CHRIST COLLEGE OF ENGINEERING (AUTONOMOUS), IRINJALAKUDA

The Revival

MAGAZINE BY THE DEPARTMENT OF CIVIL ENGINEERING

2025–2026

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

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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.

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CONTENTS

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

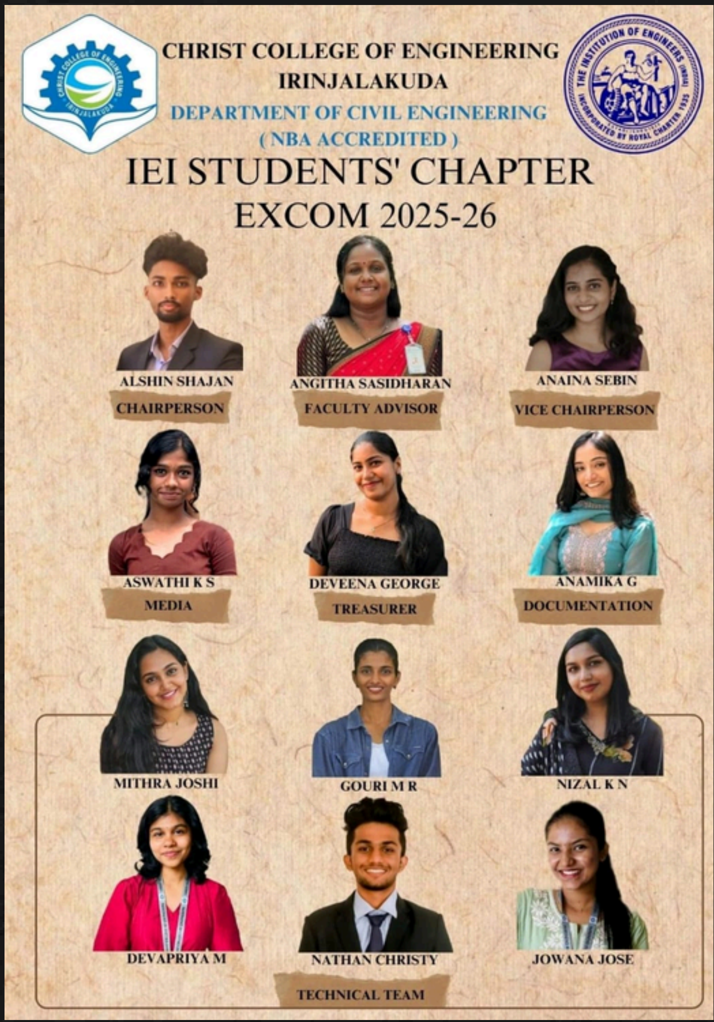
"If we can create an eco-friendly civilisation, that would be a great victory for both humanity and na- ture!"

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 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

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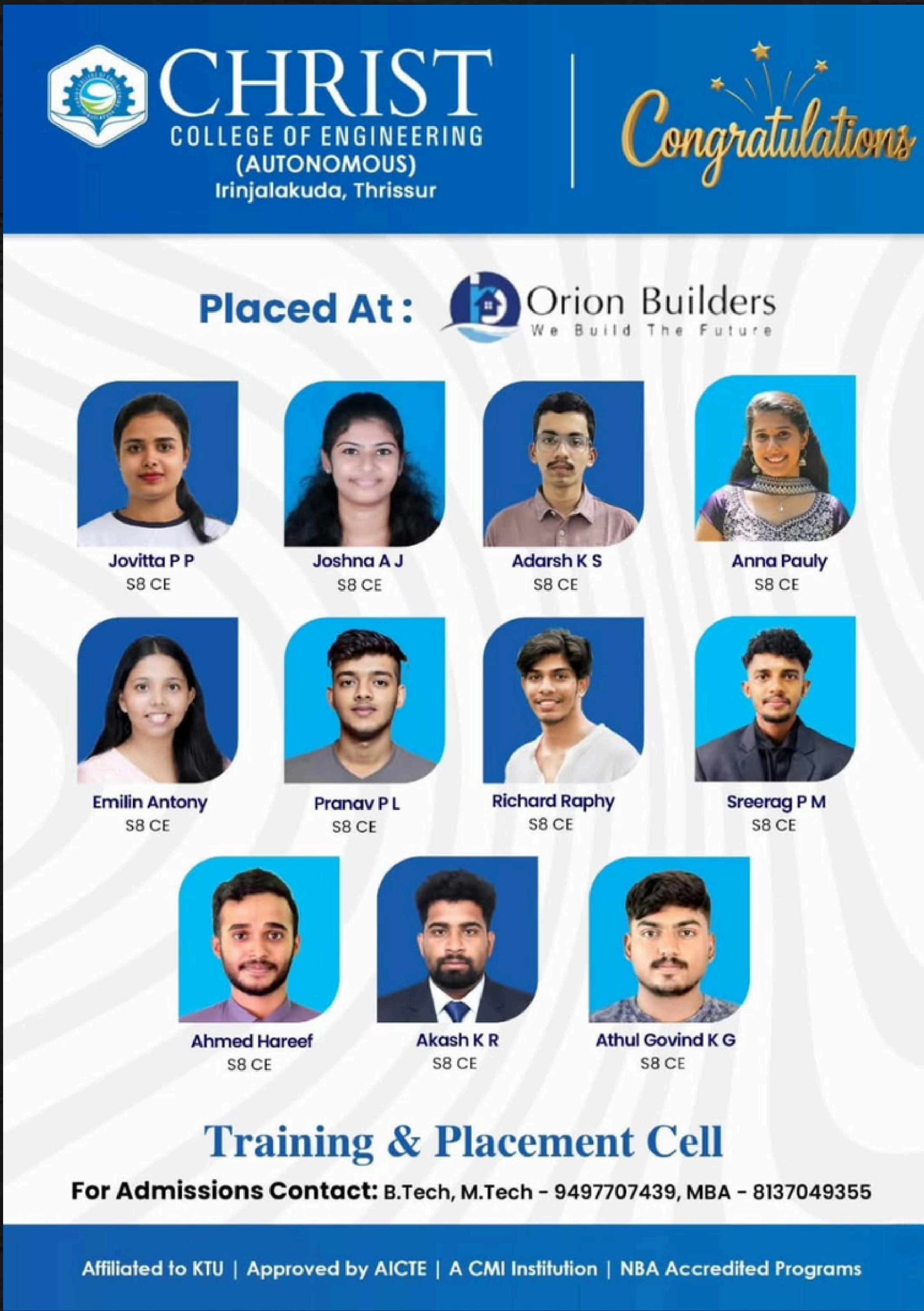

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ACTIVITIES

The Institution of Engineers (India) Kochi Local Centre organized an All India Workshop on “Building a Greener Tomorrow: Advances in Sustainable Construction” on 22nd & 23rd August 2025 at IEI Bhavan, Kochi.
The event featured distinguished experts from industry, academia, and research who shared perspectives on sustainable construction practices, eco-friendly technologies, and innovative solutions.

CONSTRUCTIUM - A DIGITAL DESIGN EXPO 2025

The Department of Civil Engineering in association with Project Club, Christ College of Engineering successfully hosted a Project Expo for S5 CE students as part of their SEP continuous evaluation. The expo showcased remarkable BIM projects that highlighted students' ability to integrate design, technology, and collaboration, reflecting their growth as future industry professionals

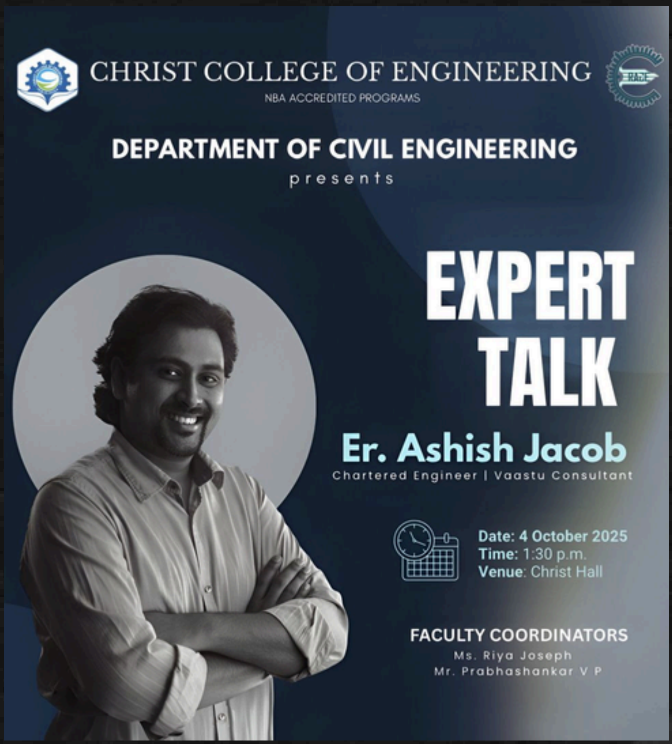
Ecoquest

The Department of Civil Engineering, Christ College of Engineering, successfully conducted EcoQuest 2025 – an idea pitching competition organized by the EnvoTech Club on 26th September 2025.

With the theme "Green Classroom", the event received an overwhelming response with the participation of 20 teams, including enthusiastic students from both schools and colleges. The young innovators showcased creative and sustainable ideas, making the competition a remarkable platform for knowledge sharing and environmental awareness.

Expert Talk

The Department of Civil Engineering organized an Expert Talk on 4 October 2025 at Christ Hall. The session was delivered by Er. Ashish Jacob, Chartered Engineer and Vaastu Consultant. The talk provided valuable insights into professional practices, industry perspectives, and practical applications in the field of civil engineering. The session was interactive and informative, offering students an opportunity to gain knowledge from an experienced industry expert.



Alumni Talk

The Department of Civil Engineering organized an Alumni Talk on 4 October 2025 at Christ Hall. The session was delivered by Ms. Anna Saju from NICMAR University, Pune. She shared her academic journey, professional experiences, and insights into higher studies and career opportunities in the field of civil engineering. The session was informative and motivating, providing students with valuable guidance for their future endeavors.

Civil Studio Fest 2026

The Department of Civil Engineering organized Civil Studio Fest 2026 on 5 January 2026 as part of the Student Enrichment Program (SEP), in association with ECONSTRUCT Design & Build Pvt. Ltd., Bengaluru. The one-day event was conducted for Civil Engineering students with the objective of enhancing industry exposure and professional competencies.
The sessions were led by Mr. Sandeep Pingale, Managing Director, and Mrs. Shraddha Pingale, Joint Director, who shared valuable insights on current industry practices, project execution, and employability skills. The program provided students with practical knowledge and industry-oriented guidance, making it an enriching learning experience.

INDUSTRIAL VISITS

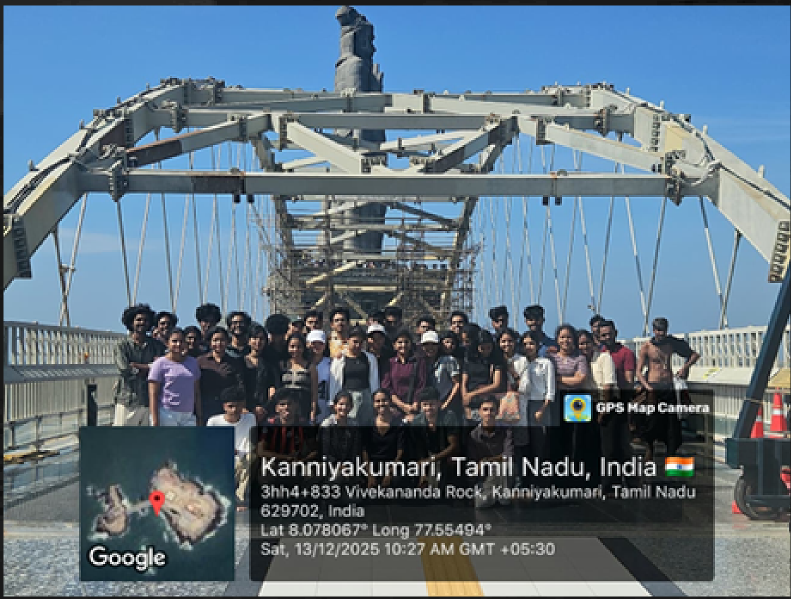
S5 and S7 students visited the Pre-Engineered Building (PEB) site at CCE, gaining valuable insights into the construction process. A huge thank you to Mr. Vivek G Nair (Project Engineer, Wootz Structures Pvt. Ltd.) for explaining the concepts and sharing industry expertise with our students.

Faculty members Riya Joseph, Angitha Sasidharan, Dr. Vivek Viswanath and Neenu Johnson assisted the students on 15.9.25 and 16.9.25

The S6 Civil Engineering students participated in an educational field trip to Peechi Dam and KERI (Kerala Engineering Research Institute) under the guidance of Dr. Sherjah P Yusuf Ali. The visit provided valuable exposure to the structural components of dams, their hydraulic features, and the functioning of the inspection gallery.

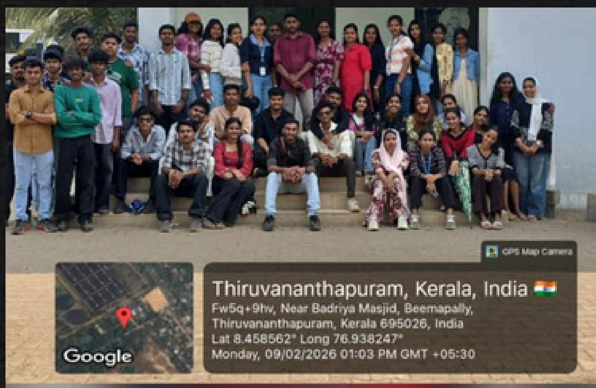
At KERI, students had the opportunity to observe research facilities, testing methods, and practical applications of concepts learned in class.

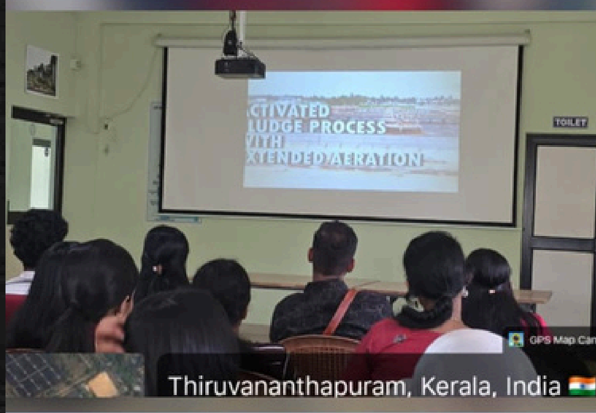
The trip offered an enriching blend of theory and real-world engineering, helping students deepen their understanding of hydraulic structures and dam safety.

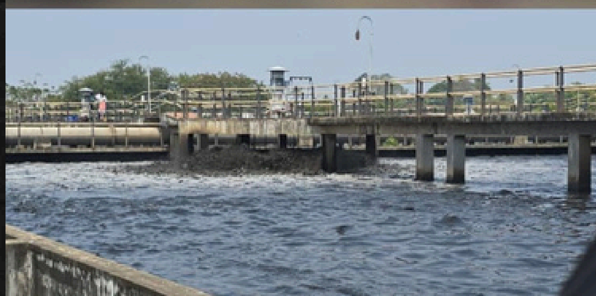


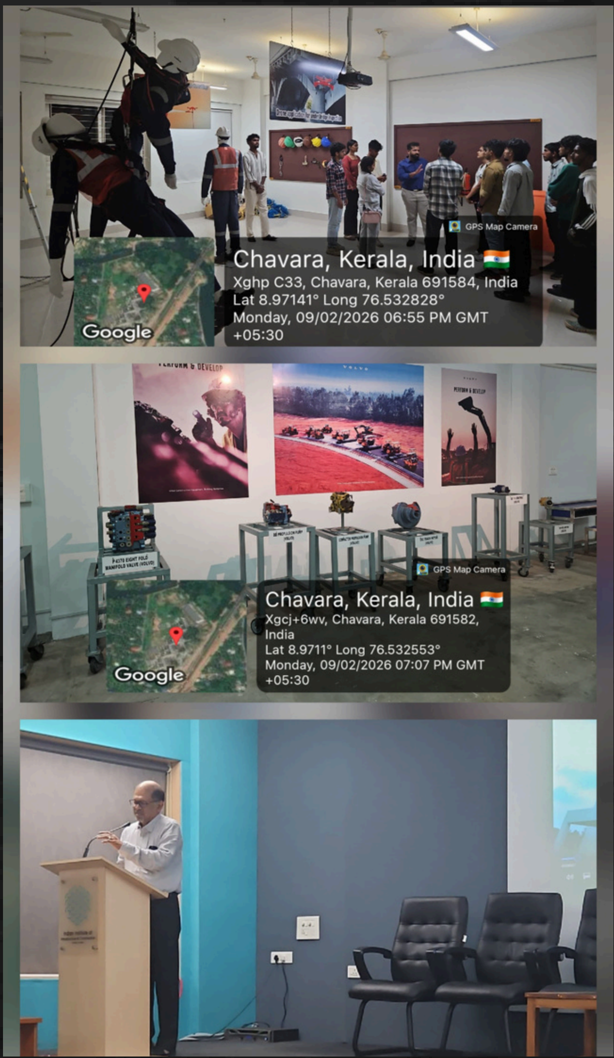
As part of the Industrial Visit, S4 students visited the Glass Bridge at Kanyakumari. During the visit, they observed the bridge's structural design, safety features, and construction detailing. The experience provided valuable practical exposure and helped them understand the real-time application of engineering concepts

The S6 Civil Engineering students, as part of the EnvoTech Club activities, undertook an industrial visit to the Muttathara Sewage Treatment Plant, the largest sewage treatment facility in Kerala with a treatment capacity of 107 MLD. The plant operates using the Activated Sludge Process, one of the most widely adopted biological treatment methods for wastewater management. During the visit, students had the opportunity to observe the various stages involved in sewage treatment, including preliminary, primary, secondary, and sludge treatment processes. This provided them with valuable practical knowledge and a deeper understanding of large-scale sewage treatment, environmental protection, and sustainable wastewater management practices. The visit was highly informative and helped bridge the gap between theoretical learning and real-world engineering applications.









The EnvoTech Club of the Department of Civil Engineering organized an industrial visit to the Indian Institute of Infrastructure and Construction (IIIC), Kollam, for the S6 Civil Engineering students. The visit provided students with valuable exposure to modern construction technologies, innovative infrastructure development methods, and industry-oriented training practices. They observed advanced construction techniques, modern machinery, and practical methods used in real-time infrastructure projects, which enhanced their understanding of current industry standards and professional requirements. The visit helped students bridge the gap between theoretical knowledge and practical application, while also highlighting the importance of technical skills and quality in construction.

The S6 Civil Engineering students, in association with the EnvoTech Club, visited the Vizhinjam International Seaport to gain practical exposure to large-scale marine infrastructure and port operations. Students observed breakwater construction, port logistics, and safety practices, helping them connect theoretical knowledge with real-world engineering applications. The visit enhanced their understanding of modern port construction and marine engineering.

Life Cycle–Based Design Approach for Sustainable Civil Structures

-Aisha Kalapurakkal Saleem

Introduction

The construction sector plays a vital role in economic development, but it is also one of the largest consumers of natural resources and energy. Rapid urbanization, population growth, and infrastructure expansion have increased the environmental impact of civil engineering projects. In this context, sustainability has become a major responsibility of civil engineers. The life cycle–based design approach offers an effective solution by promoting environmentally responsible, economically viable, and socially acceptable civil structures throughout their entire life span.

Concept of Life Cycle–Based Design

Life cycle–based design is a comprehensive approach that evaluates a structure from its initial planning stage to its final demolition or reuse. It includes planning and design, raw material extraction, material production, construction, operation, maintenance, and end-of-life management. Unlike conventional design approaches that mainly focus on initial cost and strength requirements, life cycle–based design considers long-term performance, environmental impact, and total cost over the entire service life of the structure.

Importance of Sustainability in Civil Structures

Sustainable civil structures aim to minimize negative environmental impacts while meeting functional and safety requirements. Life cycle–based design supports sustainability by reducing excessive material usage, energy consumption, and waste generation. It encourages engineers to consider future consequences of present design decisions, ensuring that infrastructure development does not compromise environmental balance or the needs of future generations.

Sustainable Material Selection

Material selection plays a crucial role in determining the environmental impact of a structure. Life cycle–based design promotes the use of sustainable, durable, and locally available materials to reduce transportation energy and carbon emissions. Materials such as fly ash, ground granulated blast furnace slag, recycled aggregates, and low-carbon cement help reduce embodied energy. Choosing durable materials also reduces maintenance requirements and extends the service life of the structure.

Energy Efficiency during Service Life

The operational phase of a structure accounts for a major portion of its total energy consumption. Life cycle–based design emphasizes energy-efficient building designs through proper orientation, natural lighting, effective ventilation, and thermal insulation. The integration of renewable energy sources such as solar and wind power further reduces dependence on fossil fuels and lowers greenhouse gas emissions, making structures more sustainable in the long run.

Durability and Long-Term Performance

Durability is a key factor in sustainable design. Structures that are designed to withstand environmental conditions and loads over long periods require fewer repairs and replacements. Life cycle–based design focuses on improving durability by selecting appropriate materials, protective measures, and construction techniques. This not only enhances safety and performance but also reduces resource consumption and waste generation over time.

Life Cycle Cost Analysis

Life cycle cost analysis (LCCA) is an important tool used in life cycle–based design to evaluate the total cost of a structure throughout its life span. It includes initial construction cost, operation cost, maintenance cost, and end-of-life cost. Although sustainable design alternatives may have higher initial costs, they often result in lower overall costs due to reduced energy use, maintenance, and repair expenses, making them economically beneficial in the long term.

End-of-Life Considerations

End-of-life planning is an essential aspect of life cycle–based design. By considering demolition, reuse, recycling, or safe disposal during the design stage, engineers can significantly reduce construction and demolition waste. Designing structures for easy disassembly and material recovery supports the concept of a circular economy and promotes responsible management of natural resources.

Role of Civil Engineers

Civil engineers play a central role in implementing life cycle–based design approaches. By using tools such as life cycle assessment (LCA), sustainable design guidelines, and green building rating systems, engineers can make informed decisions that improve sustainability. Their professional responsibility extends beyond construction to ensuring long-term environmental protection and societal well-being.

Digital Twins for Sustainable Infrastructure Planning

-Aswathy K S

The global push for sustainability has fundamentally changed how we approach infrastructure planning and development. As populations grow and the impacts of climate change intensify, there is a critical need for infrastructure that is not only resilient and efficient but also minimizes environmental impact. This shift necessitates advanced tools and methodologies that can handle the complexity of modern urban and regional systems. Enter the Digital Twin: a sophisticated, virtual replica of a physical asset, process, or system. In the context of infrastructure, a Digital Twin is far more than a simple 3D model; it is a dynamic, living simulation that allows planners to test scenarios, predict performance, and optimize design choices for long-term sustainability.

Digital Twins integrate real-time data from sensors, building information models (BIM), geographic information systems (GIS), and historical records to create a comprehensive, data-rich environment. This virtual environment serves as a powerful sandbox for sustainable planning. Before breaking ground on a new project—be it a smart grid, a bridge, or a public transit network—planners can use the twin to assess various design options against a suite of sustainability metrics. For instance, a twin can simulate the energy performance of a building design under various climate conditions, allowing engineers to adjust materials and orientation to maximize passive heating and cooling, thereby reducing the building's lifetime carbon footprint. Similarly, for transportation networks, a twin can simulate traffic flow improvements and assess the air quality impact of implementing new public transport routes or charging stations for electric vehicles. This predictive capability is key to making informed decisions that lock in sustainable outcomes from the start, avoiding costly and carbon-intensive retrofits later on.

Enhancing Resource Efficiency and Resilience

One of the most significant contributions of Digital Twins to sustainability is in enhancing resource efficiency and resilience. By continuously monitoring the physical infrastructure, the twin can detect anomalies, predict maintenance needs, and optimize operational performance in real-time. For a water utility, a twin can pinpoint areas of leakage in the distribution network with high precision, dramatically reducing water loss, a critical sustainability challenge in many regions. In the realm of energy infrastructure, a twin of a smart grid can optimize the integration and distribution of intermittent renewable energy sources like solar and wind power, ensuring system stability and minimizing the reliance on fossil fuel backups.

Furthermore, the twin's ability to model catastrophic events—such as floods, earthquakes, or extreme heat waves—allows planners to stress-test designs and build resilience into the very fabric of the infrastructure. This includes optimizing the placement of critical facilities and designing protective measures that ensure continuity of service during and after a disaster, minimizing the social and economic disruption associated with extreme weather events. The integration of real-time environmental data allows infrastructure owners to proactively adapt to changing conditions.

Fostering Collaboration and Public Engagement

The use of Digital Twins also fosters unprecedented collaboration and stakeholder engagement, which are cornerstones of truly sustainable planning. By providing a shared, interactive virtual environment, the twin democratizes access to complex planning information. City officials, engineers, environmental consultants, and the public can visualize the long-term impact of proposed projects, leading to more transparent decision-making and better-vetted solutions.

For example, presenting a virtual walk-through of a planned development allows community members to provide tangible feedback on elements like pedestrian pathways, green spaces, and aesthetic impact. This iterative, data-driven approach to planning ensures that infrastructure projects align not only with technical standards but also with the social and environmental values of the communities they serve. This capability is especially important when planning large-scale public projects, as early and transparent engagement can significantly reduce delays and public opposition.

The Future is Digital and Sustainable

As the technology matures, Digital Twins are poised to become the indispensable foundation for developing the next generation of infrastructure: systems that are inherently intelligent, profoundly sustainable, and robustly resilient in the face of a changing world. The investment in Digital Twin technology is an investment in minimizing the environmental footprint and maximizing the longevity of urban systems. It shifts infrastructure development from a reactive process to a proactive one, where sustainable outcomes are designed into the system from the very beginning. The ability to simulate and predict performance across the entire lifecycle of an asset, from construction to operation to decommissioning, ensures that every decision contributes positively to the triple bottom line: people, planet, and profit. The future of sustainable infrastructure is being built, first, in the digital realm, promising a more efficient, resilient, and environmentally responsible world.

Energy-Positive Buildings: Structures That Produce more Energy than They Consume

- Alen Joby

Energy-positive buildings (also called net-positive or energy-surplus buildings) are advanced structures designed to generate more energy over a year than they consume for heating, cooling, lighting, appliances, and other operations. Unlike conventional buildings that rely heavily on external power sources, these buildings act as mini power plants, exporting surplus energy to the grid or nearby buildings. With rising energy demand, climate change concerns, and the push toward sustainability, energy-positive buildings represent a crucial step toward a low-carbon future.

Key Design Strategies for Energy-Positive Buildings

Passive design measures are the first step in reducing energy demand. Proper building orientation maximizes natural daylight and solar gain, while high-performance insulation and airtight envelopes minimize heat losses. Shading devices, green roofs, and reflective materials help control indoor temperatures, and natural ventilation and daylighting reduce dependence on artificial lighting and mechanical systems.

Energy-efficient systems further lower operational energy consumption. LED lighting with daylight and occupancy sensors ensures efficient lighting use, while high-efficiency HVAC systems such as heat pumps provide effective climate control. Smart appliances and building automation systems (BAS) monitor and optimize energy use, improving performance and occupant comfort
.

Renewable energy generation is central to energy-positive buildings. On-site technologies such as solar photovoltaic panels, solar thermal systems, small-scale wind turbines, and geothermal energy enable buildings to produce clean energy. Building-integrated renewable systems allow energy generation without compromising architectural aesthetics or functionality.

Energy storage and smart grid integration address the variability of renewable energy. Battery and thermal storage systems store excess energy for later use, while electric vehicles can function as mobile energy storage units. Connection to smart grids enables two-way energy flow, allowing surplus energy to be supplied to the grid and deficits to be met during peak demand.

Materials and construction techniques enhance sustainability throughout the building life cycle. The use of low-embodied-energy materials, high-performance glazing, prefabrication, and locally sourced materials reduces environmental impact, construction waste, and transportation energy.

Benefits of Energy-Positive Buildings

Energy-positive buildings significantly reduce greenhouse gas emissions and operational costs while improving energy security. They offer better indoor environmental quality and occupant comfort, and contribute to sustainable urban development by transforming buildings from energy consumers into energy producers.

Challenges and Future Scope

Key challenges include higher initial costs, the need for skilled design and operation, climate dependency, and regulatory constraints. However, ongoing advancements in renewable energy technologies, energy storage, smart controls, and supportive policies are steadily overcoming these limitations. With continued innovation, energy-positive buildings will play a vital role in achieving sustainable and resilient cities.

AI Driven Structural Design for Material and Cost Optimisation

-Martina

The construction industry is steadily embracing artificial intelligence as a powerful tool in structural engineering. AI driven structural design focuses on improving efficiency by optimising material use and reducing overall project costs while maintaining safety and performance standards. Traditional design methods often rely on conservative assumptions, which can lead to excessive material consumption. AI offers a data based alternative that supports more accurate and economical decisions. By analysing large volumes of design data, simulations and past project outcomes, AI systems can evaluate numerous design options in a short time. This enables engineers to identify structural configurations that use less concrete or steel without compromising strength or durability. Even small reductions in material quantities can result in significant cost savings, especially in large scale infrastructure projects.

Material optimisation through AI also contributes to sustainability. Construction materials require high energy input and generate considerable carbon emissionĥs during production. AI driven design encourages efficient structural forms and reduces waste, supporting environmentally responsible construction practices alongside financial benefits. Cost optimisation extends beyond materials alone. AI can assess how design choices influence construction methods, labour requirements and project duration. Designs that are simpler to build often lead to shorter construction times and lower risks of delays, further improving cost efficiency. While AI does not replace the role of the structural engineer, it enhances professional judgement by providing advanced analytical support. As digital skills and AI literacy grow within the profession, AI driven structural design is set to play a central role in delivering safer, more economical and more sustainable structures in the future.

Autonomous Construction Technologies and Their Role in Sustainability

- Krishnendu M U

The construction industry plays a vital role in national development, yet it is also one of the largest contributors to environmental degradation through high energy consumption, material waste, and carbon emissions. With the growing need for sustainable development, autonomous construction technologies are emerging as an innovative solution to make construction practices more efficient, safer, and environmentally friendly.Autonomous construction technologies include the use of robots, artificial intelligence (AI), drones, and automated machinery to perform construction activities with minimal human involvement. Examples include robotic bricklayers, self-operating excavators, 3D concrete printers, and drones used for surveying and site inspection. These technologies rely on sensors, GPS, and data-driven decision-making to carry out tasks with high accuracy.

One of the key sustainability benefits of autonomous construction is the reduction of material waste. Automated systems ensure precise measurements and controlled execution, minimizing errors and rework. Technologies like 3D printing use only the required amount of materials, helping conserve natural resources. Additionally, AI-based planning tools optimize scheduling and logistics, reducing unnecessary use of energy and materials

Autonomous machinery also contributes to lower environmental impact. Optimized machine operations reduce fuel consumption and greenhouse gas emissions. The use of electric and hybrid autonomous equipment further supports eco-friendly construction practices. Drones reduce the need for frequent site visits and heavy surveying equipment, indirectly lowering emissions and environmental disturbance.

Safety and social sustainability are equally important. By assigning hazardous tasks to autonomous machines, worker exposure to dangerous conditions is reduced. This leads to safer construction sites and allows workers to take on skilled roles such as monitoring and decision-making.

In conclusion, autonomous construction technologies have the potential to reshape the construction industry by promoting sustainability, efficiency, and safety. As future engineers, understanding and adopting these technologies is essential for building a greener and smarter built environment.

Smart Structures: Building a Sustainable Future

-Alna George

In today's rapidly urbanizing world, the demand for infrastructure that is both resilient and environmentally responsible has never been greater. Traditional systems—whether in energy, transport, or housing—struggle to keep pace with rising populations, climate pressures, and resource scarcity. Enter smart structures: buildings and urban systems enhanced with digital intelligence, designed to optimize efficiency, reduce waste, and adapt to changing conditions. These innovations are not futuristic luxuries but practical responses to the challenges of modern living.

Energy consumption is one of the most pressing issues. Conventional buildings account for a significant share of global electricity use, often due to outdated heating, cooling, and lighting systems. Smart buildings, however, integrate sensors, automation, and renewable energy sources to cut down on waste. Motion-sensitive lighting, AI-controlled HVAC systems, and rooftop solar panels are already helping households and businesses lower costs while reducing their carbon footprint.

Urban congestion presents another challenge. Traffic jams not only waste time but also fuel, contributing to air pollution and stress. Smart transport systems are transforming mobility by using real-time data to manage traffic flow, reroute vehicles, and improve public transit. Cities like Singapore and Barcelona have pioneered intelligent traffic lights and integrated mobility apps, offering a glimpse of how technology can make commuting smoother and cleaner.

Water scarcity is equally critical. Leaks and inefficient distribution waste millions of litres daily, while agriculture often suffers from over-irrigation. Smart water meters and IoT-based leak detection systems are helping conserve resources, while smart irrigation ensures crops receive just the right amount of water. Waste management, too, benefits from innovation: sensor-enabled bins notify collection services when they're full, optimizing routes and reducing fuel use, while AI-driven recycling systems improve sorting and reduce landfill overflow.

Beyond everyday efficiency, smart structures also enhance climate resilience. Flood-detection sensors embedded in bridges, responsive building materials that adapt to temperature changes, and smart grids that balance renewable energy supply are examples of how infrastructure can withstand and adapt to extreme weather events. Real-world projects such as Masdar City in the UAE, Songdo in South Korea, and Europe’s smart grid initiatives demonstrate the potential of these technologies to reshape urban living.

Of course, challenges remain. High initial costs can deter adoption, and there is a risk that rural or low-income communities may be left behind if smart solutions remain concentrated in wealthy urban centres. Privacy concerns also loom large, as constant monitoring raises questions about surveillance and data security. Moreover, smart systems require skilled technicians and regular updates, which can strain resources in developing regions.

Yet despite these hurdles, the promise of smart structures is undeniable. They represent a new way of thinking about infrastructure—not as static entities but as dynamic systems capable of learning, adapting, and evolving. By embedding intelligence into the very fabric of our cities and communities, we move closer to a future that is not only technologically advanced but also sustainable, inclusive, and resilient.

Ethical and Responsible Engineering for Sustainable Infrastructure Development

-Jowana Jose

Engineering is not merely about constructing buildings, roads, and bridges; it is about shaping the future responsibly. Every structure designed today has long-term consequences on society, the environment, and future generations. Ethical and responsible engineering therefore plays a vital role in achieving sustainable infrastructure development. Engineers must look beyond immediate project completion and short-term economic gains, and instead consider the broader environmental, social, and economic impacts of their decisions.

Sustainable infrastructure development focuses on efficient resource utilization, environmental protection, and long-term performance. This involves selecting eco-friendly and recyclable materials, minimizing construction waste, reducing carbon emissions, and incorporating energy-efficient design principles. Concepts such as green buildings, renewable energy integration, water conservation systems, and climate-responsive design are examples of how sustainability can be integrated into infrastructure projects. By adopting innovative technologies and sustainable practices, engineers contribute to reducing environmental degradation while maintaining structural performance and safety.

Ethics in engineering goes beyond technical accuracy. It includes honesty in reporting data, transparency in project execution, adherence to safety standards, and accountability for professional decisions. Engineers must strictly follow codes of conduct and regulatory guidelines to ensure public safety and trust. Compromising on material quality, ignoring safety protocols, or overlooking environmental assessments may lead to severe long-term consequences. Responsible engineers prioritize public welfare above personal or financial interests.

Furthermore, responsible engineering emphasizes inclusivity and resilience. Infrastructure should be designed to serve all sections of society, including vulnerable communities. Accessibility, affordability, and disaster resilience are essential components of sustainable development. With increasing climate change impacts such as floods, cyclones, and heat waves, engineers must incorporate disaster-resistant design strategies and adaptive technologies to ensure long-term durability and safety.

Modern tools such as Building Information Modeling (BIM), digital twins, and smart monitoring systems enable engineers to plan, analyze, and optimize infrastructure performance more efficiently. These technologies support data-driven decision-making, reducing risks and enhancing sustainability outcomes. However, technological advancement must always be guided by ethical judgment and social responsibility.

Another important aspect of ethical and responsible engineering is life-cycle thinking and long-term maintenance planning. Sustainable infrastructure is not only about initial design and construction, but also about how a structure performs throughout its entire lifespan. Engineers must consider durability, maintenance requirements, operational efficiency, and eventual decommissioning or reuse. Conducting life-cycle cost analysis, environmental impact assessments, and risk evaluations helps in making informed decisions that reduce future repair costs and environmental burdens. By planning for longevity and adaptability, engineers ensure that infrastructure remains functional, safe, and sustainable for decades.

In conclusion, ethical and responsible engineering is the foundation of sustainable infrastructure development. It ensures that development remains balanced, environmentally conscious, socially inclusive, and economically viable. By combining technical expertise with moral values and environmental awareness, engineers become true contributors to society—building not just structures, but a resilient and sustainable future for generations to come

Climate-Resilient Infrastructure: Designing for an Uncertain Future

- Daniel

Climate change has emerged as one of the most critical challenges influencing infrastructure development across the globe. Increasing temperatures, unpredictable rainfall patterns, rising sea levels, heat waves, floods, cyclones, and droughts are placing unprecedented stress on civil infrastructure systems. Traditional engineering practices were largely based on historical climate data and predictable environmental conditions. However, the current era demands a shift from reactive design to proactive and adaptive planning. Climate-resilient infrastructure focuses on designing, constructing, and managing structures that can withstand, adapt to, and quickly recover from climate-related stresses.

Resilience in infrastructure refers to the ability of systems to resist damage, maintain functionality during extreme events, and recover rapidly after disruptions. It goes beyond structural strength; it includes durability, adaptability, and long-term performance. Engineers must now incorporate future climate projections into planning and design processes rather than relying solely on past records. Risk-informed decision-making and scenario-based modeling are becoming essential tools in modern infrastructure development.

Flood-resistant design is one of the primary considerations in climate-resilient planning. In flood-prone regions, elevated foundations, reinforced embankments, improved drainage networks, and permeable pavements help mitigate water-related damage. Coastal infrastructure requires additional protection through sea walls, surge barriers, and nature-based solutions such as mangrove restoration. These strategies reduce vulnerability while maintaining ecological balance.

Heat resilience is another significant aspect of sustainable infrastructure. Rising temperatures affect structural materials, increase energy demand, and contribute to urban heat island effects. The use of reflective roofing materials, green roofs, proper ventilation systems, and heat-resistant construction materials helps maintain thermal comfort and structural integrity. Smart urban planning that includes shaded streets, urban forests, and open spaces further enhances climate adaptation.

Wind-resistant structural systems are crucial in regions prone to cyclones and hurricanes. Aerodynamic building forms, stronger connections between structural elements, and advanced material technologies improve resistance against high wind pressures. Seismic and climate resilience can also be integrated to ensure multi-hazard preparedness.

An emerging approach in climate-resilient infrastructure is the integration of nature-based solutions. Green infrastructure such as wetlands, bioswales, rain gardens, and green belts works alongside engineered systems to manage stormwater, reduce flooding, and improve air quality. These solutions are often cost-effective and environmentally sustainable compared to conventional grey infrastructure.

Technology also plays a vital role in enhancing resilience. Smart sensors and real-time monitoring systems help track structural performance and detect early signs of stress or damage. Data analytics and predictive modeling enable engineers to anticipate risks and plan maintenance proactively. Geographic Information Systems (GIS) assist in hazard mapping and informed site selection, reducing exposure to climate-related threats.

Economic considerations are equally important. Although climate-resilient infrastructure may involve higher initial investment, it significantly reduces long-term repair costs, economic losses, and social disruption. Investing in resilience ensures continuity of essential services such as transportation, water supply, healthcare, and energy systems during emergencies.

Community involvement and inclusive planning are essential components of resilience. Infrastructure should be designed to protect vulnerable populations and ensure equitable access to safety and services. Collaboration between engineers, policymakers, environmental experts, and local communities strengthens the effectiveness of resilience strategies.

In conclusion, climate-resilient infrastructure represents a forward-thinking approach to sustainable development. It acknowledges the uncertainties of a changing climate and transforms them into opportunities for innovation and improvement. By combining advanced engineering techniques, smart technologies, ecological integration, and responsible planning, civil engineers can create infrastructure systems that are robust, adaptable, and future-ready. Designing for uncertainty is no longer optional—it is a fundamental responsibility in building a safe, sustainable, and resilient future for generations to come

Green Materials and Sustainable Construction Practices

-Houniliu Pamei

The construction industry plays a fundamental role in economic development, yet it is also one of the largest consumers of natural resources and contributors to carbon emissions. Rapid urbanization and infrastructure expansion have increased the demand for raw materials such as cement, steel, sand, and aggregates. To achieve a sustainable future, civil engineering must shift from conventional construction methods to environmentally responsible materials and practices. Green materials and sustainable construction techniques provide an effective pathway toward reducing environmental impact while maintaining structural performance and safety.

Green materials are defined as construction materials that minimize environmental damage during production, transportation, usage, and disposal. These materials often have lower embodied energy, reduced carbon emissions, improved recyclability, and minimal toxicity. For example, fly ash and ground granulated blast furnace slag (GGBS) are industrial by-products that can partially replace cement in concrete, significantly reducing carbon emissions associated with cement production. Similarly, geopolymer concrete offers a promising alternative with lower greenhouse gas emissions compared to traditional Portland cement concrete.

The use of recycled materials further enhances sustainability. Recycled steel reduces the need for mining virgin ore, while recycled aggregates from demolished structures minimize construction waste. Sustainable timber products such as cross-laminated timber (CLT) offer renewable alternatives to conventional structural systems, especially in mid-rise buildings. Bamboo, known for its high tensile strength and rapid growth rate, is also gaining attention as a sustainable construction material.

Sustainable construction practices extend beyond material selection. Efficient site management, waste reduction strategies, and prefabrication techniques significantly lower environmental impact. Modular construction, where building components are manufactured off-site and assembled on-site, reduces material wastage, shortens construction time, and minimizes disturbance to the surrounding environment. Proper planning also decreases fuel consumption and emissions from heavy machinery.

Water conservation is another key component of sustainable construction. Techniques such as rainwater harvesting, wastewater recycling, and efficient plumbing systems reduce freshwater demand. Dust control measures and noise reduction strategies improve environmental quality during project execution. Energy-efficient equipment and renewable energy integration on construction sites further reduce the carbon footprint of infrastructure projects.

Life-cycle assessment (LCA) has become an essential tool in evaluating the sustainability of materials and construction methods. Instead of focusing solely on initial costs, LCA considers environmental impacts throughout the entire lifespan of a structure, including production, operation, maintenance, and disposal. This comprehensive evaluation supports informed decision-making and long-term sustainability.

Adopting green materials and sustainable construction practices requires collaboration between engineers, architects, policymakers, and industry stakeholders. Government regulations, environmental certifications, and green building rating systems encourage responsible construction practices. By integrating environmental awareness with engineering innovation, the construction industry can significantly contribute to climate change mitigation and resource conservation.

Ultimately, green materials and sustainable construction practices represent a transformative shift in civil engineering. They demonstrate that infrastructure development and environmental protection can coexist, guiding society toward a more responsible and sustainable future.

Smart Transportation Systems for Sustainable Urban Development

- Archana E R

Urbanization is rapidly transforming cities around the world, leading to increased traffic congestion, air pollution, energy consumption, and infrastructure stress. Traditional transportation systems struggle to accommodate growing populations and rising mobility demands. Smart transportation systems offer an innovative solution by integrating advanced technologies, data analytics, and sustainable mobility strategies to enhance efficiency and reduce environmental impact.

Smart transportation relies on Intelligent Transportation Systems (ITS), which use sensors, cameras, communication networks, and data processing tools to monitor and manage traffic flow in real time. Adaptive traffic signals adjust signal timing based on congestion levels, reducing unnecessary delays and fuel consumption. Real-time traffic information systems help commuters choose efficient routes, minimizing travel time and emissions.

Public transportation networks play a crucial role in sustainable mobility. Smart ticketing systems, GPS-based bus tracking, and integrated transport platforms improve convenience and encourage greater use of public transit. By promoting mass transit over private vehicles, cities can significantly reduce greenhouse gas emissions and road congestion. Additionally, the development of dedicated cycling lanes and pedestrian-friendly infrastructure supports low-carbon mobility options.

The rise of electric vehicles (EVs) further strengthens sustainable transportation efforts. Smart charging infrastructure ensures efficient energy distribution and prevents grid overload. When combined with renewable energy sources, EV adoption significantly reduces reliance on fossil fuels. Autonomous and shared mobility solutions also contribute to improved resource utilization and reduced traffic density.

Data analytics and artificial intelligence enhance transportation planning by predicting traffic patterns, identifying accident-prone zones, and optimizing infrastructure design. Urban planners can use this data to develop efficient road networks, parking management systems, and logistics operations. Smart parking systems, for instance, guide drivers to available spaces, reducing idle driving and fuel wastage.

Environmental sustainability is closely linked to transportation infrastructure design. The use of durable, recycled materials in road construction, permeable pavements for stormwater management, and noise-reducing barriers contributes to eco-friendly urban development. Integrating green corridors and urban landscaping alongside transport networks improves air quality and aesthetic value.

Economic and social benefits also emerge from smart transportation systems. Reduced congestion enhances productivity, improved safety measures decrease accident rates, and efficient mobility strengthens urban connectivity. Most importantly, smart transportation ensures equitable access to mobility services for diverse populations.

In conclusion, smart transportation systems represent a critical component of sustainable urban development. By combining technology, environmental responsibility, and efficient planning, engineers can transform urban mobility into a system that is safe, inclusive, and environmentally sustainable. As cities continue to expand, smart transportation will play a defining role in shaping resilient and future-ready infrastructure.

Water-Sensitive Urban Design and Smart Water Management

-Sreehari E J

Water is one of the most critical resources for sustainable development, yet rapid urbanization has severely disrupted natural water cycles. Cities today face two extreme challenges—water scarcity and urban flooding. Conventional drainage systems focus on quickly diverting rainwater away from cities, often leading to groundwater depletion and increased flood risk. Water-Sensitive Urban Design (WSUD) offers a sustainable alternative by integrating natural water management principles into urban planning.

Water-sensitive design aims to capture, store, treat, and reuse water within urban environments. Instead of treating rainwater as waste, it views it as a valuable resource. Techniques such as rainwater harvesting systems, recharge wells, and permeable pavements allow water to infiltrate into the ground, replenishing aquifers. Green roofs and rooftop gardens further reduce runoff while improving thermal performance of buildings.

Stormwater management is a key element of WSUD. Bioswales, rain gardens, retention ponds, and constructed wetlands slow down surface runoff, filter pollutants, and reduce flooding risks. These systems combine engineering with ecological processes, creating environmentally friendly solutions that are both functional and aesthetically pleasing.

Smart water management enhances these systems through technology. Sensors embedded in pipelines detect leakages in real time, reducing water loss in distribution networks. Automated control systems optimize water pressure and ensure efficient supply. Data analytics help authorities monitor consumption patterns and improve demand forecasting.

Wastewater recycling is another essential component of sustainable water infrastructure. Treated wastewater can be reused for irrigation, industrial applications, and non-potable domestic purposes. Decentralized treatment plants reduce pressure on central systems and promote localized water reuse.

By integrating ecological principles, innovative design, and smart technology, water-sensitive urban planning creates resilient cities capable of managing water sustainably. It protects natural resources, reduces environmental degradation, and ensures long-term water security for growing populations.

Net-Zero Carbon Infrastructure: Moving Toward Decarbonization

-Abhinav Krishna

The construction and infrastructure sector contributes significantly to global carbon emissions. Cement production, steel manufacturing, transportation, and operational energy consumption collectively increase greenhouse gas levels. Net-zero carbon infrastructure aims to balance carbon emissions through reduction strategies, energy efficiency, and renewable integration, ultimately contributing to climate change mitigation.

Achieving net-zero begins at the design stage. Efficient structural systems minimize material usage without compromising strength or safety. Optimized structural configurations reduce embodied carbon—the emissions generated during material production and construction. Engineers increasingly consider low-carbon alternatives such as blended cements, recycled steel, and sustainable timber.

Renewable energy integration plays a crucial role in reducing operational emissions. Solar panels, wind turbines, geothermal systems, and building-integrated photovoltaics enable infrastructure to generate clean energy. Smart energy management systems monitor consumption and optimize performance, ensuring minimal wastage.

Energy-efficient building envelopes, high-performance insulation, natural ventilation, and passive design strategies further reduce operational energy demand. Lighting systems with motion sensors and energy-efficient HVAC systems contribute to overall carbon reduction.

Carbon offset strategies, such as afforestation and carbon capture technologies, complement emission reduction efforts. Life-cycle assessment tools evaluate carbon impact from construction to demolition, guiding informed decision-making.

Although net-zero infrastructure may require higher initial investment, long-term economic and environmental benefits outweigh the costs. Reduced energy bills, lower maintenance expenses, and environmental compliance provide financial stability over time. Net-zero infrastructure reflects a commitment to sustainable development and aligns engineering practice with global climate goals.

Adaptive Reuse and Retrofitting of Existing Structures

- Suryanath E S

In the pursuit of sustainable development, civil engineering must shift its focus from continuous new construction to intelligent utilization of existing infrastructure. Demolition and reconstruction consume enormous quantities of energy, generate significant waste, and increase carbon emissions. Adaptive reuse and retrofitting present sustainable alternatives by extending the lifespan of existing structures while enhancing their safety, functionality, and efficiency.

Adaptive reuse involves repurposing an existing building for a function different from its original purpose. Instead of demolishing aging industrial buildings, warehouses, or institutional structures, engineers and architects transform them into commercial spaces, residential complexes, cultural centers, or educational facilities. This approach not only preserves architectural heritage but also retains the embodied energy already invested in construction materials. By conserving structural frameworks, foundations, and primary systems, adaptive reuse significantly reduces resource consumption and environmental impact.

Retrofitting, on the other hand, focuses on upgrading structural performance to meet modern safety standards and functional requirements. Many older structures were designed according to outdated codes that did not account for present-day loads, seismic forces, or climate-related stresses. Structural retrofitting techniques such as steel jacketing, reinforced concrete overlays, fiber-reinforced polymer (FRP) wrapping, and base isolation systems enhance load-carrying capacity and disaster resistance.

Seismic retrofitting is particularly crucial in earthquake-prone regions. Techniques such as shear wall addition, bracing systems, and column strengthening improve lateral stability and reduce collapse risk. Similarly, climate-resilient retrofits may include flood-proofing foundations, corrosion protection in coastal regions, and wind-resistant reinforcements in cyclone-prone areas.

Energy retrofitting further strengthens sustainability goals. Replacing outdated HVAC systems with energy-efficient alternatives, improving thermal insulation, upgrading glazing systems, and integrating renewable energy technologies reduce operational energy demand. Smart lighting systems, occupancy sensors, and automated climate control systems enhance energy efficiency while improving user comfort.

Beyond environmental benefits, adaptive reuse contributes to economic and social sustainability. It often costs less than complete reconstruction and reduces project timelines. Revitalizing existing buildings also supports urban regeneration, maintains cultural identity, and prevents urban sprawl. Communities benefit from improved infrastructure without losing historical or architectural value.

Life-cycle cost analysis demonstrates that retrofitting can be financially advantageous in the long term. Reduced demolition waste, lower material consumption, and extended service life make adaptive reuse a practical and responsible engineering strategy. By prioritizing renovation over replacement, civil engineers actively contribute to resource conservation and carbon footprint reduction.

In a world striving for sustainability, adaptive reuse and retrofitting embody the philosophy of building smarter rather than building more. They transform aging infrastructure into resilient, efficient, and future-ready assets while preserving the past and protecting the environment.

Artificial Intelligence in Structural Health Monitoring

-Anfred

The rapid advancement of infrastructure systems demands smarter and more efficient maintenance strategies. Bridges, high-rise buildings, dams, tunnels, and transportation networks are exposed to continuous stress from environmental conditions, traffic loads, material aging, and natural disasters. Ensuring their safety and durability requires more than periodic visual inspections. Artificial Intelligence (AI) is revolutionizing Structural Health Monitoring (SHM) by enabling intelligent, data-driven infrastructure management.

Structural Health Monitoring involves embedding sensors within structures to measure parameters such as stress, strain, vibration, displacement, tilt, and temperature. These sensors continuously collect real-time data that reflects how a structure behaves under different conditions. Traditionally, analyzing this large volume of data was time-consuming and reactive. With AI integration, advanced algorithms process and interpret data instantly, identifying patterns and anomalies that may indicate structural deterioration.

Machine learning models are trained using historical performance data to distinguish between normal structural behavior and early warning signs of damage. For example, unusual vibration patterns in a bridge may signal fatigue cracks, while unexpected deflections in a high-rise building may indicate foundation settlement. AI systems generate automatic alerts, enabling engineers to take preventive action before minor issues escalate into serious failures.

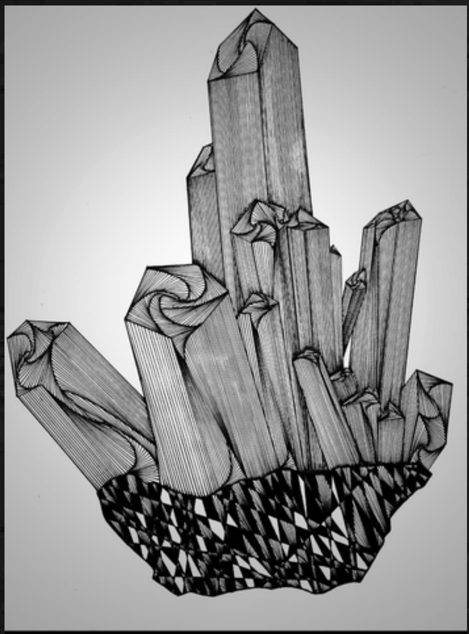
One of the most significant contributions of AI in SHM is predictive maintenance. Instead of waiting for visible damage, predictive systems forecast potential failures based on data trends, reducing emergency repairs and downtime. Early detection also supports sustainability by minimizing unnecessary reconstruction, reducing material waste, and extending the service life of structures. Integration with IoT networks and AI-based inspections further strengthens monitoring efficiency and safety.

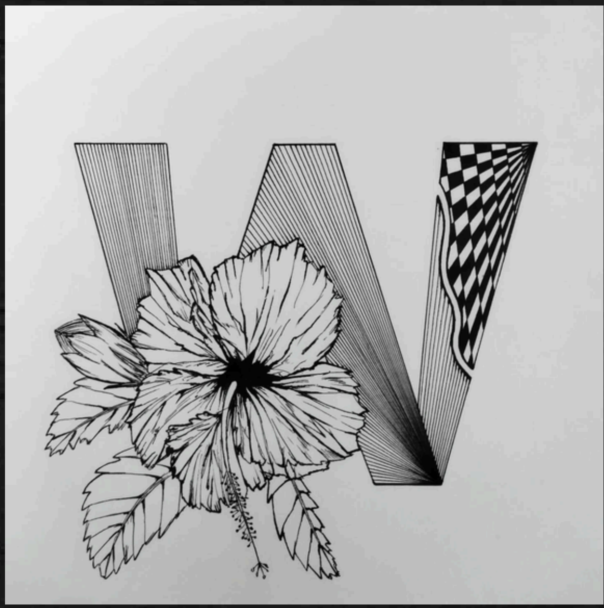
Artificial Intelligence transforms conventional infrastructure into smart, adaptive systems capable of continuous self-assessment. By combining advanced sensing technologies with intelligent analysis, engineers can enhance safety, resilience, and long-term performance, supporting the development of smarter and more sustainable infrastructure for the future.

LOVE

-Dianghunshisha Jyrwa

What would it be like to love someone?
How does it feels to be loved?
It feels good to be love and loved,
Though we must learn to control love.
It looks simple,honest and PURE.
But,who knows what it's like
DEEP down?
Once we're caught up in this,
We are bound to fight.
It's either to fight and survive,
OR
To lose and surrender to it.
To win,we must overcome every ugly things.
AND if we lose, we'll become it's prisoner.
We'll only end up hurting and hating ourselves.
The once love we have,
Would turn to a powerful hatred
which we can't get rid of.
It would prevent us from escaping
and trap us into it's endless
Beautiful and twisted abyss.
LIFE is not very fair,
Isn't it?
They burnt her and created the scars in her face and body.
Then asked her,
"Why can't you be more beautiful?"
Ironic, Isn't it?
They made her evil,then asked
"Why can't you be better?"
"Why can't you love them?"
asking a girl who's deprived of love such questions, how Ironic!
They should've said
"We're sorry..."
Though it won't change much





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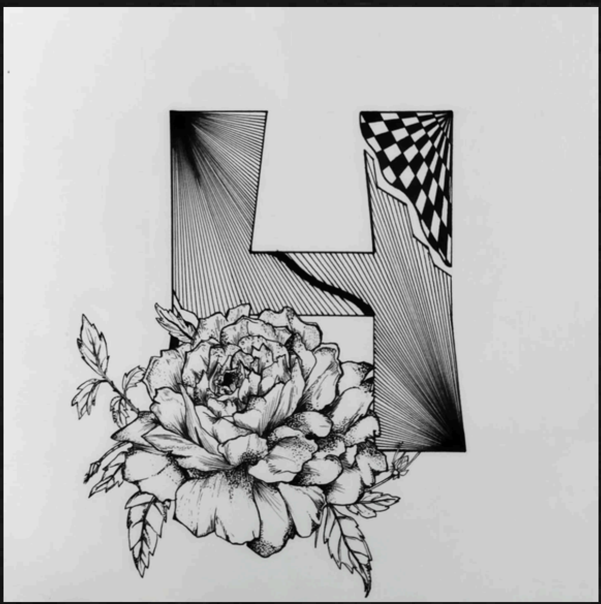

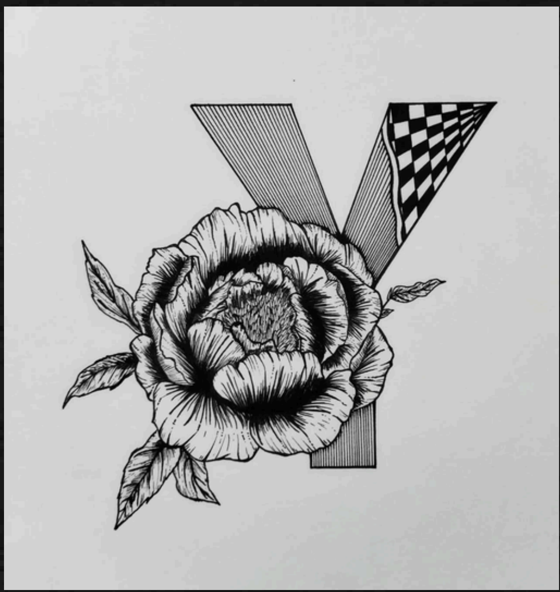

Aibel Vimal K
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Aibel Vimal K
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Sahaz Krishna
S6 CE

Sahaz Krishna
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Sahaz Krishna
S6 CE

Sahaz Krishna
S6 CE

VISAKHAN A N
S4 CE

LAKSHMI V R
S4 CE