from academic institutions, industries, research organizations for sharing of knowledge and experience in the recent trends and revolutionary technologies in civil engineering. The conference programme featured a wide variety of invited and contributed lectures from national and international speakers with expertise in their respective fields. The ICRTCE-2024 has become one of the most extensive, spectacular international events hosted by St. Martin's Engineering College (SMEC), for its high- level quality and the large size of participation. Well- known international and national invited speakers addressed the audience, shared knowledge, and rich experiences on Revolutionary Technology in Civil Engineering.

I am sure that this conference will provide a forum to national and international students, academicians, researchers and industrialists to interact and involve in Research and Innovation. Such academic events benefit the students, teachers and researchers immensely and widen the horizons of their knowledge.

Best Wishes

Dr. D V Sreekanth
Dean Administration

Prof. Sandhya Kiran J K

Convener and Head of the Department

MESSAGE

The world is always poised to move towards new and progressive engineering solutions that results in cleaner, safer and sustainable quality products for the use of mankind. India too is emerging as a big production center for world class. Civil Engineering plays a vital role in this endeavor.

The aim of the 4th International Conference on **" Revolutionary Technology in Civil Engineering"** being conducted by the Departments of Civil Engineering of SMEC, is to create a platform for academicians and researchers to exchange their innovative ideas and interact with researchers of the same field of interest. This will enable to accelerate the work to progress faster to achieve the individuals end goals, which will ultimately benefit the larger society of India.

We, the organizers of the conference are glad to note that 125 papers have been received forpresentation during the online conference. After scrutiny by editorial board 55 papers have been selected, and the authors have been informed to be there at the online platform for presentations. Stepshave been taken to publish these papers with ISBN number in the Conference Proceedings and all the selected papers will be published in Scopus/ UGC recognized reputed journals.

The editorial Committee and the organizers express their sincere thanks to all authors who have shown interest and contributed their knowledge in the form of technical papers. We are delighted and happy to state that the conference has moved towards a grand success with the untiring effort of faculties and staff members of SMEC and with the blessing of the Principal and Management of SMEC.

Prof. Sandhya Kiran J K
Convener and Head of the Department

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Mrs. K. Chaitra, Assistant Professor, Dept. of CE, SMEC.
Mr. G. Vamshi Prathap, Assistant Professor, Dept. of CE, SMEC.

TABLE OF CONTENTS

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0153

SUSTAINABLE DEVELOPMENT IN WATER SECTOR: IMPLEMENTATION OF IOT- ENABLED MONITORING & CONTROL SYSTEMS IN DAMS & RESERVOIRS

SandhyaKiran.J.K[1], K. Chaitra[2], G. Vamshi Prathap[3]

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ABSTRACT

Sustainable development in the water sector is imperative for ensuring the long-term availability and quality of water resources. This paper explores the implementation of Internet of Things (IoT)-enabled monitoring and control systems in dams and reservoirs to promote sustainable water management. IoT technology, with its network of sensors and connected devices, offers real-time data on water levels, flow rates, and structural integrity. This advanced monitoring capability allows for precise control and timely interventions, enhancing the efficiency and safety of water resource management. The integration of IoT systems in dams and reservoirs can lead to optimized water usage, reduced energy consumption, and minimized environmental impact. Furthermore, IoT-enabled systems facilitate predictive maintenance, reducing the risk of failures and enhancing the resilience of water infrastructure. The paper presents case studies of successful IoT technology deployments in water management, discusses technical and operational challenges, and outlines future research and development directions. The findings underscore the potential of IoT technologies to revolutionize sustainable water management practices.

Keywords: Sustainable Development, Internet of Things (IoT), Monitoring Systems, Water Management, Real-time Data, Resource Optimization.

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0154

FIRE RESISTANCE EVALUATION OF RECYCLED AGGREGATE CONCRETE: EXPERIMENTAL STUDY AND ANALYSIS

K. Chaitra[1], SandhyaKiran.J.K[2], G. Vamshi Prathap[3]

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ABSTRACT

To assess the fire resistance performance of recycled aggregate concrete (RAC) components with varying compressive strengths, four full-scale concrete columns were designed and tested under high-temperature conditions. Two of the specimens were constructed using normal concrete with compressive strengths of C20 and C30, while the other two were made from recycled coarse aggregate (RCA) concrete with compressive strengths of C30 and C40. These specimens were subjected to identical constant axial forces and exposed to simulated building fire conditions in a laboratory furnace. Various parameters from the experimental results were analyzed and compared, including temperature change, vertical displacement, lateral deflection, fire endurance, and failure characteristics. The temperature distribution within the specimens was simulated using ABAQUS Software (ABAQUS Inc., Providence, RI, USA), and the simulated results closely matched the experimental findings. The results indicate that the rate of heat transfer from the surface to the interior of the columns increases with higher concrete compressive strengths for both RAC and normal concrete columns. Under identical initial axial force ratios and column cross-sections, columns with lower concrete compressive strengths exhibited better fire resistance performance. Additionally, the RAC columns demonstrated superior fire resistance performance compared to the normal concrete columns with equivalent compressive strengths.

Keywords: recycled aggregate concrete (RAC) column; fire resistance; high-temperature test; temperature field; finite element method (FEM) analysis; concrete compressive strength

ISBN: 978-93-94246-26-3

Paper ID: ICRTCE-2024-0155

INVESTIGATION RELATED TO IMPACT OF DIFFERENTIAL TEMPERATURE ON SHEAR STRENGTH OF SOIL WITH SELECTED STUDY AREA

P. Guruswamy Goud[1], Sandhya Kiran.J.K[2], K. Chaitra[3], G. Vamshi Prathap[4]

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ABSTRACT

The study investigates the impact of differential temperature on the shear strength of soil, focusing on a selected study area. Soil shear strength is a critical parameter in geotechnical engineering, influencing the stability and performance of foundations, retaining structures, and slopes. Variations in temperature can alter soil properties such as moisture content, cohesion, and internal friction angle, which directly affect shear strength. This research evaluates how temperature fluctuations impact these parameters through laboratory experiments and field tests on soil samples under controlled conditions. The outcomes are compared to natural field conditions to establish a correlation between temperature variations and shear strength. The findings aim to contribute to improved geotechnical designs, particularly in regions experiencing significant thermal variations, thereby enhancing structural safety and resilience.

Keywords: Differential temperature, shear strength, soil properties, cohesion, internal friction angle, geotechnical engineering, thermal effects, soil behavior, structural stability.

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0156

THE ROLE OF COMPOSITE MATERIALS IN MODERN STRUCTURAL ENGINEERING

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ABSTRACT

Advanced composite materials exhibit excellent performance and offer broad engineering applications, garnering significant attention in recent years. These materials can be categorized into fiber-reinforced composites, laminated composites, matrix composites, and other types. This article provides a comprehensive overview of the various types and characteristics of advanced composite materials and evaluates the latest research on structural strengthening and resilience improvement from the perspectives of new methods, modeling optimization, and practical applications. In the realm of fiber-reinforced composite materials, hybrid technology combining carbon fiber and glass fiber achieves dual advantages, significantly enhancing mechanical properties. The maximum increases in mechanical properties of multilayer sandwich RH plates through hybrid technology are 435.4% in tensile strength, 149.2% in flexural strength, and 110.7-114.2% in shear strength. For laminated composite materials, varying the deposition sequence allows for different mechanical properties. In matrix composites, nano copper oxide particles prepared via nanotechnology can boost the hardness and tensile strength of the metal matrix material by 77% and 78%, respectively. Other composite materials, such as viscoelastic materials and magnetorheological variants, have also gained widespread attention. While the development of composite materials benefits from new methods and technologies, challenges such as complex preparation processes, high costs, and performance instability persist. To better meet practical engineering needs, further improvements and innovations in modeling and optimization are necessary, taking into account the characteristics, application requirements, cost, complexity, and performance of different composite materials. This includes applications of advanced composite materials in civil engineering, maritime vessels, automobiles, batteries, and other fields.

Keywords: advanced composite materials, structural strengthening, resilience improvement, fiber-reinforced composite materials, laminated composite materials, matrix composite materials

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0157

ARTIFICIAL INTELLIGENCE FOR REAL-TIME STRUCTURAL PERFORMANCE MONITORING

K. Prabhakar[1], SandhyaKiran.J.K[2], G. Vamshi Prathap[3], K. Chaitra[4]

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ABSTRACT

Structural performance monitoring is critical for ensuring the safety, reliability, and longevity of infrastructure. Traditional monitoring methods often involve manual inspections and periodic evaluations, which can be time-consuming and limited in scope. This project investigates the application of artificial intelligence (AI) for real-time structural performance monitoring to enhance the efficiency and accuracy of detecting and responding to structural issues. The study begins with an overview of current structural monitoring techniques and their limitations. It then introduces AI technologies, such as machine learning and deep learning, as tools for processing real-time data from various sensors installed on structures. These sensors collect data on parameters like strain, vibration, temperature, and displacement, which are essential for assessing structural health. The core of the project involves developing AI models capable of analyzing the collected data to detect anomalies, predict potential failures, and provide actionable insights. Machine learning algorithms are trained on historical data to identify patterns and correlations that signal structural issues. Deep learning models enhance this capability by learning complex relationships and improving predictive accuracy. The implementation strategy includes designing a robust data acquisition system that integrates with AI platforms, developing algorithms for real-time analysis, and creating a user-friendly interface for monitoring and decision-making. The system is tested in various scenarios to evaluate its effectiveness in detecting issues and generating alerts. Expected outcomes include improved accuracy in detecting structural anomalies, faster response times to potential problems, and enhanced overall safety. By continuously monitoring structural performance, the AI-based system aims to provide timely information that supports proactive maintenance and reduces the risk of structural failures.

Keywords: artificial intelligence (AI), Deep learning models, structural performance, structural failures.

ISBN: 978-93-94246-26-3

Paper ID: ICRTCE-2024-0206

IMPACT OF AUTONOMOUS VEHICLES ON URBAN TRANSPORTATION

***Challa Kalyani[1], SandhyaKiran.J.K[2], K. Chaitra[3], G. Vamshi Prathap[4]**
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ABSTRACT

Autonomous vehicles (AVs) represent a transformative technology poised to revolutionize urban transportation systems worldwide. This abstract explores the multifaceted impacts of AVs on urban mobility, infrastructure, and societal dynamics. AVs promise to enhance efficiency and safety by reducing traffic congestion and human error-related accidents. They have the potential to optimize traffic flow through advanced sensors and communication technologies, thereby minimizing travel times and fuel consumption. Additionally, AVs may facilitate the integration of shared mobility services, offering flexible and affordable transportation options that could potentially reduce private vehicle ownership. However, the widespread adoption of AVs also presents challenges. Urban infrastructure may require significant adaptation to accommodate AVs, including adjustments to road design, traffic management systems, and parking facilities. Furthermore, concerns about cyber security, liability issues, and ethical considerations surrounding AV decision-making algorithms must be addressed to ensure public trust and safety. This abstract concludes by highlighting the need for interdisciplinary research and collaborative efforts among policymakers, urban planners, engineers, and technology developers to harness the full potential of AVs while mitigating their potential drawbacks. By carefully navigating these challenges, cities can leverage autonomous vehicles to create more sustainable, efficient, and equitable urban transportation systems for future generations.

Keywords: Autonomous vehicles, cyber security, accidents, sustainable, efficient

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-207

DESIGN OF FLEXIBLE PAVEMENT BY VARIOUS METHODS AND THERE COST ANALYSIS

S. Priyanka[1], SandhyaKiran.J.K[2], K. Chaitra[3], G. Vamshi Prathap[4]

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ABSTRACT

Interstate and asphalt configuration assumes an essential part in the DPR ventures. The attractive execution of the asphalt will bring about higher reserve funds as far as vehicle working expenses and travel time, which has a direction on the general financial plausibility of the undertaking. This project area of study is Hyderabad to Yadhadri road (NH-163) is a wide road in Telangana state. This paper talks about the plan strategies that are generally being taken after and analyzes the "Outline of unbending and adaptable asphalts by different techniques and their cost examination by every strategy". Adaptable asphalt are favored over bond solid streets as they have an incredible preferred standpoint that these can be fortified and enhanced in stages with the development of activity and furthermore their surfaces can be processed and reused for recovery. The adaptable asphalts are more affordable likewise with respect to beginning speculation and support. Albeit rigid asphalt is costly however have less upkeep and having great outline period. The monetary part is completed for the outline asphalt of an area by utilizing the outcome get by plan strategy and their comparing segment layer thickness. It should be possible by drawing examinations with the standard way and reasonable way. This aggregate work incorporates accumulation of information investigation different adaptable and inflexible asphalt plans and their estimation technique is particularly helpful to build who manages interstates.

Keywords: Design of flexible pavement, Cost analysis, IRC- 64, IRC –37 (R-2012), Estimations etc.

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0158

ZOJI LA BIDIRECTIONAL TUNNEL: PIONEERING ALL-WEATHER CONNECTIVITY IN THE HIMALAYAS

Khushi Patel[1], Yerra Achyuth Rao[2], Thodishetty Abhinay[3], Prof. Sandhya Kiran J. K[4].

[1,2,3,] UG Students and [4,] Assistant professor, Department of Civil Engineering,
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ABSTRACT

The Himalayas are one of the most unstable regions in the world. Underground excavations are very challenging in this region due to the fragile geology, tectonic activities and complex geological structures. In the present study, three hydropower head race tunnel projects from Nepal, as well as six additional tunnel projects from Bhutan, India and Pakistan located at different parts of the Himalayas, are reviewed with a focus on the common problems encountered during the tunnelling and their possible causes and remedies. It is found that rock bursts often occurred around the overburden of 1000 m or higher, while tunnel squeezing problems were commonly observed in a wide range of overburden. Most of the rock failures occurred in sheared zones, thrusts and heavily weathered rock mass. The geological conditions around these projects are often characterized by significant presence of folds, faults, joints and inter bedding of different types of rock strata; they are so complex and diverse that it is often difficult to accurately predict the field condition from conventional geotechnical site investigation. In many cases, the presence of shear zones, thrusts and tectonic activities has a strong influence on the in situ stress. Review of these prominent projects suggests that the complicated dynamics between a wide range of geological and geotechnical factors play a critical role in the tunnelling in the Himalayas.

Keywords: Zoji la, tunnelling, tectonic, fragile geology, faults, joints, bedding.

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0159

PUSA DECOMPOSER METHOD FOR WASTE DEGRADATION FOR SOLID WASTE MANAGEMENT

Gurrala Nandhikar[1], Mary Manisha[2], Amraju Pavan[3], Prof. Sandhya Kiran J. K[4].

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St. Martin's Engineering College, Hyderabad, Telangana, India.
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ABSTRACT

Crop residue burning (CRB) poses a serious threat to the climate, soil fertility, human health and wellbeing, and air quality, which increases mortality rates and slumps agricultural productivity. This study conducts a pan-India analysis of CRB burning based on the spatial characteristic of crop residue management practices and analyzes the linkage among health, agriculture value addition, and regional finance using the simultaneous equation to find the causality and panel quintile regression for direct effect and intergroup difference. We discuss some of the alternative crop residue management practices and policy interventions. Along with in situ management, this paper discusses ex situ crop residue management (CRM) solutions. The ex situ effort to manage crop residue failed due to the scarcity of the supply chain ecosystem. Force of habit and time constrain coupled with risk aversion have made farmers reluctant to adopt these solutions. Our results show that financial viability and crop residue have bidirectional causality; therefore, both the central and state governments must provide a financial solution to lure farmers into adopting residue management practices. Our analysis shows that framers are likely to adopt the management solution (farmers have some economic benefits) and are reluctant to adopt the scientific solution because the scientific solution, such as "Pusa decomposer", is constrained by the weather, temperature, and humidity, and these parameters vary throughout India.

Keywords: CRB, soil fertility, crop residue management, pusa decomposer.

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0160

STUDY ON STRENGTH AND DURABILITY CHARACTERISTICS OF CONCRETE USING GOLD MINE WASTE

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ABSTRACT

The mining industry generates a substantial amount of waste materials, including tailings and waste rocks, which, if not managed correctly, pose threats to the environment and public health due to their long-term accumulation and disposal. Simultaneously, the construction sector consumes important amounts of natural resources like water and rocks. However, research shows that inert mining waste can serve as a substitute for conventional raw materials in construction, particularly in concrete. This review focuses on using mining waste as an alternative to concrete technology to promote cleaner practices in construction and circular economy in mining. Mining waste, with its physical characteristics and chemical composition, can function as diverse components in concrete, such as sand, aggregates, and binders. This article assesses these properties and explores their incorporation into concrete production, aiming to stimulate further research and development, foster environmentally responsible approaches, and underline the direct link to reaching SDGs to achieve sustainability in the construction industry.

Keywords: mining, waste rocks, conventional raw material, binders.

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0161

EXPERIMENTAL INVESTIGATION ON TURNING WASTE INTO WEALTH BY SUGARCANE STRAW ASH FOR SOIL AND CROP IMPROVEMENT

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ABSTRACT

Sugarcane (Saccharum officinarum) is one of the major crops cultivated in tropical and sub-tropical countries, and the primary purpose is to obtain raw sugar. It is an important substance for sugar and alcohol production by both the sugar and beverage industries. During cane processing, various byproducts are obtained, namely sugarcane bagasse, bagasse ash, press mud cake, sugarcane vinasse, and spent wash. There are many challenging problems in storage, and they cause great environmental pollution. This review discusses their properties by which they can be used for cleaner agricultural and environmental sustainability. Utilization of byproducts results in value-added soil properties and crop yield. Replacing chemical fertilization with these organic natured byproducts not only minimizes the surplus usage of chemical fertilizers but is also cost-effective and an eco-friendly approach. The drawbacks of the long-term application of these byproducts in the agricultural ecosystem are not well documented. We conclude that the agriculture sector can dispose of sugar industry byproducts, but proper systematic disposal is needed. The need arises to arrange some seminars, meetings, and training to make the farming community aware of by-products utilization and setting a friendly relationship between the farming community and industrialists.

Keywords: Saccharum officinarum, press mud cake, surplus usage, eco-friendly, chemical fertilizers

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0162

PROTECTION OF UNDERGROUND PIPELINE SYSTEMS USING SPECIAL INFUSED SOIL CUSHIONING-POLYSTYRENE GEOFOAM

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ABSTRACT

High-speed railway (HSR) lines commonly operate over hundreds of kilometres, crossing several other large-scale infrastructures, such as highways, tunnels, bridges, and pipelines. This fact makes adjacent infrastructure more vulnerable to high-speed train (HST)-induced vibrations; thus, their potential distress should be carefully examined. The current study aims to assess the level of traffic-induced vibrations on the surface of buried pipelines vertically crossing under an HSR line. Firstly, the necessity to reduce high vibration levels is highlighted, utilizing a three-dimensional (3D) finite element model in conjunction with the moving load approach. Subsequently, an efficient mitigation measure is proposed to minimize these vibrations. For this purpose, a low-weight, high-performance geosynthetic fill material, i.e., expanded polystyrene (EPS) geofoam blocks, has been implemented between the HSR line and the buried pipeline to minimize the impact of vibrations. In this manner, HST-induced vibrations are reflected on EPS blocks, preventing them from reaching the pipeline surface. Based on this detailed parametric study, useful conclusions are drawn regarding the mechanical properties and geometry of the EPS protection layer.

Keywords: High-speed railway (HSR), high-speed train (HST), expanded polystyrene (EPS), geofoam blocks

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0163

DEVELOPMENT OF A SMART IRRIGATION SYSTEM FOR URBAN LANDSCAPE

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ABSTRACT

Global drylands, covering about 41% of Earth's surface and inhabited by 38% of the world's population, are facing the stark challenges of water scarcity, low water productivity, and food insecurity. This paper highlights the major constraints to agricultural productivity, traditional irrigation scheduling methods, and associated challenges, efforts, and progress to enhance water use efficiency (WUE), conserve water, and guarantee food security by overviewing different smart irrigation approaches. Widely used traditional irrigation scheduling methods (based on weather, plant, and soil moisture conditions) usually lack important information needed for precise irrigation, which leads to over- or under-irrigation of fields. On the other hand, by using several factors, including soil and climate variation, soil properties, plant responses to water deficits, and changes in weather factors, smart irrigation can drive better irrigation decisions that can help save water and increase yields. Various smart irrigation approaches, such as artificial intelligence and deep learning (artificial neural network, fuzzy logic, expert system, hybrid intelligent system, and deep learning), model predictive irrigation systems, variable rate irrigation (VRI) technology, and unmanned aerial vehicles (UAVs) could ensure high water use efficiency in water-scarce regions. These smart irrigation technologies can improve water management and accelerate the progress in achieving multiple Sustainable Development Goals (SDGs), where no one gets left behind.

Keywords: drylands, water use efficiency (WUE), variable rate irrigation (VRI) technology, and unmanned aerial vehicles (UAVs).

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0164

GPS BASED TOLL COLLECTION SYSTEM FROM VEHICLES

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ABSTRACT

Expressway section speed can visually reflect the section operation condition, and accurate short time section speed prediction has a wide range of applications in path planning and traffic guidance. However, existing expressway speed prediction data have defects, such as sparse density and incomplete object challenges. Thus, this paper proposes a framework for a combined expressway traffic speed prediction model based on wavelet transform and spatial-temporal graph convolutional network (WSTGCN) of the Electronic Toll Collection (ETC) gantry transaction data. First, the framework pre-processes the ETC gantry transaction data to construct the section speeds. Then wavelet decomposition and single-branch reconstruction are performed on the section speed sequences, and the spatial features are captured by graph convolutional network (GCN) for each reconstructed single-branch sequence, and the temporal features are extracted by connecting the gated recurrent unit (GRU). The results indicate that the WSTGCN model makes notable improvements compared to the model of the baseline for different prediction ranges.

Keywords: Expressway, Electronic Toll Collection (ETC), wavelet transform and spatial-temporal graph convolutional network (WSTGCN), by graph convolutional network (GCN), gated recurrent unit (GRU)

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0165

SMART SOIL SOLUTIONS: INTEGRATING E-SOIL AND HYDROPHONES FOR ADVANCED CIVIL ENGINEERING

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ABSTRACT

The latest progress in information and communication technology (ICT) and the Internet of Things (IoT) have opened up new opportunities for real-time monitoring and controlling of cities' structures, infrastructures, and services. In this context, smart water management technology provides the data and tools to help users more effectively manage water usage. Data collected with smart water devices are being integrated with building management systems to show how much water is used by occupants as well as to identify the consumption areas to use water more efficiently. By this approach, smart buildings represent an innovative solution that enhances a city's sustainability and contributes to overcoming environmental challenges due to increasing population and climate change. One of the main challenges is resource-saving and recovery. Water is an all-important need of all living beings, and the concerns of its scarcity impose a transition to innovative and sustainable management starting from the building scale. Thus, this manuscript aims to provide an updated and valuable overview for researchers, consumers, and stakeholders regarding implementing smart and sustainable technologies for water resource management, primarily for building-scale uses.

Keywords: information and communication technology (ICT), Internet of Things (IoT), water resource management, smart water devices

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0166

STUDY ON GREENING THE BUILDING INDUSTRY BY AGRO CRETE BLOCKS AS ECO-FRIENDLY ALTERNATIVES

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ABSTRACT

The fabrication of bricks commonly consumes relatively high natural resources. To reduce the carbon footprint in the brick production industry, repurposing industrial wastes in the making of sustainable bricks is a recent trend in research and application. Local wastes, such as oil palm shell (OPS), palm oil fuel ash (POFA), and quarry dust (QD), are massively produced annually in the palm oil-exporting countries. Moreover, QD from mining industries is hazardous to both water and air quality. For better waste management in marching towards sustainability, these wastes should be given their second life as construction materials. Therefore, this paper investigates the possibility of incorporating agro-industrial wastes into the brick mixture by examining their properties by means of several standardized tests. For the mix design, a 100% replacement of coarse aggregate with OPS, 20% replacement of cement with POFA, 20% cement weight of limestone as admixture, and 0 to 50% replacements of fine aggregate with QD are experimentally considered. The optimum mix of these wastes is preliminarily determined by focusing on high compressive strength as an indicator. Other examinations include splitting tensile, flexural strength, water absorption, and efflorescence tests. Although the agro-industrial waste cement brick is 18% lower in the strength to weight ratio compared to that of conventional, it is observed that it has better late strength development due to its POFA pozzolanic properties. Moreover, the proposed green cement brick is further checked for compliance with several standards for feasible use in the construction industry. Financially, the cost for the brick with the new mix design is almost equivalent to that of conventional. Hence, this green cement brick is reasonable to be employed in the construction industry to promote material sustainability for better waste management.

Keywords: oil palm shell (OPS), palm oil fuel ash (POFA), and quarry dust (QD), efflorescence tests and pozzolanic properties.

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0167

REDUCING CHALLENGES OF WATER CRISIS IN BANGALORE RECOMMENDING RAIN WATER HARVESTING

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ABSTRACT

Rainwater harvesting is an ancient practice currently used for flood and drought risk mitigation. It is a well-known solution with different levels of advanced technology associated with it. This study is aimed at reviewing the state of the art with regards to rainwater harvesting, treatment, and management. It focuses on the environmental and social benefits of rainwater harvesting and links them to the Sustainable Development Goals. The review identifies characteristics of laws and regulations that encourage this practice and their current limitations. It presents methodologies to design a rainwater harvesting system, describes the influence of design variables, and the impact of temporal and spatial scales on the system's performance. The manuscript also analyses the most advanced technologies for rainwater treatment, providing insights into various processes by discussing diverse physiochemical and biological technology options that are in the early stages of development. Finally, it introduces trends and perspectives which serve to increase rainwater harvesting, water reuse, and effective management.

Keywords: Rainwater harvesting, Sustainable Development Goals (SDG), temporal and spatial scales.

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0168

STUDY ON CONCRETE CURING METHODS AND THEIR IMPACT ON STRENGTH DEVELOPMENT

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ABSTRACT

The application of pre-cast components in building structures has become increasingly widespread, with projects often utilizing steam curing methods. The utilization of pre-fabricated concrete has demonstrated the capacity to enhance construction efficiency. However, strength and durability issues arising from steam curing of concrete have become prominent considering the quality of concrete construction. The use of fly ash and slag in steam-cured concrete to improve its performance has gained extensive popularity. While research into single-blended mineral admixtures has been conducted with notable achievements, the study of steam-cured concrete with binary blended mineral admixtures remains relatively limited. This paper focuses on the mechanical properties and durability of steam-cured concrete with mineral admixtures (fly ash and slag), exploring the influence of mineral admixture ratios and steam-curing regimes on the mechanical properties and durability of concrete. The properties of the steam-cured concrete were further analyzed through compressive strength tests, mercury intrusion porosimetry, and thermo gravimetric analyses. It was found that when fly ash and slag were added in equal proportions, the compressive strength and microstructure of the concrete were optimized. In addition, the optimized static resting time and constant temperature time should be controlled as 3 h and 6 h, respectively, to improve the compressive strength and microstructure of the steam-cured concrete.

Keywords: pre-cast components, pre-fabricated concrete, steam-cured concrete, mineral admixtures (fly ash and slag).

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0169

PAVING THE FUTURE BY SUSTAINABLE FLEXIJUTE NANOTECH SOLUTIONS

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ABSTRACT

Innovative advancements in sustainable technologies are crucial for addressing contemporary environmental challenges. "FlexiJute Nanotech Solutions" represents a pioneering approach to sustainability through the integration of flexible jute-based materials with cutting-edge nanotechnology. This abstract explores the potential of FlexiJute Nanotech Solutions in revolutionizing various industries by offering eco-friendly alternatives to conventional materials. By harnessing the inherent strength and versatility of jute fibers combined with nano-technological enhancements, these solutions aim to significantly reduce carbon footprints while maintaining high performance standards. The abstract delves into the transformative potential of FlexiJute Nanotech Solutions across sectors such as construction, automotive, and consumer goods, highlighting their role in paving a sustainable path for future generations.

Keywords: FlexiJute Nanotech, nano-technological enhancements, eco-friendly, environmental challenges.

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0170

STRENGTH AND DURABILITY CHARACTERISTICS OF TERNARY BLENDING CONCRETE

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ABSTRACT

At present, reducing carbon emissions is an urgent problem that needs to be solved in the cement industry. This study used three mineral admixtures materials: limestone powder (0–10%), metakaolin (0–15%), and fly ash (0–30%). Binary, ternary, and quaternary pastes were prepared, and the specimens' workability, compressive strength, ultrasonic pulse speed, surface resistivity, and the heat of hydration were studied; X-ray diffraction and attenuated total reflection Fourier transform infrared tests were conducted. In addition, the influence of supplementary cementitious materials on the compressive strength and durability of the blended paste and the sustainable development of the quaternary-blended paste was analyzed. The experimental results are summarized as follows: (1) metakaolin can reduce the workability of cement paste; (2) the addition of alternative materials can promote cement hydration and help improve long-term compressive strength; (3) surface resistivity tests show that adding alternative materials can increase the value of surface resistivity; (4) the quaternary-blended paste can greatly reduce the accumulated heat of hydration; (5) increasing the amount of supplementary cementitious materials can effectively reduce carbon emissions compared with pure cement paste. In summary, the quaternary-blended paste has great advantages in terms of durability and sustainability and has good development prospects.

Keywords: Binary, ternary, and quaternary pastes, heat of hydration, metakaolin, sustainability.

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0171

ASSESSMENT OF CONCRETE DETERIORATION AND REPAIR TECHNIQUES IN MARINE ENVIRONMENTS

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ABSTRACT

Modern engineering faces challenges in ensuring technical standards for service, durability, and sustainability. Political, administrative, and budgetary factors, coupled with climate change, pose tasks to structural integrity, affecting industries and economies. Marine infrastructures represent a strategic asset of a country as they handle a large part of the economic exchanges. This article analyzes five essential factors that play a fundamental role in the performance analysis of coastal structures: chloride-induced corrosion, degradation models, maintenance strategies, monitoring, and climate change. We start with reinforcement corrosion, which is considered as the main cause of distress, particularly in coastal zones, for the long-term behavior of structures. Additional pressure from the influences of climate change is becoming evident and extreme, leading to a reduction in capacity. To guarantee the lifespan of infrastructures, degradation models contribute by estimating the long-term performance of the asset as a strategic piece to the development of effective maintenance solutions. Artificial Neural Networks (ANNs) have gained recent prominence in this field due to their ability to learn intricate patterns from historical data, making them valuable instruments for predicting structural deterioration. Additionally, quantifying the condition of the structure from monitoring data plays a crucial part in providing information on the current situation of the structure. Finally, this review summarizes the challenges associated with the maintenance of aging marine structures considering aspects such as corrosion, monitoring, and the future challenges this area will face due to climate change.

Keywords: coastal zones, Artificial Neural Networks (ANNs), structural deterioration, corrosion.

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0172

MAKING GREEN POROUS CONCRETE FOR RAIN WATER HARVESTING AND URBAN PAVEMENTS

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ABSTRACT

Due to urbanization and improper drainage, flooding is a common phenomenon. The pavements and courtyards are presently covered with impervious concrete cement blocks which will not allow rain and drain water to percolate and reach groundwater table. Most of the cities get flooded even with little rainfall due to poor infiltration and drainage. Moreover, these concrete surfaces emit thermal radiation and create heat islands and enhance the global climatic temperature. If paving material is of pervious nature, it will enhance rain water harvesting and will recharge groundwater aquifers below urban areas. But all the available paving materials are impervious and heat emitting in nature, which creates health hazards too. In order to solve this problem, a cost effective, pervious concrete pavement block with a green cover on the top can be made from locally available materials. The more void space in this pavement blocks will allow water to percolate freely downwards and allow grass to be cultured and grown on top of this pavement block other than green aesthetic look and cool eco-friendly environment.

Keywords: urbanization, improper drainage, flooding, pervious concrete pavement block.

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0173

MICROBIAL-INDUCED CALCIUM CARBONATE PRECIPITATION FOR SOIL IMPROVEMENT

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ABSTRACT

Microbial-Induced Calcium Carbonate Precipitation (MICP) is a bio-mediated ground improvement technique that has garnered significant attention for its potential in sustainable soil stabilization. This process involves the use of ureolytic bacteria, such as Sporosarcina pasture, to hydrolyze urea, leading to the production of carbonate ions. These ions react with calcium ions present in the soil to form calcium carbonate ($CaCO_3$), which acts as a cementing agent that binds soil particles together, enhancing the soil's mechanical properties. MICP offers a promising alternative to conventional chemical soil stabilization methods by leveraging natural processes, thereby reducing the environmental footprint. This technique has been successfully applied in various geotechnical applications, including erosion control, liquefaction mitigation, and slope stabilization. The efficacy of MICP is influenced by factors such as bacterial concentration, nutrient availability, and environmental conditions. Current research focuses on optimizing these parameters and understanding the long-term behaviour of bio-cemented soils. This abstract reviews the principles of MICP, its applications, and the challenges associated with its implementation, highlighting its potential as a sustainable solution for soil improvement.

Researchers are focused on optimizing the parameters that affect MICP, such as the type and concentration of bacteria, the composition of the nutrient solution, and the environmental conditions.. MICP presents a sustainable and effective solution for soil improvement, leveraging natural biological processes to achieve soil stabilization. By understanding and optimizing the factors influencing MICP, and addressing the challenges related to its implementation, this technique has the potential to transform the field of geotechnical engineering, offering a green alternative to traditional soil stabilization.

Keywords: Microbial-Induced Calcium Carbonate Precipitation (MICP), hydrolyse urea, soil stabilization, bacterial concentration.

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0174

INTERNET - CONNECTED BRIDGES AND TUNNELS

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ABSTRACT

The advent of internet-connected bridges and tunnels marks a transformative era in infrastructure management and civil engineering, leveraging the Internet of Things (IoT) and advanced data analytics to revolutionize the way these critical structures are monitored, maintained, and operated. This detailed abstract explores the multifaceted benefits and technological innovations underpinning internet-connected bridges and tunnel. At the core of internet-connected infrastructure is an array of sophisticated sensors and IoT devices embedded throughout the structure. These devices continuously monitor various parameters, including stress, strain, vibration, temperature, and humidity. For example, accelerometers and strain gauges detect even minor deformations or vibrations that could indicate potential structural issues. This real-time data collection enables engineers to assess the health of the structure continuously and identify signs of wear and tear or damage long before they become critical, thereby preventing catastrophic failures. The integration of advanced data analytics with sensor networks allows for predictive maintenance, a paradigm shift from traditional reactive maintenance approaches. By analyzing patterns and trends in the data, predictive algorithms can forecast when and where maintenance is required, optimizing resource allocation and reducing downtime. This proactive approach not only extends the lifespan of the infrastructure but also ensures that maintenance activities are more cost-effective and timely. Smart traffic management systems are integral to internet-connected bridges and tunnels. These systems utilize real-time traffic data to optimize traffic flow, reduce congestion, and improve overall efficiency. For instance, adaptive traffic signals and dynamic lane management can adjust in response to current traffic conditions, mitigating bottlenecks and enhancing the travel experience. Additionally, automated toll collection systems streamline operations and reduce the need for physical toll booths, further easing traffic flow. Furthermore, real-time video surveillance and communication networks provide critical situational awareness during emergencies, enabling faster and more coordinated responses.

Keywords: internet-connected bridges, Automated alert systems, Internet of Things (IoT), structural integrity.

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0175

SMART GRID INTEGRATION WITH CIVIL INFRASTRUCTURE

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ABSTRACT

The integration of smart grids with civil infrastructure is a pivotal advancement in modern energy management and urban planning. A smart grid—an intelligent electrical network using digital communication technology—facilitates efficient and reliable electricity distribution by dynamically managing demand, enhancing sustainability, and supporting renewable energy sources. Coupling this technology with civil infrastructure, such as buildings, transportation systems, and public utilities, enables optimized energy usage, real-time monitoring, and a reduced carbon footprint. Smart infrastructure embedded with sensors, smart meters, and automated controls allows seamless energy distribution, aligning consumption with grid conditions to reduce peak loads and support distributed energy resources like solar panels and electric vehicle (EV) charging stations.

This integration not only fosters energy efficiency and resilience but also advances the development of smart cities. Key benefits include lower operational costs, enhanced energy security, and reduced environmental impacts. However, challenges such as cybersecurity, initial infrastructure costs, and regulatory requirements must be addressed. This paper examines the technical, economic, and environmental implications of smart grid-civil infrastructure integration, highlighting its role in sustainable urban development.

Keywords: Smart Grid, Civil Infrastructure, Energy Management, Renewable Energy Integration, Smart Cities, Distributed Energy Resources, Real-Time Monitoring, Energy Efficiency, Sustainability, Cybersecurity, Urban Development.

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0176

ADVANCED EARTHQUAKE ENGINEERING

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ABSTRACT

Advanced Earthquake Engineering is a critical field dedicated to enhancing the resilience of structures and infrastructure in regions prone to seismic activity. This discipline applies cutting-edge technologies, computational modeling, and innovative design methodologies to understand and mitigate the impact of earthquakes on buildings, bridges, roads, and other critical facilities. Advanced Earthquake Engineering encompasses a wide range of strategies, including seismic hazard assessment, structural retrofitting, base isolation, and the use of energy-dissipating devices.

Through sophisticated simulations, researchers and engineers can predict structural responses to different earthquake scenarios, allowing for the design of structures that absorb and dissipate seismic forces. Additionally, materials science contributes to the development of high-performance materials that enhance durability and energy absorption. The field also leverages real-time monitoring systems and Internet of Things (IoT) sensors embedded within infrastructure to monitor seismic activities and structural health, enabling rapid response and assessment post-earthquake.

This paper explores the latest innovations in Advanced Earthquake Engineering, including performance-based design, smart materials, and real-time structural monitoring. It also addresses the challenges in implementing these techniques, such as cost constraints, regulatory compliance, and the need for interdisciplinary collaboration. Ultimately, this field plays a vital role in building resilient communities and minimizing earthquake-related damages and loss of life.

Keywords: Advanced Earthquake Engineering, Seismic Hazard Assessment, Structural Resilience, Base Isolation, Energy Dissipation, Computational Modeling, Seismic Retrofitting, Performance-Based Design, Smart Materials, Structural Monitoring, Earthquake-Resistant Design, Disaster Mitigation, Resilient Infrastructure

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0177

CRYOGENIC CONSTRUCTION TECHNIQUES

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ABSTRACT

Cryogenic Construction Techniques involve the specialized methods and materials used to build infrastructure capable of withstanding extremely low temperatures. These techniques are essential in industries such as energy, aerospace, and pharmaceuticals, where cryogenic environments (typically below -150°C) are required for storage, transport, and processing of liquefied gases like LNG (liquefied natural gas), hydrogen, and oxygen. Cryogenic construction demands unique engineering approaches to ensure structural integrity, material durability, and thermal efficiency in subzero conditions.

The primary challenges in cryogenic construction include selecting materials that maintain strength and flexibility at low temperatures, preventing thermal expansion and contraction-induced stresses, and ensuring insulation to minimize energy loss. Techniques often involve the use of specialized alloys, composite materials, and advanced insulation technologies to prevent brittleness and leakage. Additionally, joint designs, welding methods, and safety protocols must be adapted for low-temperature performance to prevent fractures and ensure durability over time.

This paper examines the key materials, technologies, and design principles used in cryogenic construction, as well as the challenges in implementing them, including high costs, technical expertise requirements, and rigorous safety standards. The potential for cryogenic infrastructure to support emerging clean energy sectors, such as hydrogen, is also discussed. Cryogenic Construction Techniques are thus critical in developing resilient infrastructure that supports industries relying on ultra-low temperature processes.

Keywords: Cryogenic Construction, Low-Temperature Engineering, Liquefied Natural Gas (LNG), Cryogenic Materials, Thermal Insulation, Structural Integrity, Cryogenic Storage, Hydrogen Infrastructure, Advanced Alloys, Thermal Expansion, Low-Temperature Welding, Energy Efficiency, Clean Energy

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0178

SUSTAINABLE COASTAL ENGINEERING

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ABSTRACT

Sustainable Coastal Engineering is a field focused on designing, constructing, and managing coastal infrastructure and ecosystems in a way that balances human needs with environmental sustainability. As climate change accelerates sea level rise and intensifies storm events, the necessity for sustainable and resilient coastal solutions has become paramount. This discipline combines engineering principles with ecological preservation, promoting approaches that mitigate coastal erosion, prevent flooding, and protect marine habitats while minimizing adverse environmental impacts.

Key strategies in Sustainable Coastal Engineering include the use of nature-based solutions, such as the restoration of mangroves, coral reefs, and salt marshes, which provide natural barriers to coastal erosion and flooding. Additionally, the implementation of green infrastructure, like living shorelines, integrates natural landscapes with structural protections. Advanced modeling techniques and real-time monitoring systems are also used to assess the impact of coastal interventions on ecosystems and communities, ensuring that engineered solutions are adaptive and resilient over time.

This paper discusses innovative techniques in Sustainable Coastal Engineering, including the use of renewable materials, adaptive coastal management practices, and hybrid solutions that combine natural and built environments. It also addresses challenges such as balancing development with conservation, securing funding, and addressing regulatory barriers. The ultimate goal of Sustainable Coastal Engineering is to protect coastal communities while enhancing the health and resilience of coastal ecosystems.

Keywords: Sustainable Coastal Engineering, Climate Resilience, Nature-Based Solutions, Coastal Erosion Control, Flood Protection, Marine Habitat Preservation, Green Infrastructure, Living Shorelines, Sea Level Rise, Adaptive Management, Renewable Materials, Coastal Ecosystems, Hybrid Coastal Solutions

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0179

INTEGRATED WATER RESOURCE MANAGEMENT

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ABSTRACT

Integrated Water Resource Management (IWRM) is a holistic approach to managing water resources in a way that balances social, economic, and environmental needs. With growing pressures from population growth, urbanization, climate change, and industrial demands, IWRM seeks to optimize water use, improve water quality, and ensure equitable access. The approach involves coordinated planning and management of water, land, and related resources to maximize economic and social welfare without compromising the sustainability of vital ecosystems.

IWRM promotes cross-sectoral collaboration among stakeholders—governments, industries, communities, and environmental organizations—to develop adaptive management strategies that address diverse challenges such as water scarcity, pollution, ecosystem degradation, and flood risks. Techniques in IWRM include demand management, pollution control, watershed management, and the use of sustainable infrastructure, such as constructed wetlands and green stormwater systems. Advanced modeling, data collection, and real-time monitoring technologies also play a significant role in facilitating informed decision-making and enabling responsive management in dynamic water environments.

This paper explores the principles and practices of IWRM, highlighting its application in urban, agricultural, and industrial contexts. Key challenges, including regulatory constraints, financial limitations, and the need for public participation, are also discussed. IWRM ultimately aims to create a resilient and sustainable water management framework capable of adapting to future demands and environmental changes.

Keywords: Integrated Water Resource Management, Water Sustainability, Cross-Sectoral Collaboration, Water Scarcity, Watershed Management, Pollution Control, Ecosystem Sustainability, Demand Management, Climate Adaptation, Sustainable Infrastructure, Water Quality, Stakeholder Engagement, Adaptive Management

ISBN: 978-93-94246-26-3

Paper ID: ICRTCE-2024-0180

SMART PAVEMENTS

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ABSTRACT

Smart Pavements represent an innovative approach to road infrastructure, integrating technology into traditional pavement systems to enhance safety, efficiency, and sustainability in transportation networks. By embedding sensors, communication technologies, and energy-harvesting systems, smart pavements can monitor traffic flow, detect structural damage, and provide real-time data to road operators and autonomous vehicles. This data enables predictive maintenance, reducing repair costs and extending pavement lifespan while enhancing road safety and traffic management.

Applications of smart pavement technology include real-time monitoring of temperature, weight, and strain, which allows for proactive identification of wear and stress points. Additionally, some smart pavements incorporate solar panels or piezoelectric materials to generate energy, which can power street lighting, charge electric vehicles, or support road sensors. The integration with IoT and V2X (vehicle-to-everything) communication systems further supports the development of intelligent transportation systems, helping vehicles navigate road conditions, avoid hazards, and improve fuel efficiency.

This paper explores the key technologies and materials used in smart pavement systems, discussing their benefits, costs, and environmental impact. The challenges associated with smart pavement deployment, including high initial costs, technological complexity, and the need for regulatory frameworks, are also examined. Smart pavements are a cornerstone in developing sustainable, efficient, and adaptable urban infrastructure for modern smart cities.

Keywords: Smart Pavements, Intelligent Transportation Systems, IoT, V2X Communication, Real-Time Monitoring, Predictive Maintenance, Traffic Management, Autonomous Vehicles, Energy Harvesting, Solar Pavement, Piezoelectric Materials, Road Safety, Sustainable Infrastructure

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0181

SUSTAINABLE RIVER ENGINEERING

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ABSTRACT

Sustainable River Engineering is a multidisciplinary approach focused on the design, management, and restoration of river systems to balance human needs with ecological health. This field addresses the challenges posed by urbanization, agriculture, climate change, and industrial activities, which can degrade river ecosystems and increase flood risks. Sustainable river engineering promotes practices that protect water quality, enhance biodiversity, and restore natural flow regimes, while supporting flood control, irrigation, and recreational uses.

Key techniques in sustainable river engineering include riverbank stabilization with bioengineering methods, restoration of natural river meanders, sediment management, and the construction of green infrastructure, such as wetlands and riparian buffers. These nature-based solutions reduce erosion, improve water filtration, and provide habitats for diverse species. Advanced hydrological modeling and data collection technologies also play a significant role in assessing river dynamics and enabling adaptive management that responds to changing environmental conditions.

This paper examines sustainable river engineering practices and their applications, with a focus on the use of eco-friendly materials, nature-based solutions, and adaptive design. It also discusses challenges, such as balancing development with ecosystem preservation, managing stakeholder interests, and meeting regulatory standards. Ultimately, sustainable river engineering aims to create resilient river systems that support both human communities and natural ecosystems over the long term.

Keywords: Sustainable River Engineering, River Restoration, Flood Management, Bioengineering, Riverbank Stabilization, Nature-Based Solutions, Hydrological Modeling, Sediment Management, Riparian Buffers, Green Infrastructure, Ecosystem Resilience, Water Quality, Climate Adaptation

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0182

ENERGY HARVESTING FROM ROADWAYS

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ABSTRACT

Energy harvesting from roadways is an emerging field focused on converting the kinetic, thermal, and vibrational energy generated by vehicles into usable electrical power. This approach involves embedding energy-harvesting technologies, such as piezoelectric materials, thermoelectric devices, and solar cells, into road surfaces, capturing energy that would otherwise be lost. By transforming transportation infrastructure into a source of renewable energy, energy-harvesting roadways can reduce reliance on fossil fuels, provide localized power sources, and support smart city developments.

Key technologies in roadway energy harvesting include piezoelectric materials that generate electricity from the pressure and vibrations caused by vehicle movement, thermoelectric materials that convert temperature differences between the road surface and sublayers into power, and photovoltaic cells embedded within or adjacent to the road. This energy can be used to power street lighting, traffic signals, sensors, and even electric vehicle (EV) charging stations, thereby enhancing energy efficiency and infrastructure resilience.

This paper examines the potential of energy-harvesting roadways, detailing the types of materials and technologies used, benefits, and potential applications. Challenges, such as high initial costs, durability under heavy traffic, and efficiency limitations, are also discussed. The development of energy-harvesting roadways represents a promising step towards more sustainable, self-sufficient infrastructure, contributing to cleaner energy and smart transportation systems.

Keywords: Energy Harvesting, Roadways, Piezoelectric Materials, Thermoelectric Devices, Solar Cells, Kinetic Energy, Renewable Energy, Smart Cities, Infrastructure Resilience, Sustainable Transportation, Electric Vehicle Charging, Traffic Sensors, Photovoltaic Roadways

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0183

CARBON FOOTPRINT REDUCTION IN CONSTRUCTION PROJECTS

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ABSTRACT

Carbon footprint reduction in construction projects is a critical focus area for the construction industry, which is responsible for a significant portion of global greenhouse gas emissions. Achieving sustainability in construction requires adopting practices and technologies that minimize carbon emissions during the design, material selection, construction, and operation phases of a project. This approach not only helps mitigate climate change but also improves resource efficiency, reduces energy consumption, and promotes environmentally responsible construction methods.

Key strategies for reducing the carbon footprint in construction projects include the use of low-carbon and recycled materials, such as sustainable concrete, steel, and timber, along with energy-efficient building designs that reduce operational energy demand. Incorporating renewable energy sources, such as solar panels and wind turbines, into the design and construction phases further lowers emissions. Advanced building technologies, such as energy-efficient HVAC systems, green roofing, and smart insulation, contribute to long-term sustainability. Additionally, optimizing construction logistics and implementing waste reduction practices, including the reuse of materials and efficient transportation methods, also play an essential role in minimizing carbon emissions.

This paper explores the principles, technologies, and techniques used in carbon footprint reduction in construction projects. It highlights the importance of life cycle assessments (LCAs) to evaluate the environmental impact of construction activities, and discusses the challenges of balancing cost, regulations, and sustainability goals. Ultimately, reducing the carbon footprint of construction projects is essential for the industry to align with global climate goals and ensure a sustainable built environment.

Keywords: Carbon Footprint, Construction Projects, Sustainability, Low-Carbon Materials, Energy Efficiency, Renewable Energy, Green Building Design, Waste Reduction, Life Cycle Assessment (LCA), Sustainable Construction, Environmental Impact, Energy-Efficient Systems, Climate Change Mitigation

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0184

OFFSHORE WIND FARMS AND CIVIL ENGINEERING

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ABSTRACT

Offshore wind farms represent a rapidly growing segment of renewable energy generation, harnessing the power of wind over the ocean to produce electricity. These large-scale systems are particularly important for reducing dependence on fossil fuels and addressing climate change. Civil engineering plays a pivotal role in the design, construction, and maintenance of offshore wind farms, as it involves the development of robust infrastructure capable of withstanding harsh marine environments, such as strong winds, waves, and corrosive saltwater.

Key civil engineering challenges in offshore wind farm development include the design and installation of foundations, the development of offshore substations, and the integration of electrical systems. Foundations, which are essential for anchoring wind turbines in deep waters, come in various forms, including monopiles, jacket structures, and floating platforms. These structures must be designed to endure dynamic marine conditions and ensure long-term stability. Civil engineering also supports the installation of subsea cables for power transmission, ensuring reliable connectivity between the turbines and the mainland grid.

This paper explores the essential civil engineering considerations in offshore wind farm projects, focusing on site selection, environmental impact assessments, foundation design, transportation logistics, and safety protocols. It also addresses the challenges of financing, regulatory compliance, and technological innovations required to reduce costs and improve efficiency. Offshore wind farms are a critical component of the transition to a sustainable energy future, and civil engineering expertise is central to their successful implementation.

Keywords: Offshore Wind Farms, Civil Engineering, Renewable Energy, Marine Infrastructure, Foundation Design, Monopiles, Floating Platforms, Subsea Cables, Power Transmission, Environmental Impact, Offshore Substations, Wind Turbine Installation, Sustainable Energy, Offshore Construction

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0185

SEISMIC ISOLATION SYSTEMS

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ABSTRACT

Seismic isolation systems are advanced engineering solutions designed to protect structures from the damaging effects of earthquakes by decoupling the building or infrastructure from ground motion. These systems allow for relative movement between the superstructure and the foundation, effectively reducing the seismic forces transmitted to the building. By isolating the structure from ground vibrations, seismic isolation improves the safety and longevity of buildings, bridges, and other critical infrastructure in earthquake-prone regions.

Common types of seismic isolation systems include elastomeric bearings, sliding bearings, and hybrid systems that combine different mechanisms to provide optimal performance. Elastomeric bearings, often made from layers of rubber and steel, are highly effective in absorbing energy and reducing seismic forces. Sliding bearings allow for horizontal displacement, accommodating ground motion while minimizing structural damage. Advanced technologies, such as smart materials and active control systems, are also being integrated into seismic isolation to enhance performance during large earthquakes.

This paper explores the principles, design considerations, and benefits of seismic isolation systems, highlighting their role in improving earthquake resilience. It also addresses the challenges of system installation, maintenance, and cost, and discusses their application in both new construction and the retrofitting of existing structures. Seismic isolation systems are essential tools in modern earthquake engineering, offering a proactive solution to safeguard human life and protect valuable infrastructure from seismic hazards.

Keywords: Seismic Isolation, Earthquake Engineering, Structural Resilience, Elastomeric Bearings, Sliding Bearings, Hybrid Systems, Seismic Protection, Earthquake Resistance, Smart Materials, Active Control Systems, Building Safety, Seismic Retrofit, Earthquake Mitigation

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0186

OPTIMIZATION OF CONSTRUCTION SUPPLY CHAINS

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ABSTRACT

Optimization of construction supply chains is a crucial strategy for enhancing efficiency, reducing costs, and improving the overall performance of construction projects. Construction supply chains involve the coordination of materials, labor, equipment, and logistics to ensure timely delivery, cost-effectiveness, and quality control. Inefficiencies in this complex process can lead to delays, budget overruns, and suboptimal resource utilization. Therefore, optimizing the construction supply chain is essential for delivering projects on time and within budget, while maintaining high-quality standards.

Key strategies for supply chain optimization in construction include the implementation of just-in-time (JIT) inventory systems, advanced scheduling, and predictive analytics to anticipate demand fluctuations and minimize material waste. Additionally, the integration of digital tools like Building Information Modeling (BIM), Enterprise Resource Planning (ERP) systems, and supply chain management software helps streamline procurement, communication, and coordination among various stakeholders. Automation and robotics are also being explored to improve material handling, logistics, and on-site assembly, reducing manual labor and increasing productivity.

This paper discusses various approaches to optimizing construction supply chains, focusing on technology-driven solutions, lean construction techniques, and collaboration among suppliers, contractors, and project managers. Challenges such as supply chain disruptions, vendor management, and the impact of external factors like labor shortages and transportation delays are also addressed. Ultimately, an optimized construction supply chain is vital for enhancing project outcomes, minimizing environmental impact, and driving the sustainability of the construction industry.

Keywords: Construction Supply Chain, Supply Chain Optimization, Just-in-Time Inventory, Building Information Modeling (BIM), Lean Construction, Predictive Analytics, Supply Chain Management, Automation, Robotics, Project Efficiency, Procurement, Logistics, Sustainability, Digital Tools, Vendor Management

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0187

SUSTAINABLE MINING PRACTICES

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ABSTRACT

Sustainable mining practices aim to balance resource extraction with environmental, social, and economic considerations to ensure long-term viability and minimal ecological impact. These practices involve reducing greenhouse gas emissions, conserving water, using renewable energy, and rehabilitating mined land to restore ecosystems. Additionally, sustainable mining emphasizes stakeholder engagement, community development, and responsible waste management to create a positive socio-economic impact while protecting biodiversity. By integrating advanced technologies and innovative strategies, the mining industry can align with global sustainability goals and contribute to a more equitable and environmentally conscious future.

Keywords:

Sustainable mining, environmental stewardship, resource efficiency, renewable energy, waste management, community engagement, biodiversity, land rehabilitation, greenhouse gas reduction.

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0188

EFFECT OF FIBRES ON STRENGTH CHARACTERISTICS OF CONCRETE

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ABSTRACT

Concrete is the mostly consumed material in the field of construction across the world. It can be easily moulded into any shape by the mixture of different materials such as cement, water, fine and coarse aggregate. In general, concrete can withstand against compression than tension. Hence to improve the tensile characteristics of concrete, different types of fibers can be incorporated to overcome strength and durability properties. Usually, fibers used in concrete are natural and artificial fibers. Among them synthetic and steel fibers are used in the present study. These two types of fibers are added in percentages of 0.5%, 1% and 1.5 % respectively by cement weight. The experimental investigation is carried out to utilize the synthetic and steel fibers in M25 grade concrete for the development of strength characteristics in terms of compression and are compared by performing destructive and non- destructive tests at curing and non-curing conditions. The optimum percentages of fibers content is determined and comparison is made between the results obtained. The results obtained are found to be satisfying the requirements.

Keywords: Concrete; fibers; compressive strength; curing; cement

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0189

SMART AND SUSTAINABLE BUILDING FACADES

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ABSTRACT

Smart and sustainable building facades are pivotal in advancing energy-efficient and environmentally responsible architecture. These facades integrate cutting-edge technologies and eco-friendly materials to enhance building performance while reducing ecological impacts. Features like adaptive shading systems, photovoltaic glass, advanced thermal insulation, and natural ventilation optimize energy usage by harnessing renewable energy sources and maintaining indoor environmental quality. Smart technologies, such as IoT sensors and AI-driven automation, enable real-time monitoring and adjustments for lighting, temperature, and airflow, ensuring occupant comfort and energy savings. Additionally, they contribute to aesthetics and urban sustainability by incorporating green walls, reflective surfaces, and innovative materials. By merging design with functionality, smart and sustainable facades support global efforts to achieve carbon neutrality and create resilient, future-ready buildings.

Keywords: Smart building facades, sustainable architecture, energy optimization, adaptive shading, IoT sensors, AI-driven automation, photovoltaic systems, green walls, thermal comfort, carbon neutrality, urban resilience, renewable energy, environmental impact reduction.

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0190

IMPROVING THE BEARING CAPACITY OF BLACK COTTON SOIL BY USING COPPER SLAG, PLASTIC AND CALCIUM CARBIDE

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ABSTRACT

Expansive Black cotton soils are widely distributed worldwide, and are a significant damage to infrastructure and buildings'. Soil stabilization means improvement of the bearing capacity of soil by controlled compaction, proportioning, or addition of suitable admixtures or stabilizers. Because of its high Swelling and shrinkage characteristics, the black cotton soils have challenged the highway engineers. So in this research, a material such as copper slag, plastic and calcium carbide was used to improve the strength properties of soil. California Bearing Ratio and Standard Proctor test were conducted with different percentages of copper slag, calcium carbide (10%, 25%), and Plastic bottle strips (1.0%, 2.%). It is found that the properties of black cotton soil mixed with copper slag, calcium carbide and plastic bottle strips are suitably enhanced. For this research work vane share test, standard proctor test, unconfined compression test, sieve analysis, and pychnometer test were conducted. We had performed a vane share test and found the shared strength of selected soil was increased from 5.23×10-4 N/mm2 to 10.24×10-4 N/mm2.

Keywords:

Expansive Stabilization; Swelling; Shrinkage; California Bearing Ratio; copper slag.

ISBN: 978-93-94246-26-3

Paper ID: ICRTCE-2024-0191

ASSESSMENT OF CAPACITY IN RETROFITTED RESIDENTIAL BUILDINGS FOR TRANSITION TO COMMERCIAL USE-RESEARCH

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ABSTRACT

This paper explores the integration of latest advanced materials and technologies with traditional retrofitting methods to optimize performance and cost-effectiveness. Case studies of retrofitted structures utilizing advanced techniques are analysed to assess their performance in real-world scenarios. Additionally, computational modelling and simulation techniques are utilized to predict the behaviour of retrofitted structures under seismic loading, providing valuable insights into their performance and durability. The paper also addresses challenges and considerations associated with the implementation of advanced retrofitting techniques, including material compatibility, construction logistics, and cost considerations. The importance of interdisciplinary collaboration between engineers, architects, and stakeholders is emphasized to ensure the successful implementation of retrofitting projects. This paper highlights the significance of employing advanced techniques such as Geopolymer and Glass fibre-reinforced polymer (GFRP) in retrofitting and strengthening existing structures to enhance their resilience against seismic loading. By leveraging these innovative technologies and methodologies, existing structures can be fortified to mitigate the impact of seismic events, safeguarding lives and preserving critical infrastructure.

Keywords:
Expansive Stabilization; Swelling; Shrinkage; California Bearing Ratio; copper slag.

ISBN: 978-93-94246-26-3

Paper ID: ICRTCE-2024-0192

LOW COST HOUSING STRUCTURE USING STEEL AND FERROCEMENT

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ABSTRACT

Low-cost housing has become a pressing need to accommodate the increasing population in urban and rural areas, particularly in developing regions. Employing steel and ferrocement in construction offers a revolutionary approach to addressing affordability, sustainability, and durability challenges. Steel, known for its exceptional tensile strength and versatility, forms the primary structural framework, providing stability and resilience. Ferrocement, a composite material made of cement mortar reinforced with wire mesh or fibers, complements steel by delivering a lightweight yet durable shell that is economical and easy to fabricate. This construction method minimizes material waste, reduces labor costs, and accelerates the building process, making it ideal for prefabrication and on-site assembly. The steel-ferrocement combination also offers enhanced resistance to environmental factors such as seismic activity, corrosion, and thermal fluctuations, ensuring long-term reliability. Furthermore, its adaptability to various architectural designs supports innovative and space-efficient housing solutions. By integrating these materials, low-cost housing projects can achieve sustainability goals, improve living standards, and address the global housing crisis effectively.

Keywords: Low-cost housing, steel structures, ferrocement, affordable construction, sustainable building materials, prefabrication, seismic resistance, thermal efficiency, lightweight housing, urban development, cost-effective housing solutions.

ISBN: 978-93-94246-26-3

Paper ID: ICRTCE-2024-0193

RAILWAY INFRASTRUCTURE INNOVATIONS

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ABSTRACT

The increasing demand for sustainable practices in geotechnical engineering has driven the exploration of innovative materials and methods to enhance soil properties. This study evaluates the efficacy of bio-enzymatic soil stabilization in geotechnical applications, emphasizing its environmental and economic benefits. Bio-enzymes, as natural and eco-friendly additives, improve soil compaction, strength, and durability by altering the soil's microstructure and reducing void spaces. The comprehensive analysis includes laboratory tests and field applications to assess parameters such as bearing capacity, permeability, and resistance to environmental stresses. Results indicate that bio-enzymatic treatment not only reduces construction costs and carbon footprint but also improves soil performance, making it a sustainable alternative to traditional chemical stabilizers. The study concludes that bio-enzymatic soil stabilization holds significant potential for sustainable infrastructure development, particularly in road construction, foundation improvement, and erosion control, aligning with global goals for green construction.

Keywords: bio-enzymatic soil stabilization, sustainable geotechnical applications, soil compaction, eco-friendly soil treatment, soil strength enhancement, geotechnical sustainability, green construction, soil microstructure improvement, erosion control, bearing capacity improvement.

ISBN: 978-93-94246-26-3

Paper ID: ICRTCE-2024-0194

CONSTRUCTION SAFETY TECHNOLOGIES

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ABSTRACT

Construction safety technologies are revolutionizing the industry by enhancing worker safety, reducing accidents, and promoting efficient risk management on job sites. These technologies include wearable devices such as smart helmets and vests equipped with sensors to monitor vital signs, detect hazards, and alert workers in real-time. Drones are used for site inspections and hazard assessments, while robotics and automation reduce human exposure to dangerous tasks. Advanced software solutions like Building Information Modeling (BIM) and AI-driven safety analytics improve planning, hazard prediction, and compliance tracking. Virtual and augmented reality (VR/AR) enable immersive safety training and scenario-based learning. By integrating these innovations, construction companies can foster a safer, more productive work environment and minimize the costs associated with workplace incidents.

Keywords: Construction safety, wearable technology, smart helmets, drones in construction, robotics, automation, hazard detection, BIM, AI safety analytics, VR/AR training, risk management, worker safety, accident prevention, compliance tracking.

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0195

RESILIENT URBAN DESIGN FOR CLIMATE ADAPTATION

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ABSTRACT

Resilient urban design for climate adaptation focuses on creating cities that can withstand and adapt to the impacts of climate change while ensuring sustainability and livability. This approach integrates nature-based solutions, such as green roofs, urban forests, and wetlands, to manage stormwater, reduce urban heat, and enhance biodiversity. Climate-responsive infrastructure, including permeable pavements, flood-resistant buildings, and renewable energy systems, mitigates risks from rising temperatures, sea levels, and extreme weather events. Smart technologies like IoT sensors and data-driven analytics enhance real-time monitoring and disaster response. Community engagement and inclusive planning ensure that adaptation strategies address social equity and protect vulnerable populations. By prioritizing resilience, urban design fosters climate-adaptive environments that are prepared for future challenges while supporting sustainable growth.

Keywords: Resilient urban design, climate adaptation, nature-based solutions, green infrastructure, renewable energy, urban heat mitigation, flood resilience, smart cities, IoT sensors, disaster response, social equity, sustainable urbanization, biodiversity enhancement, climate-responsive infrastructure.

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0196

CONCRETE DURABILITY ENHANCEMENTS

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ABSTRACT

Concrete durability enhancements focus on improving the lifespan and performance of concrete structures by addressing challenges such as cracking, corrosion, and environmental degradation. Innovations in materials, such as high-performance concrete (HPC), self-healing concrete, and fiber-reinforced composites, significantly increase strength, resistance to chemical attacks, and adaptability to harsh conditions. Advanced admixtures, including water-reducing agents, corrosion inhibitors, and nanomaterials, enhance durability by optimizing pore structure and reducing permeability. Techniques like surface treatments, protective coatings, and cathodic protection systems safeguard against environmental wear and tear. Additionally, sustainable practices, such as the use of recycled aggregates and low-carbon cement alternatives, contribute to eco-friendly construction while maintaining long-term performance. These advancements ensure safer, more cost-effective, and sustainable infrastructure for future generations.

Keywords: Concrete durability, high-performance concrete, self-healing concrete, fiber-reinforced composites, corrosion resistance, advanced admixtures, nanomaterials, surface treatments, cathodic protection, sustainable construction, recycled aggregates, low-carbon cement, chemical resistance, long-term performance.

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0197

INNOVATIVE STORMWATER MANAGEMENT SOLUTIONS

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ABSTRACT

Innovative stormwater management solutions are transforming urban water systems by addressing challenges like flooding, water pollution, and resource scarcity. These solutions integrate green infrastructure, such as rain gardens, bioswales, and green roofs, to naturally capture, filter, and absorb stormwater, reducing runoff and improving water quality. Permeable pavements and infiltration trenches enhance groundwater recharge while mitigating surface flooding. Advanced technologies, including smart drainage systems and real-time water monitoring, optimize stormwater management through data-driven insights and automation. Additionally, stormwater harvesting systems enable water reuse for irrigation and non-potable applications, promoting resource efficiency. By blending engineering innovations with ecological principles, these solutions support sustainable urban development, improve resilience to climate change, and enhance environmental quality.

Keywords: Stormwater management, green infrastructure, rain gardens, bioswales, green roofs, permeable pavements, infiltration systems, smart drainage, water harvesting, climate resilience, urban sustainability, water quality improvement, resource efficiency, flooding mitigation.

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0198

VERTICAL FARMING AND URBAN AGRICULTURE INTEGRATION

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ABSTRACT

Vertical farming and urban agriculture integration are reshaping the future of food production by optimizing space usage and promoting local, sustainable food systems in urban environments. Vertical farming utilizes multi-layered structures and controlled environment agriculture (CEA) technologies, such as hydroponics, aeroponics, and aquaponics, to maximize crop yield while minimizing the use of water, pesticides, and land. Urban agriculture incorporates rooftop gardens, community plots, and indoor farms to increase access to fresh produce and reduce food miles. Innovations in LED lighting, climate control systems, and IoT-based monitoring enhance productivity and resource management. These integrated systems contribute to food security, reduced carbon emissions, and resilient city ecosystems. By blending advanced farming technologies with urban planning, vertical farming and urban agriculture create self-sufficient, eco-friendly food networks that adapt to growing urban populations and changing climates.

Keywords: Vertical farming, urban agriculture, controlled environment agriculture (CEA), hydroponics, aeroponics, aquaponics, sustainable food systems, urban sustainability, food security, resource efficiency, LED lighting, climate control, IoT monitoring, eco-friendly farming, local food production.

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0199

HYBRID STRUCTURAL SYSTEMS

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ABSTRACT

Hybrid structural systems combine different types of materials and construction techniques to leverage the unique strengths of each, resulting in more efficient, resilient, and sustainable buildings. These systems may integrate traditional materials like concrete and steel with modern alternatives such as timber, composite materials, and innovative composites that offer enhanced performance in terms of strength-to-weight ratios, durability, and environmental impact. For instance, combining the flexibility of steel with the sustainability and lightweight properties of engineered timber can provide better seismic performance, reduce carbon footprints, and expedite construction timelines. Hybrid systems also support more adaptable and modular designs, allowing for better responses to site-specific requirements and changing building needs. Through advanced engineering, computational design, and material science, hybrid structural systems are becoming a vital part of modern architecture, contributing to sustainable, high-performance, and cost-effective buildings.

Keywords: Hybrid structural systems, composite materials, engineered timber, concrete-steel combinations, sustainability, seismic performance, material science, construction efficiency, structural engineering, carbon footprint reduction, modular design, adaptive construction, high-performance buildings.

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0200

CLIMATE-RESILIENT URBAN PLANNING

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ABSTRACT

Climate-resilient urban planning focuses on designing and developing cities that can withstand and adapt to the impacts of climate change while promoting sustainability and livability. This approach involves incorporating strategies that mitigate risks associated with extreme weather events, rising temperatures, and sea-level rise. Key principles include the integration of green infrastructure, such as parks, urban forests, and wetlands, to manage stormwater, improve air quality, and provide natural cooling. Climate-resilient planning also emphasizes sustainable building practices, energy-efficient designs, and the use of renewable energy sources to reduce greenhouse gas emissions. Smart technologies, including IoT sensors and data analytics, are employed for real-time monitoring and adaptive responses. Community engagement and inclusive planning ensure that adaptation strategies are equitable and address the needs of vulnerable populations. By prioritizing resilience, urban planning can foster robust, safe, and adaptive cities that thrive in the face of climate challenges.

Keywords: Climate-resilient urban planning, green infrastructure, sustainable building, stormwater management, urban cooling, renewable energy, smart cities, IoT sensors, data analytics, community engagement, inclusive planning, extreme weather adaptation, carbon reduction, climate adaptation strategies.

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0201

SUSTAINABLE DEMOLITION PRACTICES

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ABSTRACT

Sustainable demolition practices focus on minimizing the environmental impact of deconstructing buildings and structures while maximizing the reuse and recycling of materials. This approach goes beyond traditional demolition by incorporating methods that prioritize safety, resource efficiency, and waste reduction. Techniques such as deconstruction, which involves carefully dismantling buildings to salvage reusable components, help prevent valuable materials from ending up in landfills. Advanced technologies like robotic demolition, which can precisely control the dismantling process, and innovative waste separation systems improve the efficiency of material recovery. Sustainable demolition also includes the use of eco-friendly dust and noise reduction methods to minimize disruption to surrounding areas. By implementing a circular economy model, where materials are repurposed for new construction projects, sustainable demolition supports the reduction of carbon emissions and conserves natural resources, contributing to a greener built environment.

Keywords: Sustainable demolition, deconstruction, material reuse, recycling, waste reduction, robotic demolition, eco-friendly practices, circular economy, resource efficiency, noise reduction, dust control, carbon emissions, green construction, environmental impact.

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0202

BIOPHILIC DESIGN IN URBAN ENVIRONMENTS

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ABSTRACT

Biophilic design in urban environments emphasizes the integration of natural elements into built spaces to enhance human well-being, foster connection to nature, and promote sustainability. This design approach incorporates features such as green walls, rooftop gardens, water features, natural lighting, and the use of natural materials to create a sense of harmony between urban structures and the natural world. By improving air quality, reducing urban heat, and providing serene spaces, biophilic design helps mitigate the negative effects of urbanization, such as stress and reduced mental health. Additionally, biophilic principles encourage biodiversity and support ecosystem services within cities. The use of biophilic design principles can lead to more productive and happier communities, enhance ecological resilience, and contribute to a higher quality of life while promoting sustainable urban development.

Keywords: Biophilic design, urban environments, nature integration, green walls, rooftop gardens, water features, natural lighting, sustainable architecture, human well-being, biodiversity, urban heat reduction, ecosystem services, mental health, sustainable urban development.

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0203

INNOVATIVE FLOOD DEFENSE SYSTEMS

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ABSTRACT

Innovative flood defence systems are essential for protecting urban and coastal areas from the increasing risks of flooding due to climate change and rising sea levels. These systems combine advanced engineering, technology, and sustainable practices to provide effective flood mitigation. Key innovations include the use of movable barriers, flood gates, and surge barriers that can be deployed as needed to protect vulnerable areas. Green infrastructure, such as wetlands, rain gardens, and permeable pavements, helps manage stormwater naturally, reducing the pressure on drainage systems. Smart flood defense solutions use sensors, IoT devices, and data analytics to provide real-time monitoring and early warning systems, enabling proactive flood management. Additionally, urban planning strategies such as elevated structures and flood-resistant building designs are integrated to enhance resilience. By adopting these forward-thinking solutions, communities can better withstand extreme weather events and protect lives, property, and ecosystems.

Keywords:
Flood defense systems, innovative engineering, climate adaptation, movable barriers, surge barriers, green infrastructure, stormwater management, smart flood solutions, IoT monitoring, early warning systems, urban planning, flood-resistant buildings, resilience, sustainable flood mitigation.

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0204

HIGH-RISE BUILDING DESIGN INNOVATIONS

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ABSTRACT

High-rise building design innovations focus on enhancing structural performance, energy efficiency, sustainability, and occupant comfort in tall structures. Modern advancements include the use of advanced materials such as high-strength concrete, composite materials, and lightweight metals that improve the strength-to-weight ratio and reduce construction costs. Innovative design features like sky gardens, wind turbines, and solar panels integrate renewable energy sources to support energy self-sufficiency and reduce carbon emissions. Smart technologies, including Building Information Modeling (BIM), IoT sensors, and AI-driven systems, enable real-time monitoring, predictive maintenance, and optimized energy management. Additionally, innovations in structural engineering, such as the use of tuned mass dampers and aerodynamic shapes, mitigate the effects of wind and seismic activity, ensuring stability and safety. Sustainable practices, like rainwater harvesting, green roofs, and efficient HVAC systems, contribute to the overall environmental performance and resilience of high-rise buildings. These advancements collectively support the development of urban landscapes that are not only tall and striking but also environmentally responsible and adaptable to future challenges.

Keywords: High-rise building design, structural innovation, advanced materials, renewable energy, sky gardens, wind turbines, solar panels, Building Information Modeling (BIM), IoT sensors, AI-driven systems, tuned mass dampers, aerodynamic design, sustainability, rainwater harvesting, green roofs.

ISBN: 978-93-94246-26-3

Proceedings of "4th International conference on Revolutionary Technology in Civil Engineering" (ICRTCE-2024) organized on 17th and 18th December 2024.

Paper ID: ICRTCE-2024-0205

AUTOMATION IN CONSTRUCTION SURVEYING

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ABSTRACT

Automation in construction surveying is revolutionizing the industry by improving accuracy, efficiency, and safety on job sites. Advanced technologies such as robotic total stations, GPS and GNSS systems, laser scanning, and drones enable precise data collection and mapping with minimal human intervention. These tools automate routine tasks, reduce measurement errors, and accelerate the survey process, leading to significant time and cost savings. The integration of Building Information Modeling (BIM) with surveying technologies allows for seamless data synchronization, enhancing project coordination and visualization. Automated surveying also supports real-time monitoring of construction progress and site conditions, facilitating better decision-making and proactive issue resolution. Additionally, AI and machine learning algorithms are being utilized to analyze survey data for predictive analytics, improving project planning and risk management. These advancements help create safer and more efficient construction workflows, laying the foundation for more streamlined, high-quality projects.

Keywords: Automation, construction surveying, robotic total stations, GPS, GNSS systems, laser scanning, drones, data collection, Building Information Modeling (BIM), real-time monitoring, AI in surveying, machine learning, predictive analytics, construction efficiency, site safety.

ISBN: 978-93-94246-26-3

ABOUT CONFERENCE

The 4th International Conference on "Revolutionary Technology in Civil Engineering" (ICRTCE-2024)" will be organized by Department of Civil Engineering, St. Martin's Engineering College, Secunderabad, Telangana, India on 17th & 18th December 2024. ICRTCE-2024 will serve as a colloquy for sharing the proficiency among academicians, researchers, scientist and industrial personnel from all over the world in the areas of engineering and technology.

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Dhulapally, Near Kompally, Secunderabad - 500 100, T.S. www.smec.ac.in

ISBN:
978-93-94246-26-3

Editor in chief
Dr.P.Santosh Kumar Patra