



CHRIST COLLEGE OF ENGINEERING (AUTONOMOUS), IRINJALAKUDA

The Revival

MAGAZINE BY THE DEPARTMENT OF CIVIL ENGINEERING

2025–2026

ISSUE 2

Innovation
Beneath the Surface

CHERISHED WORDS FROM EXECUTIVE DIRECTOR

Smart Structures and a Sustainable Future is not just a theme—it is a responsibility entrusted to every aspiring civil engineer. As you design and build the infrastructure of tomorrow, let innovation, efficiency, and environmental consciousness guide your work.

The future demands structures that are intelligent, resilient, and sustainable. I am confident that your learning, creativity, and commitment will contribute to shaping a built environment that serves society while respecting nature.

I appreciate the efforts of the Civil Engineering Department and the student editorial team for bringing out this magazine. May it inspire thoughtful ideas, responsible engineering, and a vision for a better tomorrow.



Fr. John Paliakara CMI
Executive Director
Christ College of Engineering

CHERISHED WORDS FROM PRINCIPAL

It gives me immense pleasure to present this magazine of the Civil Engineering Department on the theme "Smart Structures and a Sustainable Future." In today's rapidly evolving world, civil engineers play a vital role in shaping resilient, intelligent, and environmentally responsible infrastructure. This magazine reflects the innovative thinking, technical insight, and commitment of our students and faculty toward sustainable development and smart construction practices. I congratulate the department for this commendable effort and wish the magazine great success in inspiring young minds to build a smarter and greener future



Dr. Sijo M T
Principal
Christ College of Engineering

CHERISHED WORDS FROM VICE PRINCIPAL

I'm delighted to pen a few words for the latest edition of our Civil Engineering department magazine, focusing on 'Smart Structures and Sustainable Future'. As an NBA Accredited Program, this department is striving for innovation and excellence. I congratulate the team for highlighting a pressing theme in civil engineering today, paving the way for a smarter, more sustainable world. Our students and faculty are working tirelessly to address real-world challenges, and this magazine showcases their efforts. I believe this edition will inspire our readers to explore new frontiers in civil engineering. I wish the Civil Engineering Department continued success in all their endeavors.



Dr. V. D. John
Vice Principal
Christ College of Engineering

CHERISHED WORDS FROM HOD

It is a pleasure to share a few words in this edition of our department magazine themed "Smart Structures and Sustainable Future." This theme highlights the growing role of intelligent design and sustainable practices in shaping modern engineering.

Smart structures, integrated with advanced technologies, are transforming how we build and maintain infrastructure. At the same time, sustainability reminds us of our responsibility to create solutions that are efficient, resilient, and environmentally conscious.

As a department, we strive to equip our students not only with technical knowledge but also with the vision to design for a better and more sustainable world. I appreciate the efforts of the editorial team and contributors who made this publication possible.

May this edition inspire innovation and responsible engineering among all readers.



Dr. Sherjah P Yusuf Ali
Associate Professor &
Head of the Department



Department of Civil Engineering

VISION

To be a recognized centre for moulding technically competent and socially committed Civil Engineering professionals through quality education and practical training.

MISSION

1. To impart quality education in Civil Engineering by integrating theory and practice, keeping pace with emerging technologies.
2. To encourage students to take up innovative research projects that can benefit the society.
3. To mould competent professionals upholding sustainable practices, ethical values, leadership qualities and lifelong learning capabilities.

Programme Specific Outcomes (PSOs)

Graduates will be able to:

1. Apply expertise in structural, geotechnical, transportation, water resource, construction management and environmental engineering to develop sustainable solutions in the Civil Engineering domain.
2. Design civil engineering systems integrating quality, safety, ethical standards and societal requirements.
3. Use conventional and modern tools in the field of Civil Engineering to address the requirements of industry and higher education.

Programme Educational Objectives (PEOs)

Graduates will be able to:

1. Apply engineering knowledge and modern technologies in various domains of Civil Engineering to execute projects.
2. Develop an attitude for higher studies, research and innovation to foster adaptability for global professional requirements.
3. Comprehend societal needs for sustainable development and attain optimal solutions ethically through team work and lifelong learning.

EXPLORING THE SPIRIT OF THE REVIVAL

Step into the world of innovation, ideas, and engineering excellence through The Revival, proudly presented by the Department of Civil Engineering. This magazine serves as a creative and intellectual platform that brings together technology, sustainability, and modern engineering practices.

Driven by a dedicated team of students and faculty, The Revival aims to present insightful articles, technical perspectives, and visual narratives that reflect the dynamic nature of civil engineering in today's evolving world. From emerging trends to real-world applications, each page captures the essence of learning and innovation.

We value our readers as an integral part of this journey and invite you to engage, reflect, and share in the knowledge presented. As we move forward into the academic year 2025–26, The Revival continues to celebrate curiosity, creativity, and the spirit of progress.

FACULTY COORDINATORS



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EDITING TEAM



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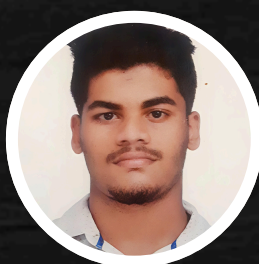


ALDRIN T SEBASTIAN

ASSORTING TEAM



ALEN JOBY



DANIEL SONI



ANUGRAHA P S



FADIYA HIND



ABHINAV KRISHNA

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COMMITTEES

RACE

Academic Year: 2025-26

"Together, we rise by lifting each other."



The executive committee of RACE (Receptive Association of Civil Engineers) for the academic year 2025– 26 had been elected. These leaders drove our association forward with passion, innovation, and a commitment to excellence, bringing fresh ideas and unstoppable drive. They led the way in organizing a series of impactful events, workshops, and opportunities that enriched both our academic journey and professional skills. The year turned out to be one of growth, collaboration, and success.

ENVOTECH CLUB

"If we can create an eco-friendly civilisation, that would be a great victory for both humanity and nature!"

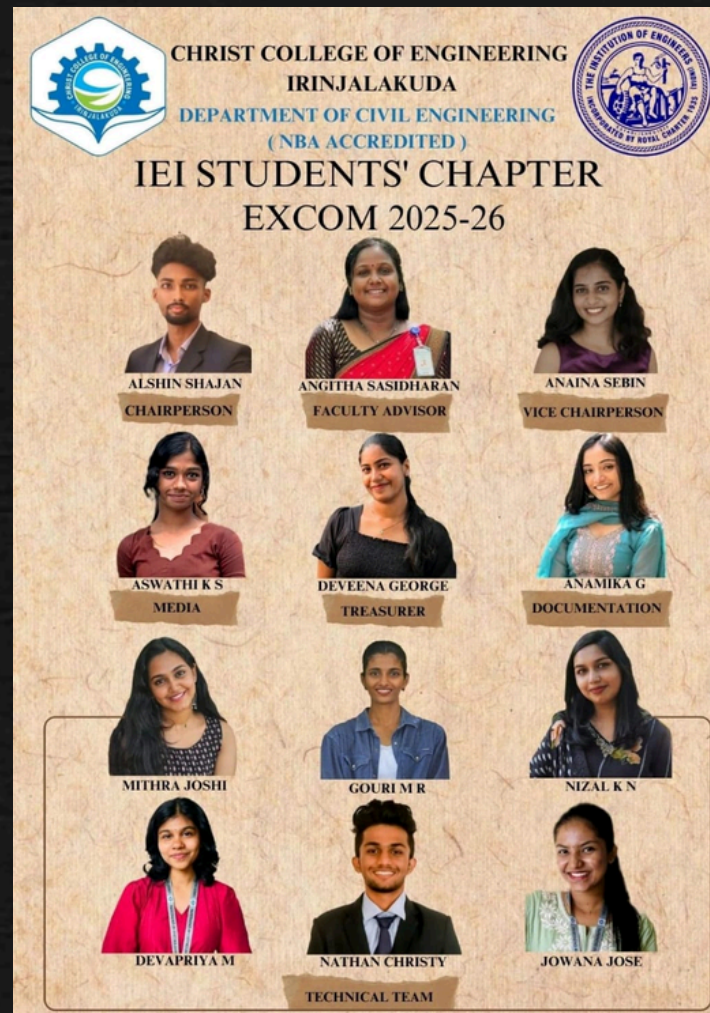


With a motive to provide a common platform for technical activities related to environmental preservation, we have launched Envotech Club. The Envotech club initiated by the department of civil engineering Christ College of Engineering, Irinjalakuda is purely and honorary group activity of students aimed at practicing energy conservation and environment protection technical project. This gives through a platform for the members to acquire process and share knowledge on the subject.

The main objective of this Envotech Club is to drive home the message of environmentalism in the minds of students, by planning and organizing regular activities. The club focuses on: Solid waste disposal, Help in civic activities, Help in pollution control, Tree plantation, Create awareness of the conservation of the and wetness, Seminars, Lectures etc.

The Institution of Engineers (India) Students' Chapter

EXCOM for the Academic Year 2025-26



The Institution of Engineers (India) (IEI) is a premier professional body of engineers that promotes engineering excellence, innovation, and knowledge sharing. With a rich history spanning over a century, IEI has been fostering growth and development in the engineering fraternity through various activities, including technical events, research and development initiatives, and professional development programs. The IEI Students' Chapter, initiated in 2021 with 81 student members, aims to encourage professional growth among students through technical talks, industrial visits, workshops, and competitions. By participating in IEI activities, students can enhance their technical skills, gain industry insights, and build professional networks, ultimately contributing to the advancement of the engineering field.

Builders Association of India (BAI) Students' Chapter

EXCOM for the Academic Year 2025-26



Fostering Industry-Academia Synergy: In a significant stride toward bridging the gap between industry and academia, the Builders; Association of India (BAI), Thrissur Centre, has joined hands with Christ College of Engineering (CCE), Irinjalakuda, to establish a vibrant and purpose-driven Students' Chapter within the institution. This collaboration is grounded in mutual trust, shared vision, and a commitment to advancing the knowledge and professional development of budding civil engineers. The primary objectives of this collaboration are to foster academic interest, provide students with real-world exposure, and facilitate the exchange of expertise. BAI and CCE aim to strengthen civil engineering education by promoting research, quality teaching practices, and engagement with modern construction technologies.

ACHIEVEMENTS



CHRIST
COLLEGE OF ENGINEERING
(AUTONOMOUS)

**DEPARTMENT OF
CIVIL ENGINEERING**
(NBA Accredited)



**VICUNIA
GRAZIELLA
SUTNGA**

9.63



FADIYA HIND

9.26



**ANJANA
KRISHNA K H**

9.18



**ROSE MARY
ROY**

9.08



**ANFRED JO
EMMANUEL**

9.05



ABHIRAMI P A

8.97



AIBEL VIMAL K

8.84



NAYANA K R

8.76



**KRISHNAPRIYA
NL**

8.71



**KRISHNAPRIYA
TS**

8.66



FAREEDA SALI

8.45



**RAGADA
NANDA K R**

8.26



**JAQULIN
JIMMI K**

8.24



SREEHARI V B

8.16

Congratulations

**FIRST SEMESTER EXAM TOPPERS
2025-2029 BATCH**

*For Admissions Contact:
B.Tech, M.Tech-9497707439,
MBA-8137049355*

ACHIEVEMENTS



CHRIST COLLEGE OF ENGINEERING
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DEPARTMENT OF CIVIL ENGINEERING



S3 TOPPERS
CE 2024- 2028 BATCH



CONGRATULATIONS

ACHIEVEMENTS

DEPARTMENT OF CIVIL ENGINEERING

NBA ACCREDITED

Congratulations

S5 TOPPERS, BATCH 2023-27



ASWATHY K S
SGPA 9.74



SREELAKSHMI N
SGPA 9.13



ANSHUNATHY S
SGPA 8.87



DELVIN T WILSON
SGPA 8.59



AYSWARYA E S
SGPA 8.50



SINDIA ELIZABETH
SGPA 8.35



DHIYA NAZRIN
SGPA 8.33



ANGEL ROSE JOMY
SGPA 8.22



MANAL FATHIMA
SGPA 8.17



AISHA KALAPURAKKAL
SGPA 8.17



GAUTAM FRANCIS
SGPA 8.15



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COLLEGE OF ENGINEERING
(AUTONOMOUS)

For Admissions Contact : B.Tech, M.Tech - 9497707439, MBA- 8137049355

ACHIEVEMENTS



CHRIST COLLEGE OF ENGINEERING (AUTONOMOUS)

IRINJALAKUDA, THRISSUR, KERALA - 680125

(NBA ACCREDITED PROGRAMS)

Contact for Admissions: B.Tech, M.Tech - 9497707439; MBA - 8137049355



DEPARTMENT OF CIVIL ENGINEERING

(NBA ACCREDITED)

SEM 7 KTU RESULTS



Alshin Shajan
SGPA - 8.53



A V Abimanyu
SGPA - 8.07



Hanan Shajahan
SGPA - 9.17



Arya Santhosh
SGPA - 8.13



Aiswarya Shajan
SGPA - 8.3



Adarsh K S
SGPA - 8.0

Congratulations to the Toppers!
(2022-26 Batch)

ACHIEVEMENTS



CHRIST
COLLEGE OF ENGINEERING
(AUTONOMOUS)
Irinjalakuda, Thrissur

Congratulations

Placed At :



Nizal K N
S8 CE



Alfred James
S8 CE



Navaneeth Krishna S
S8 CE

Training & Placement Cell

For Admissions Contact:

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Affiliated to KTU | Approved by AICTE | A CMI Institution | NBA Accredited Programs

ACHIEVEMENTS



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Irinjalakuda, Thrissur

Congratulations

**Placed At : Bose
Builders**



Anzam Haneen Muhammed
S8 CE

Training & Placement Cell

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Affiliated to KTU | Approved by AICTE | A CMI Institution | NBA Accredited Programs

ACHIEVEMENTS



CHRIST
COLLEGE OF ENGINEERING
(AUTONOMOUS)

CONGRATULATIONS



Vinitha E V



A V Abimanyu



Deveena George



Goutham Santhosh K S



Krishnapriya P P

PATENT PUBLISHED

Solar Powered Greywater Treatment Unit with UV Disinfection

Application Number : 202641056300

Date of Filing: 04/05/2026

RESEARCH & DEVELOPMENT CELL

ACHIEVEMENTS



CHRIST
COLLEGE OF ENGINEERING
(AUTONOMOUS)

CONGRATULATIONS



Shicy N S



Dr. Alos James



Arya Santhosh



Vismaya M V



Anett Paul

PATENT PUBLISHED

Cool roof mortar tiles using phase change material

Application Number: 202641052246

Date of Filing: 24/04/2026

RESEARCH & DEVELOPMENT CELL

ACHIEVEMENTS



CHRIST
COLLEGE OF ENGINEERING
(AUTONOMOUS)
IRINJALAKUDA - KERALA

CONGRATULATIONS

INDIAN PATENT PUBLISHED



Dr. Krishnapriya M G



Dr. Alish James



Anna Pauly



Fleming Joby Kuttikkat



Lazar Saju Francis



Thajus Dalson



Nivedith K Nirmal

Title of the Invention

"A Real-Time Air Quality Index Monitoring and Purification
System Using Organic Filter"

RESEARCH & DEVELOPMENT CELL

ACHIEVEMENTS



CHRIST COLLEGE OF ENGINEERING
(AUTONOMOUS), IRINJALAKUDA
DEPARTMENT OF CIVIL ENGINEERING

SUMMER INTERNSHIP @ IITs & NITs CIVIL ENGINEERING STUDENTS



ALNA GEORGE - S4 CE

NIT Calicut



AYSWARYA E S - S6 CE

IIT Jammu



MEITHUANSINGLIU - S4 CE

NIT Calicut

CONGRATULATIONS

FOR ADMISSIONS CONTACT: B.TECH, M.TECH-9497707439, MBA-8137049355

DEPARTMENT ACTIVITIES AND EVENTS



Planscape

The Department of Civil Engineering, Christ College of Engineering (Autonomous) organized PLANSCAPE – An Idea Pitching Competition on 29th January 2026 under the banner of TECHLETICS '26.

The event was conducted in association with the Institute of Town Planners, India-Kerala Regional Chapter (ITPI KeRC).

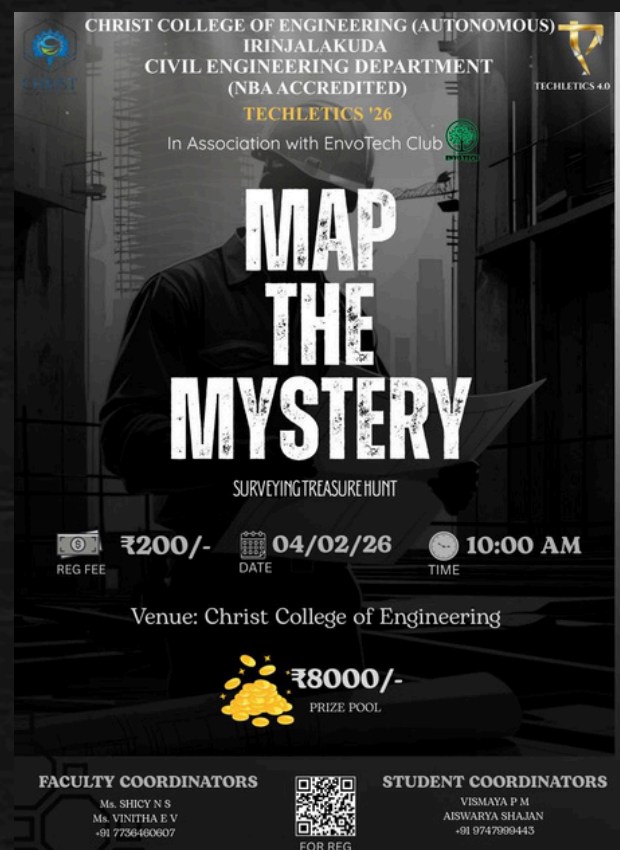
PLANSCAPE provided a platform for students to present innovative ideas in planning and design. The competition encouraged creativity, practical thinking, and confident presentation of ideas. The event saw active participation and was a great learning experience for all.

Map The Mystery

The Department of Civil Engineering (NBA Accredited), Christ College of Engineering (Autonomous), in association with the EnvoTech Club, proudly organized MAP THE MYSTERY – A Surveying Treasure Hunt on 04 February 2026 as part of TECHLETICS '26.

This exciting intercollege technical event combined surveying with adventure. Participants decoded clues, measured distances, followed bearings, and located hidden checkpoints using real surveying principles.

More than just a treasure hunt, it was a true test of accuracy, logical thinking, and teamwork.



CHRIST COLLEGE OF ENGINEERING (AUTONOMOUS)
IRINJALAKUDA
CIVIL ENGINEERING DEPARTMENT
(NBA ACCREDITED)
TECHLETICS '26
In Association with BAI

DRONE SURVEY

INVITED TALK
"DRONES & GIS: Technology, Applications & Careers"
Mr. Arshif Thumbil
CEO & Founder
Dronimagination Pvt Ltd (HOD - Drone Technology)
Topics Covered
• Introduction to Drone Technology
• Industrial Applications of GIS & Drones
• Career Opportunities
22/01/26 10:00 AM - 12:00 PM
Conference Hall
OPEN FOR ALL

HANDS-ON WORKSHOP
Practical exposure to drone operations & survey applications
Limited Seats : 20
For reg: [QR CODE]
05/02/26 8:00 AM - 12:00 PM
Christ College of Engineering (Autonomous), Irinjalakuda

FACULTY COORDINATORS
Dr. Sherjiah P. Yusuf Ali - 98466 55264
Dr. Krishnapriya M G - 98462 97741
Mrs. Bindu Rajan - 83010 72165

STUDENT COORDINATORS
Alina George - 99616 24310
Johaan S - 85903 52005

Drone Survey

The Department of Civil Engineering (NBA Accredited), Christ College of Engineering (Autonomous), in association with the Builders Association of India (BAI), organized two events as part of TECHLETICS '26 on Drone Survey and GIS. An Invited Talk was held on 22 January 2026, introducing modern drone technology, GIS applications, and career opportunities in the geospatial field. A Hands-on Drone Workshop followed on 05 February 2026, giving participants practical exposure to drone-based surveying and aerial data collection. Both sessions provided valuable insights into advanced surveying technologies shaping the future of civil engineering.

Quake Clash

The Department of Civil Engineering, Christ College of Engineering (Autonomous), in association with R.A.C.E, organized QUAKE CLASH as part of TECHLETICS '26 on 05 February 2026.

The competition challenged participants to design and construct an earthquake-resistant structure using the materials provided. The models were then tested under simulated shaking conditions to evaluate their strength and stability.

The event promoted structural awareness, innovation, teamwork, and practical application of earthquake-resistant design principles, making it both educational and exciting for the participants.

CHRIST COLLEGE OF ENGINEERING (AUTONOMOUS)
IRINJALAKUDA
DEPARTMENT OF CIVIL ENGINEERING
(NBA ACCREDITED)
TECHLETICS '26
in association with R.A.C.E

QUAKE CLASH
EARTHQUAKE RESISTANT BUILDING DESIGN COMPETITION

REG FEE ₹300/-
DATE 05 FEB 2026
TIME 1:30 P.M.
Venue: Christ Hall, St. Mary's Block
Christ College of Engineering

FOR REG: [QR CODE]

PRIZE POOL ₹6500/-

FACULTY COORDINATORS
Sr. ALPHONSA PHILIP
82811 93118
Dr. VIVEK K VISWANATH
96566 07809

STUDENT COORDINATORS
JOSHNA A. J
88481 81038
ANNA PAULY
90374 13881



Civarch

The The Department of Civil Engineering (NBA Accredited), Christ College of Engineering (Autonomous), in association with R.A.C.E, organized CIVARCH – Architectural Expo on 04 February 2026 as part of TECHLETICS '26.

CIVARCH was an architectural exhibition celebrating creativity, innovation, and design excellence in civil engineering and architecture. The expo provided a platform for students to showcase their models, drawings, and design concepts, highlighting the blend of aesthetics, functionality, and structural vision.

Structure Scan

The The Department of Civil Engineering, Christ College of Engineering (Autonomous), in association with MATTERLAB, organized STRUCTURE SCAN as part of TECHLETICS '26 on 05 February 2026.

This hands-on workshop focused on Non-Destructive Testing (NDT) techniques used to evaluate the strength and condition of concrete and structural elements without damage. Through live demonstrations, participants were introduced to advanced testing equipment and analysis methods. The session improved students' practical knowledge of structural safety and modern diagnostic techniques used in the construction industry, making it an engaging experience.





Crack the Mix

The Department of Civil Engineering, Christ College of Engineering (Autonomous), organized the Concrete Mix Design Competition as part of TECHLETICS '26 on 02 February 2026 at the Material Testing Lab, Christ College of Engineering.

This hands-on technical challenge brought together innovation and precision as participants prepared concrete mixes based on given specifications. The competition tested their understanding of mix proportioning, material properties, workability, and strength requirements. Students applied theoretical knowledge in a practical setting, aiming to achieve optimum strength and durability.

The event encouraged teamwork, technical accuracy, and problem-solving skills, making it both competitive and educational for aspiring civil engineers.

Rack N Crack

The Department of Civil Engineering, Christ College of Engineering (Autonomous), in association with Autodesk and BIMLABS Global, organized Rack N Crack – BIM Design & Modelling Competition as the flagship post event of TECHLETICS 4.0. The event attracted 21 teams from various institutions, showcasing their skills in Building Information Modelling (BIM). Following a competitive preliminary round, the top 10 teams advanced to the Grand Finale held at Park Inn & Suites by Radisson, Thrissur, on 21 February 2026. The competition provided participants with valuable exposure to modern BIM practices while fostering innovation, technical excellence, and teamwork.



ARTICLES

Biomimicry in Civil Engineering: Learning from Nature for Sustainable Design

-By Aisha

Nature has been refining its designs for millions of years, creating systems that are efficient, resilient, and sustainable. Biomimicry is the practice of studying these natural systems and applying their principles to engineering and design. In civil engineering, biomimicry is emerging as an innovative approach to developing smarter and more sustainable infrastructure.

Many engineering breakthroughs have been inspired by nature. The structure of honeycombs, for example, demonstrates how maximum strength can be achieved with minimal material usage. Similarly, termite mounds have inspired energy-efficient building designs due to their natural ventilation systems, which maintain comfortable internal temperatures without excessive energy consumption. By observing and replicating such natural solutions, engineers can create structures that are both environmentally friendly and resource-efficient.

Biomimicry offers numerous benefits for sustainable construction. Buildings inspired by natural forms often require less energy for heating, cooling, and lighting. Materials can be optimized to reduce waste while maintaining structural integrity. Nature-inspired drainage systems can also improve water management and reduce flooding in urban areas. These approaches contribute to lower carbon emissions and a reduced environmental footprint.

Modern technology has further enhanced the application of biomimicry in civil engineering. Advanced modelling software and simulation tools allow engineers to analyze natural patterns and adapt them for real-world construction projects. Combined with smart technologies, biomimetic designs can improve the performance, durability, and sustainability of infrastructure.

As the world faces increasing environmental challenges, civil engineers must explore innovative solutions that balance development with ecological responsibility. Biomimicry demonstrates that nature itself can serve as a powerful guide for sustainable design. By learning from natural systems and integrating their principles into infrastructure development, engineers can create smarter, greener, and more resilient communities for future generations.

3D Printing in Sustainable Construction: Shaping the Future of Infrastructure

-By Aswathy

The construction industry is undergoing a technological transformation, and one of the most promising innovations is 3D printing. Also known as additive manufacturing, 3D printing enables structures and components to be built layer by layer using specialized materials and automated systems. This technology has the potential to revolutionize construction by making it faster, more cost-effective, and more sustainable.

Traditional construction methods often generate significant material waste due to cutting, shaping, and excess usage. In contrast, 3D printing uses only the required amount of material, minimizing waste and improving resource efficiency. This precision not only reduces environmental impacts but also lowers overall construction costs.

Another major advantage of 3D printing is its ability to accelerate project completion. Complex structures that would normally take weeks or months to construct can be produced in a much shorter time. Faster construction means reduced energy consumption, lower labor requirements, and fewer disruptions to surrounding communities. In disaster-stricken regions, 3D printing can even be used to rapidly provide emergency housing and essential infrastructure.

The technology also encourages innovation in sustainable materials. Researchers are exploring the use of recycled concrete, industrial by-products, and eco-friendly composites as printing materials. Such developments support the transition toward a circular economy and reduce dependence on traditional construction resources.

In addition to efficiency and sustainability, 3D printing provides greater design flexibility. Engineers can create complex geometries that are difficult or impossible to achieve using conventional methods. This allows for optimized structural performance while reducing material consumption.

Although challenges such as material standardization and regulatory approval remain, the future of 3D printing in construction is highly promising. As technology continues to evolve, it is expected to play a significant role in developing smart, sustainable, and resilient infrastructure. By embracing this innovation, civil engineers can contribute to a future where construction is not only faster and more economical but also environmentally responsible.

PROJECTS

REAL TIME AIR QUALITY INDEX MONITORING AND PURIFICATION SYSTEM USING ORGANIC FILTER

Guide: Dr. Krishnapriya M G and Dr. Alosh James

Team Members:

ANNA PAULY : CCE22CE014

LAZAR SAJU FRANCIS : CCE22CE038

NIVEDITH K NIRMAL : CCE22CE043

THAJUS DAISON : CCE22CE054

Abstract:

Air Quality Index (AQI) is a numerical indicator used to evaluate the level of air pollution and its potential impact on human health. High AQI values indicate poor air quality caused by pollutants such as particulate matter (PM_{2.5}), carbon dioxide (CO₂), carbon monoxide (CO), and volatile organic compounds (VOCs). This project, titled "Real-Time AQI Monitoring and Organic Air Purification System," aims to develop a smart, low-cost solution for monitoring and improving indoor air quality. The system uses the ZPHS01C air quality sensor module to measure PM_{2.5}, CO, VOCs, temperature, and humidity with high sensitivity. An ESP32 microcontroller processes the sensor data and displays real-time air quality information on an LCD screen while also enabling wireless monitoring through a mobile application. The system continuously tracks air quality and stores data for analysis and comparison. An automatic threshold-based control activates the purification fan when AQI levels exceed safe limits and turns it off when the air quality improves, ensuring energy-efficient operation. The purification unit consists of a multi-layer organic filter made from coconut coir, cotton mat, and banana fiber to capture particulate matter. Activated carbon and amine-functionalized activated carbon are included to adsorb VOCs, odors, and carbon dioxide. The proposed system is portable, low-power, and suitable for classrooms, offices, clinics, and other indoor environments. Overall, the project demonstrates an effective combination of real-time air quality monitoring and sustainable bio-based filtration for improving indoor air quality.

Keywords: Air Quality Index (AQI), ZPHS01C air quality sensor module, Real-Time Air Quality Monitoring, Organic Air Filtration etc.

WATER QUALITY ASSESSMENT USING GIS AND REMOTE SENSING

WATER QUALITY ASSESSMENT USING GIS AND REMOTE SENSING

Guide: Dr. Sherjah P Yusuf Ali

Team Members:

AISWARYA SHAJAN: CCE22CE004

ESTHER JACSON: CCE22CE024

MITHRA JOSHI: CCE22CE040

NASREEN K N: CCE22CE041

Abstract:

Ensuring the sustainability of freshwater resources has become increasingly critical in the context of rapid urbanization, industrial growth, and climate variability. Conventional water quality monitoring methods, while reliable, are often limited in spatial and temporal coverage due to the cost and effort associated with field sampling and laboratory analysis. This study explores the use of Remote Sensing (RS) and Geographic Information Systems (GIS) for large-scale monitoring of river water quality using satellite data. Sentinel-2 imagery was utilized in conjunction with field observations to investigate the relationship between spectral characteristics and water quality conditions. A data-driven approach was adopted to estimate turbidity, an important indicator of water quality deterioration, and to analyze its spatial and temporal variability. The methodology was applied to selected rivers in Kerala, India, including the Chalakudy, Karuvannur, and Puzhakkal rivers. Cloud-based geospatial processing was employed to enable efficient handling and analysis of multi-temporal satellite datasets. The developed model exhibited a strong correlation ($R^2 = 0.715$) with Sentinel-2 bands B2, B3, and B4. Validation results demonstrated good accuracy, with an RMSE of 1.6. The results were used to generate spatial representations of turbidity distribution and to identify relatively impacted and less-impacted stretches of the rivers using GIS-based analysis. The findings demonstrate the capability of satellite-based approaches to provide synoptic, repeatable, and cost-effective insights into river water quality. Such approaches can complement conventional monitoring frameworks and support reconnaissance-level assessments for environmental management. The study highlights the potential of integrating RS, GIS, and data-driven techniques for scalable and sustainable water quality monitoring in data-scarce regions. Keywords: Remote Sensing, GIS, Sentinel-2, Google Earth Engine, Turbidity Estimation, Water Quality Monitoring, Machine Learning, Spectral Features, Spatial Analysis

ASSESSING THE IMPACT OF LANDUSE CHANGE ON FLOOD DISCHARGE OF CHALAKUDY RIVER BASIN

Guide: Dr. Sherjah P Yusuf Ali

Team Members:

AKASH K R: CCE22CE005

ANZAB HARIS: CCE22CE015

HARIKRISHNA N L: CCE22CE029

NAVANEETH KRISHNA S: CCE22CE042

Abstract:

This study presents a detailed assessment of the influence of land use and land cover (LULC) changes on flood response in the Chalakudy River Basin through semi-distributed hydrological modeling using the Hydrologic Engineering Center's Hydrologic Modeling System (HEC-HMS). The basin, which experienced extreme hydrometeorological stress during the 2018 Kerala flood event, was selected to investigate the sensitivity of rainfall-runoff processes to evolving land surface characteristics. A high-resolution Digital Elevation Model (DEM) was processed in QGIS to perform watershed delineation, stream network extraction, and sub-basin parameterization, including slope, flow direction, and flow accumulation. Hydrological inputs such as observed rainfall and discharge data for 2018 were integrated into the model along with key parameters including Curve Number (CN), lag time, and initial abstraction based on the Soil Conservation Service (SCS) methodology. Two simulation scenarios were developed: (i) a baseline condition representing 2018 LULC and hydrological parameters, and (ii) an altered condition incorporating updated 2024 LULC-derived CN values while maintaining identical rainfall inputs to isolate land surface effects. Daily streamflow in Chalakkudy River Basin was simulated using HEC-HMS for 2018. The model reproduced the timing of monsoon peaks but underpredicted the observed maximum flow of 1900 m³/s, simulating 1050 m³/s in both initial and optimized runs. Optimization improved low-flow simulation, but peak discharges remained underestimated, suggesting the need for improved parameter calibration and rainfall data. The study highlights the nonlinear sensitivity of watershed response to LULC transitions and underscores the critical role of accurate parameterization in hydrological simulations. Although the model demonstrates reasonable trend representation, the absence of calibration and validation introduces uncertainty in quantitative outputs. The findings emphasize the necessity of integrating updated geospatial datasets and adopting robust calibration techniques to improve predictive reliability. This research provides a scientific basis for sustainable land use planning, flood risk mitigation, and future integration with hydraulic models such as HEC-RAS for comprehensive flood inundation mapping and decision support systems.

Keywords: Land Use Land Cover (LULC), Hydrological Modeling, HEC-HMS, SCS Curve Number Method, Rainfall-Runoff Simulation, Flood Risk Assessment, Chalakudy River Basin

DEVELOPMENT OF ENGINEERED CEMENTITIOUS COMPOSITE (ECC) TILE INCORPORATING FLY ASH CENOSPHERE AND BIOCHAR

Guide: Ms. Angitha Sasidharan

Team Members:

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Abstract:

The increasing demand for sustainable, high-performance construction materials has driven research toward eco-friendly alternatives to conventional cement-based products. Engineered Cementitious Composite (ECC), a fiber-reinforced material known for its superior ductility and crack control, offers a promising solution for advanced structural applications.

This study investigates the development of lightweight ECC tiles incorporating fly ash cenosphere and biochar as partial replacements for Ordinary Portland Cement (OPC). By leveraging these industrial and organic by-products, the research aims to promote resource efficiency while modifying the physical and durability characteristics of the composite.

This experimental study examines the density and flexural strength of ECC tiles under varying compositions of fly ash cenosphere and biochar. Additionally, the durability is assessed through water absorption and sulphate attack resistance tests, focusing on varying biochar dosages (5%, 10%, and 15%). The study also includes the comparison of performance of developed ECC tiles and industrial vitrified tiles.

To analyse the underlying mechanisms of strength development and chemical resistance, Scanning Electron Microscopy (SEM) is employed to characterize the interfacial transition zone and fiber-matrix interaction. The findings of this study evaluate the feasibility of ECC-based sustainable tiles for flooring and structural applications, highlighting their potential as a durable, crack-resistant, and environmentally responsible alternative to conventional architectural elements.

Keywords: Engineered Cementitious Composite (ECC), Fly ash cenosphere, Biochar, Flexural Strength, Scanning Electron Microscopy (SEM).

VERTICAL-FLOW CONSTRUCTED WETLANDS AS A SUSTAINABLE GREYWATER TREATMENT

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Abstract:

With rapid urbanization and rising domestic water demand, the reuse of household wastewater has become an essential sustainability strategy. Grey water treatment is increasingly critical in arid regions where water scarcity poses a major environmental and public health concern. The aim of this study is to set up and operate a Vertical Flow Constructed Wetland (VFCW) system, determine the pollutant removal efficiency using *Colocasia esculenta* (elephant ear) and *Canna Indica* plants, and compare their overall performance and use the effluent for irrigation purposes. Raw domestic greywater was analyzed for initial pollutant levels, including pH, Turbidity, Total Solids (TS), Total Dissolved Solids (TDS), Total Suspended Solids (TSS), BOD and COD. The methodology included the preparation of synthetic greywater, followed by batch experiments using plants and column studies incorporating both planted systems and conventional filters, which demonstrated significant improvements in physical filtration efficiency. The conventional filter achieved removal efficiencies of 94.08%, 52.55%, 75.66% for turbidity, COD and BOD respectively whereas the removal efficiency obtained by *Colocasia* plant and *Canna Indica* plant -based filters are 100%, 67.83%, 84.87% and 100%, 85.93% and 87.06% for turbidity, COD and BOD respectively. The *Canna Indica* filter exhibited the highest performance through a layered media of sand and gravel over a period of 4-hour retention time. The development of the filter unit was found to be cost-effective, with an estimated total cost of ₹1130. The study shows that vertical flow constructed wetlands are an effective, sustainable, and cost-efficient method for treating greywater. The treated water is suitable for non-potable uses like irrigation and toilet flushing, supporting water conservation.

Keywords: Greywater Treatment, Vertical Flow Constructed Wetland, *Colocasia*, *Canna Indica*, Sustainable.

PERFORMANCE ANALYSIS OF LANDFILL LINER MATERIALS

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Abstract:

Landfill leachate management is a critical environmental challenge, requiring robust liner systems to prevent groundwater and soil contamination. This study investigates the performance of alternative liner materials through the industrial valorization of Red Mud, an industrial byproduct, stabilized with the eco-friendly biopolymer Sodium Alginate. Using a laboratory permeameter prototype, the research evaluates the hydraulic and structural integrity of these materials under simulated operational conditions to support the development of performance-based design criteria. Standard Proctor tests revealed that increasing Alginate content enhances structural stability until a certain point. Unconfined Compressive Test indicates 1.5% as optimum alginate content for structural stability. Fourier Transform Infrared (FTIR) spectroscopy confirmed the chemical composition, identifying free O-H groups (3690 cm^{-1}), strong silicate framework signatures ($1106\text{--}911\text{ cm}^{-1}$), and metal-oxide bending modes ($532\text{--}461\text{ cm}^{-1}$) indicative of kaolinite and iron-bearing phases essential for pollutant attenuation. While Scanning Electron Microscopy (SEM) illustrates the dense, layered mineral arrangement that minimizes permeability, the corresponding structural results confirm that this stabilized mix provides a viable, sustainable solution for engineering impermeable landfill barriers. Building upon the structural and chemical characterization, the functional performance of the optimized mix (1.5% Alginate) was validated through a series of falling head permeability tests. Initial laboratory trials under low-head conditions yielded an average hydraulic conductivity (k) of $1.194 \times 10^{-8}\text{ cm/s}$, demonstrating exceptional initial resistance to fluid migration. To simulate realistic landfill environments, the specimen was subjected to a 16.52 kPa overburden pressure using a 30 kg surcharge and an increased hydraulic head of 126 cm. Under these higher stress conditions, the discharge rate stabilized at 235 ml/day, resulting in a permeability of $2.29 \times 10^{-7}\text{ cm/s}$. These results indicate that while increased vertical loading and hydraulic gradients slightly elevate the seepage rate, the Red Mud-Alginate matrix maintains a performance level that remains closely aligned with international regulatory standards ($\leq 1 \times 10^{-7}\text{ cm/s}$). The correlation between the SEM-observed dense mineral arrangement and these low permeability values confirms that the Alginate-stabilized Red Mud is not only structurally resilient but also a highly effective hydraulic barrier. Consequently, this study establishes the composite as a technically viable and environmentally sustainable alternative to traditional clay liners for modern landfill infrastructure.

PERFORMANCE EVALUATION OF SCC USING METAKAOLIN AND STEEL FIBRES

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Abstract:

Self-compacting concrete (SCC) is an advanced construction material capable of flowing and consolidating under its own weight without external vibration. This study investigates the performance of self-compacting concrete incorporating metakaolin as a partial replacement of cement and steel fibres as reinforcement. The objective is to improve mechanical properties and durability while maintaining acceptable workability. Metakaolin was used in proportions ranging from 0% to 20%, and an optimum replacement level of 15% was identified based on compressive strength and workability results. Steel fibres were then added at 0%, 1%, 2%, 3%, and 4% to evaluate their influence. Fresh properties of the fibre-incorporated mixes were assessed using slump flow, V-funnel, and L-box tests. Slump flow decreased from 790 mm to 650 mm, V funnel time increased, and L-box ratio decreased with increasing fibre content; all mixes up to 3% fibre satisfied EFNARC specifications. Compressive strength reached a maximum of 48 MPa at 28 days at 2% fibre content, with notable improvements in split tensile and flexural strengths. Durability tests showed reduced permeability and water absorption with metakaolin, while higher fibre dosages slightly increased both. Microstructural analysis using XRD indicated the presence of key crystalline phases including quartz, calcite, and C-S-H, with the metakaolin mix showing evidence of pozzolanic activity. SEM images revealed a comparatively denser matrix and reduced microcracking in the metakaolin mix, along with a well-bonded fibre-matrix interface. EDS analysis identified the elemental composition of the concrete matrix, showing differences in calcium, silicon, and aluminium content between the control and metakaolin mixes. The optimum mix was found to be 15% metakaolin with 2% steel fibre.

Keywords: Metakaolin, Steel Fibre, Self-Compacting Concrete, Slump Flow, L-Box, V Funnel, SEM, XRD, EDS, Durability

EFFECT OF SYNTHETIC LEACHATE ON THE PROPERTIES OF LINER MATERIAL

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Abstract:

Landfills are a primary method for municipal solid waste disposal globally, with increasing environmental concerns regarding leachate and gas emissions. Contamination of soil due to the leachate from municipal solid waste is a major environmental problem. Landfill leachate is generated from liquids existing in the waste as it enters a landfill or from rainwater that passes through the waste within the facility. A good liner material for landfills is crucial to prevent leachate contamination of ground water due to infiltration of leachate. Conventionally compacted clay is used as liner material.

In this study engineered liner material of red mud with guar gum has been analysed to replace the conventional clay liners. The optimum percentage of guar gum to be mixed with red mud is derived as 1% based on the Compaction characteristics test, Unconfined compressive strength and Hydraulic conductivity test. The red mud guar gum mix exhibits superior unconfined compressive strength, marginally surpassing conventional clay liners. Additionally, its hydraulic conductivity indicates significantly lower permeability, positioning it as a viable alternative liner material. To analyse the environmental compatibility of the new liner material, a synthetic leachate is synthesized in the laboratory to closely resemble that of real leachate collected from Brahmapuram landfill at Kochi, Kerala.

The change in the geotechnical properties of the liner material when impregnated with synthetic leachate for a period of 60 Days is studied, which proved that red mud with guar gum can be effectively used as a liner material. The heavy metal adsorption capacity of red mud also proves the efficiency of newly proposed liner material.

Key words: Landfill liner, Gaur gum, Synthetic leachate, Contamination

ECO THERM BRICK: SUSTAINABLE PLASTIC BRICK WITH THERMAL INSULATION

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Abstract:

The increasing accumulation of plastic waste and the growing demand for energy-efficient construction materials have created the need for sustainable alternatives in the construction industry. This project, titled "Eco Therm Brick: Sustainable Plastic Brick with Thermal Insulation," focuses on developing an eco-friendly brick by incorporating waste plastic into conventional brick materials. The main objective of the study is to utilize HDPE (High Density Polyethylene – non-degradable plastic) waste while improving the thermal insulation properties of building bricks.

The brick is manufactured using a mixture of cement and sand in a ratio of 1:4, along with shredded HDPE plastic, metakaolin, and perlite. The mix design was determined by reviewing and comparing different research journals to identify a suitable range of material proportions. Based on this analysis, 10% metakaolin, 3% perlite, and 7% HDPE plastic were incorporated into the mix. Metakaolin is added to enhance strength and durability, while perlite improves thermal insulation by reducing heat transfer. The materials are thoroughly mixed, molded into brick shapes, and cured to obtain the final product.

The developed bricks were evaluated for compressive strength, density, and thermal insulation performance to assess their suitability for construction applications. The expected outcome of this project is to produce a sustainable, lightweight, and thermally efficient brick that contributes to plastic waste management and promotes environmentally friendly construction practices.

This study highlights the potential of integrating HDPE plastic waste and insulating materials in brick production as a practical solution for both waste utilization and energy-efficient building materials.

Keywords: HDPE, Metakaolin, Thermal Insulation, and Recycled plastic

PERFORMANCE OF BRACED STEEL BUILDINGS WITH VARIOUS CONFIGURATIONS

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Abstract:

The performance of braced steel buildings with various configurations is a critical aspect in improving structural behavior under seismic and wind loads. Bracing systems such as X-bracing, V-bracing, and advanced systems like Buckling Restrained Braces (BRB) and Resilient Slip Friction Joints (RSFJ) are widely used to enhance lateral stability. This study reviews and compares X bracing configurations in multi-storey steel structures with various configurations such as buildings with re-entrant corners, buildings on slopes, and irregularity in plan and elevation based on parameters such as storey displacement, storey drift, base shear, stiffness, and residual deformation.

Results from various studies indicate that bracing significantly reduces lateral displacement and increases structural stiffness compared to unbraced frames. X-bracing is found to be highly effective in controlling drift and displacement, while BRB systems provide better energy dissipation and RSFJ systems offer superior self-centering capability with minimal residual deformation. The location and configuration of bracing also play a vital role in overall structural performance. The study concludes that appropriate selection and placement of bracing systems can greatly enhance the seismic performance and safety of steel buildings.

Keywords: Steel structures, Bracing systems, X-bracing , Storey displacement, Storey drift ,Base shear Seismic performance, Lateral stability.

BEHAVIOUR OF ALUMINUM ALLOY CHANNEL SECTION COLUMN UNDER CYCLIC LOADING

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Abstract:

Use of Aluminium alloys as a structural member is an emerging field of research considering its highly corrosive resistance, better strength to weight ratio implies its significance in use. Channel sections are widely used as compression members, such as wall studs and chord members of roof trusses in residential and commercial buildings. The seismic behaviour of aluminium alloy channel section columns undergoing combined axial load and lateral cyclic loading is numerically investigated in this report. Energy Dissipation capacity, Ductility displacement coefficient, Stiffness degradation and column overstrength factor are considered as the main performance indices of the column section. Parametric studies were conducted by varying the global slenderness ratio, web slenderness ratio, web width to flange width ratio, and axial compression ratio. Based on these parameters the effect of performance indices is evaluated and the sections with the optimum seismic performance is investigated. From the FEA results, an analytical model called restoring force model is developed consisting of regression equation for peak load, yield load and ultimate displacement point load in the hysteresis loop.

HEALTH MONITORING OF RAILWAY TRACK BY GAUGE DETECTOR

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Abstract:

Railway transportation systems require precise maintenance of track geometry to ensure safe and stable train movement, and among all geometric parameters, the railway gauge is a critical one. Railway gauge is defined as the distance between the inner faces of the two running rails and even minor deviations in gauge width can significantly disturb wheel-rail interaction forces, increase lateral instability, accelerate rail and wheel wear, and in extreme situations lead to derailment. Railway tracks are continuously exposed to environmental and operational stresses including thermal expansion and contraction, repeated dynamic axle loading, fastening loosening, ballast settlement, and structural fatigue. Steel rails expand when the temperature increases and contract when the temperature decreases. Over long welded rails, temperature variations can create substantial internal stresses that may cause track buckling or gauge widening if not properly restrained. Conventional gauge inspection methods rely on manual mechanical gauges or periodic inspection using dedicated track recording vehicles. Although these methods provide accurate measurements, they are not continuous and cannot provide real-time alerts. Sudden or progressive gauge deviations that occur between inspection intervals may therefore remain undetected, increasing the risk of operational hazards. This project proposes a real-time railway gauge detector using a laser displacement sensor based on triangulation principles for continuously monitoring the distance between the inner faces of the rails. The system measures rail displacement with high precision, processes the data through an embedded controller, applies temperature compensation where required, and compares the measured gauge against predefined tolerance limits. If the gauge deviation exceeds permissible expansion or contraction thresholds, the system automatically generates alerts and logs the data for maintenance action. The proposed solution offers non-contact measurement, high accuracy within sub-millimeter range, automated alert generation, and continuous monitoring capability. By transforming railway gauge inspection from periodic manual verification to intelligent real-time monitoring, the system significantly enhances railway safety, reduces derailment risk, and supports predictive maintenance strategies in modern railway infrastructure.

COOL ROOF MORTAR TILE USING PHASE CHANGE MATERIAL

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Abstract:

This project presents the development of cool roof mortar tiles incorporating phase change materials (PCMs) to reduce heat gain in buildings and improve thermal comfort. The aim is to utilize free fatty acids (FFA) derived from coconut oil as a sustainable PCM for thermal energy storage in roofing applications. These materials absorb excess heat during the day and release it during cooler periods, thereby stabilizing indoor temperatures. The scope of the study includes material selection, encapsulation of FFA using a fabricated galvanized iron (GI) sheet enclosure, and integration of the PCM within mortar tiles. The mortar mix was prepared using cement, fine aggregate, and water without coarse aggregate to ensure proper embedding of the PCM unit. Differential Scanning Calorimetry (DSC) analysis confirmed that FFA exhibits a phase change temperature of 30–40°C and a latent heat capacity of 150–200 kJ/kg, making it suitable for hot climatic conditions. The expected outcome of the project is a temperature reduction of 2–5°C and delayed heat transfer compared to conventional tiles. This system offers a cost-effective, eco-friendly solution for energy-efficient and sustainable building construction.

Keywords: Cool roof tiles, Free Fatty Acids (FFA), Sustainable Building Materials.