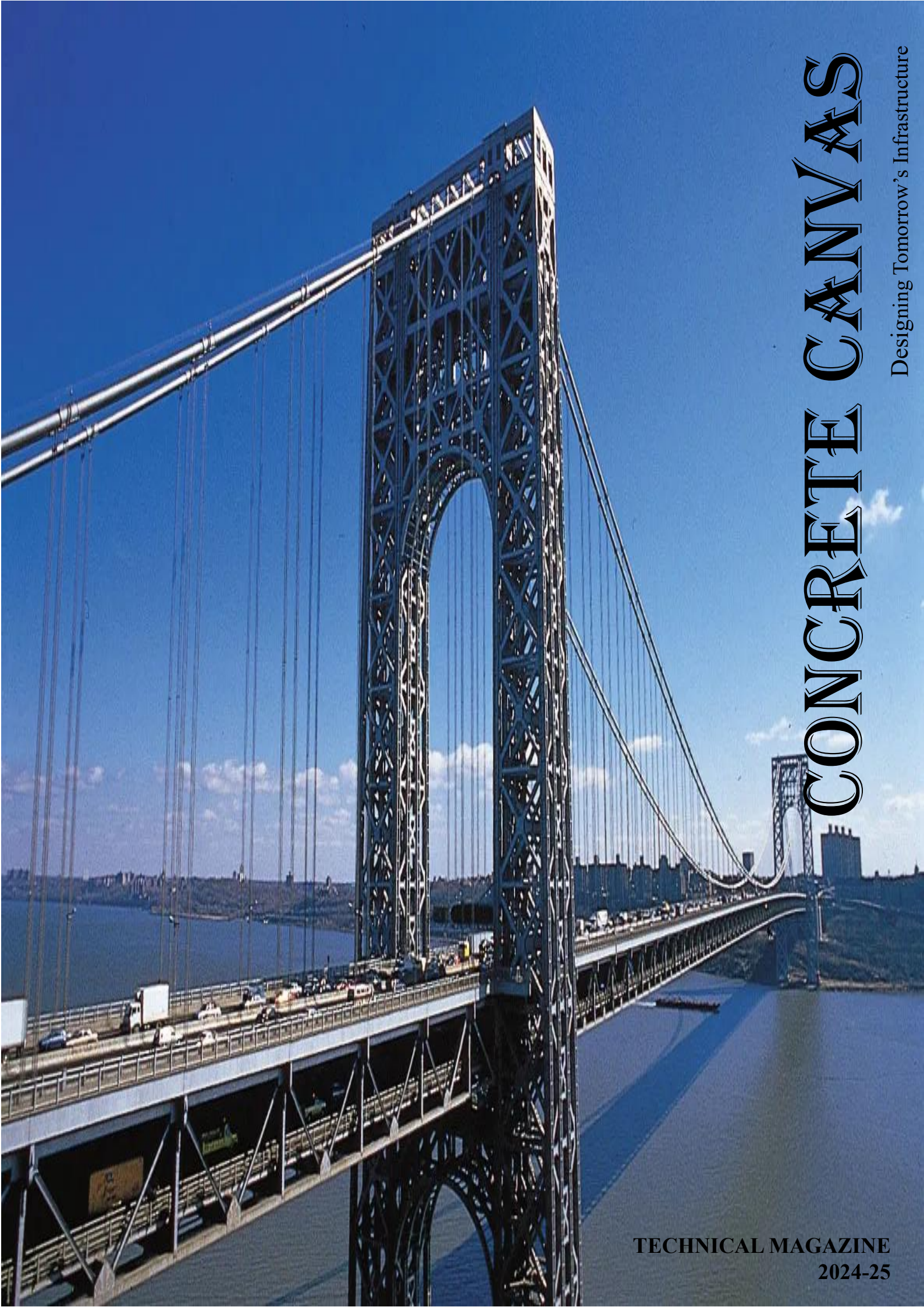


CONCRETE CANVAS

Designing Tomorrow's Infrastructure

TECHNICAL MAGAZINE
2024-25

INSTITUTE

Vision

To emerge as a leading Technical Institution by imparting knowledge in field of Engineering and Technology to its pass outs to make them Industry employable and self-enterprising so as to serve society in order to achieve harmonious relation between Human habitant and Nature in an Eco-friendly environment.

Mission

M1. To deliver knowledge at par with cutting edge technology & promote academic growth.

M2. To facilitate a creative and independent learning environment.

M3. To develop a co-relation between academia, industry and society through various consultancy and testing constructional materials.

M4. To transform individuals by inculcating values, ethics and leadership qualities.

M5. To establish an atmosphere where management principles and techniques will nature in fulfilment of institutional aims and objectives.

DEPARTMENT

Vision

To produce competent and capable Civil Engineering students by imparting excellent quality and skill based technical education for serving the society.

Mission

M1. To provide a platform for students to develop skills, knowledge and wisdom in various aspects of Civil Engineering.

M2. To inculcate ethical and moral values among the students.

M3. To encourage students to pursue higher studies as well as to perform professional and research works in Civil Engineering field.

Program Educational Objectives

PEO 1. To produce diploma graduates with a strong foundation in subjects to pursue a thriving professional to take part in providing a feasible solution for communal problems related to Civil Engineering aspects.

PEO 2. To improve the capability of graduates to execute emerging techniques for planning, analysis, design and execution of Civil Engineering projects through lifelong learning.

PEO 3. To imbibe professional ethics to the graduates with a commitment to the society and environment.

Program specific Outcomes

PSO 1: Students will have sound knowledge in analysis, design, laboratory investigations and construction aspects of Civil Engineering infrastructure, along with good foundation in mathematics, basic sciences and technical communication.

PSO 2: Students will have a broad understanding of economical, environmental, societal, health and safety factors involved in infrastructural development, and shall demonstrate ability to function within multidisciplinary teams with competence in modern tool usage.

PSO 3: Students will be motivated for continuous self-learning in engineering practice and/or pursue research in advanced areas of Civil Engineering in order to offer Engineering services to the society, ethically and responsibly.

Programme Outcomes

PO 1: Basic and Discipline specific knowledge: Apply knowledge of basic mathematics, science and engineering fundamentals and engineering specialization to solve the engineering problems.

PO 2: Problem analysis: Identify and analyse well-defined engineering problems using codified standard methods.

PO 3: Design development of solutions : Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.

PO 4: Engineering Tools, Experimentation and Testing: Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.

PO 5: Engineering practices for society, sustainability and environment: Apply appropriate technology in context of society, sustainability, environment and ethical practices.

PO 6: Project Management: Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well-defined engineering activities.

PO 7: Life-long learning: Ability to analyse individual needs and engage in updating in the context of technological changes.

MESSAGE FROM THE PRINCIPAL DESK

It is a matter of great pride and pleasure to present the 2024–2025 edition of the Civil Technical Magazine. This magazine stands as a testament to the dedication, creativity, and technical excellence of our students and faculty members.

Civil engineering plays a vital role in nation-building by shaping infrastructure and contributing to sustainable development. In today's rapidly evolving world, it is essential for budding engineers to stay updated with modern technologies, innovative practices, and environmental responsibilities. I am glad to see that this magazine highlights such advancements and encourages knowledge sharing.

I appreciate the sincere efforts of the editorial team, contributors, and faculty advisors who have worked diligently to bring out this publication. Their commitment reflects the academic spirit and collaborative culture of our institution.

I am confident that this magazine will inspire students to think critically, innovate, and contribute meaningfully to the field of civil engineering.

I extend my best wishes to everyone involved and hope this initiative continues to grow in the coming years.

Dr. Bana Bihari Mohanty
Principal

ABOUT THE DEPARTMENT

The Department of Civil Engineering has been in existence since 2014 and is producing high quality technical manpower needed by industry, R&D organizations, and academic institutions. The yearly intake of the department is 60 for regular three-year Diploma course to meet the growing requirements for emerging needs of Civil Engineering field. The departmental activities embrace Planning, Design, Construction and Management. The Department has well qualified faculty members and excellent laboratory facilities. The Diploma program imparts students to master over the field of Civil Engineering besides knowledge of recent trends and development to shine as a successful Civil Engineer. Students gain experience from field visit to nearby construction sites, dams and irrigation structures etc.

Along with regular academicals activities the students are also involved in laboratory testing activities of different industries and Govt. organization for their practical exposure which ultimately gives the hands on, minds on, hearts on concepts in their career.

MESSAGE FROM THE HOD

It gives me immense pleasure to present this edition of our Civil Engineering Technical Magazine. This publication is not merely a collection of articles, but a reflection of the curiosity, creativity, and technical competence of our students and faculty.

Civil engineering, as a discipline, plays a pivotal role in shaping the infrastructure and sustainable future of our society. From designing resilient structures to developing smart and eco-friendly solutions, the scope of this field continues to expand with innovation and technological advancement. Through this magazine, we aim to provide a platform for sharing knowledge, encouraging research, and fostering practical understanding beyond the classroom.

I am particularly delighted to see the enthusiastic participation of students in contributing technical articles, project insights, and innovative ideas. Such efforts are essential in bridging the gap between theoretical learning and real-world application. I also appreciate the editorial team for their dedication and hard work in bringing out this publication.

I encourage all readers to make the most of this magazine—explore, learn, and be inspired. Let this initiative continue to grow as a medium for intellectual exchange and professional development.

Wishing you all success in your academic and future endeavors.

Mr. Amlan Nayak
Head of the Department
Department of Civil Engineering

MESSAGE FROM THE EDITORIAL TEAM

It gives us immense pleasure to present the 2024–2025 edition of our Civil Technical Magazine. This publication is a reflection of innovation, dedication, and the continuous pursuit of knowledge in the field of civil engineering.

Civil engineering is not just about constructing structures; it is about shaping the future, building sustainable communities, and improving the quality of life. In this edition, we have focused on emerging trends, modern construction techniques, sustainable practices, and the integration of technology in infrastructure development.

We are proud to showcase the hard work and creativity of students, faculty, and contributors who have shared their valuable insights, research, and experiences. From technical articles to project highlights, this magazine serves as a platform to learn, explore, and inspire.

We sincerely thank all contributors, editors, and supporters who made this publication possible. Your enthusiasm and commitment continue to drive excellence.

We hope this edition will enhance your knowledge, spark curiosity, and motivate you to contribute towards a better and more sustainable world.

Editorial Team
Civil Technical Magazine

STUDENT EDITORIAL TEAM

Sanjay Kumar Pradhan
3rd Year, CE

Surya Narayan Dalai
3rd Year, CE

Badri Narayan Dwibedi
3rd Year, CE

Pradipta Samantray
3rd Year, CE

FACULTY EDITORIAL TEAM

Prakash Chandra Murmu
Lecturer Dept. of CE

Sushree sasmita Sahoo
Lecturer Dept. of CE

Rameswari Dash
Lab Assistant
Dept. of CE

FACULTY SECTION

CONTENTS

Smart Structures: Detecting Concrete Cracks with AI & Machine Learning

Mr. Amlan Nayak
Head of the Department

I. INTRODUCTION

Infrastructure is the backbone of modern society, and its safety and durability are of utmost importance. Over time, structures such as bridges, buildings, and pavements develop cracks due to load, environmental conditions, and material deterioration. Traditional inspection methods are time-consuming and sometimes inaccurate. With advancements in technology, Artificial Intelligence (AI) and Machine Learning (ML) are transforming the way we monitor and maintain structures. Smart structures equipped with these technologies can detect cracks early and ensure safety.

II. WHAT ARE SMART STRUCTURES?

Smart structures are engineered systems that can monitor their own condition using sensors, data processing, and intelligent algorithms. These structures can:

- Detect damage or cracks
- Analyse structural health in real time
- Provide alerts for maintenance

They combine civil engineering with modern technologies like AI, IoT, and data analytics.

Need for Crack Detection

Cracks in concrete are early signs of structural distress. If not detected in time, they can lead to:

- Reduction in structural strength
- Water seepage and corrosion of reinforcement
- Failure of structures

Early detection helps in timely repair, reducing maintenance costs and preventing disasters.

III. TRADITIONAL VS MODERN METHODS

Traditional Methods:

- Manual inspection
- Visual observation
- Use of microscopes or gauges

Limitations:

- Time-consuming

- Human errors
- Not suitable for large structures

Modern Methods (AI-Based):

- Image processing
- Automated crack detection
- Real-time monitoring

These methods are faster, more accurate, and reliable.

IV. ROLE OF AI & MACHINE LEARNING IN CRACK DETECTION

AI and ML algorithms can analyse images and data to identify cracks with high precision.

Image-Based Crack Detection

- Cameras or drones capture images of structures
- AI models process these images
- Cracks are identified and classified automatically

Deep Learning Techniques

- Convolutional Neural Networks (CNNs) are widely used
- They learn patterns of cracks from datasets
- Provide highly accurate results

Sensor-Based Monitoring

- Sensors are embedded in structures
- Data such as strain, vibration, and temperature are collected
- ML models analyze data to detect abnormalities

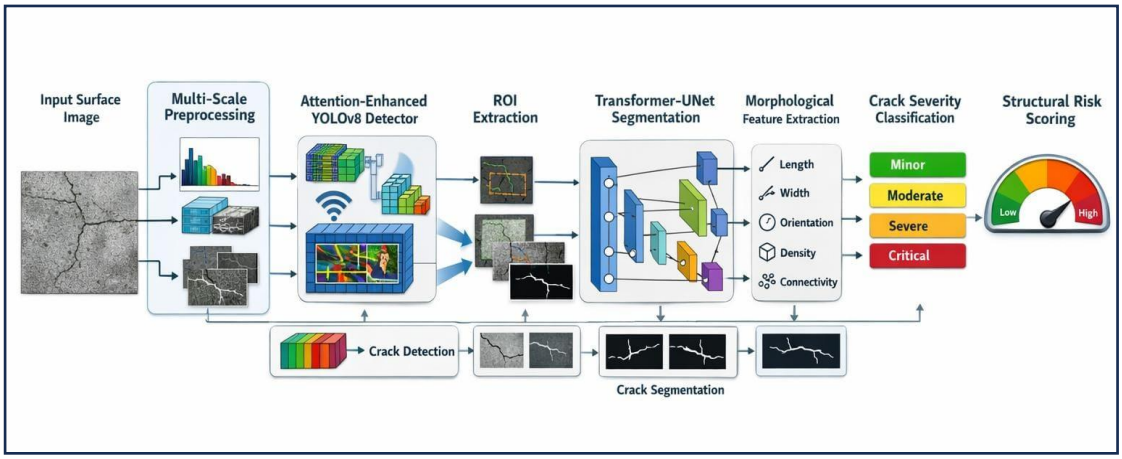
V. ADVANTAGES OF AI-BASED CRACK DETECTION

- High accuracy and reliability
- Saves time and labor
- Real-time monitoring
- Reduces maintenance cost
- Enhances structural safety

VI. APPLICATIONS

- Bridges and flyovers
- High-rise buildings
- Dams and reservoirs
- Highways and pavements

AI-based systems are especially useful in large and inaccessible structures.



VII. CONCLUSION :

AI and Machine Learning are revolutionizing the field of civil engineering by enabling smart structures capable of self-monitoring. Detecting concrete cracks using these technologies ensures safety, durability, and cost-effectiveness. As young engineers adopt these innovations, they contribute to building a smarter and more resilient nation.

Diagrid Structural System: A Modern Approach to High-Rise Buildings

Mr. Prakash Ch. Murmu
Lecturer

I. INTRODUCTION

With rapid urbanization and increasing demand for space, the construction of tall buildings has become essential. Civil engineers continuously explore innovative structural systems to ensure safety, efficiency, and aesthetics. One such advanced system is the diagrid structural system, which has gained popularity in modern high-rise construction due to its strength, flexibility, and architectural appeal.

What is a Diagrid Structural System?

A diagrid (diagonal grid) structural system is an exterior framework composed of inclined structural members arranged in a triangular pattern. Unlike conventional buildings, diagrid structures eliminate vertical columns on the exterior and rely on diagonal members to resist loads.

These diagonal elements act both as:

- Load-bearing members
- Bracing elements

This unique configuration enhances the structural performance of buildings.

II. HISTORICAL BACKGROUND

The concept of diagrid structures dates back to the late 19th century with the development of hyperboloid structures. Over time, advancements in materials and construction technology have led to the widespread use of diagrid systems in modern skyscrapers.

Components of Diagrid Structures

A typical diagrid system consists of:

- Diagonal Members: Carry both gravity and lateral loads
- Nodes: Connection points of members
- Ring Beams: Provide stability and maintain structural shape
- Tie Beams: Transfer loads between core and diagrid
- Core: Supports gravity loads and provides structural balance
- Floor Slabs: Distribute loads across the structure

III. STRUCTURAL BEHAVIOUR OF DIAGRID SYSTEM

The diagrid structure works as a vertical cantilever resisting loads through axial forces in diagonal members.

- Gravity Loads: Transferred through axial action
- Lateral Loads (Wind/Earthquake): Efficiently resisted by diagonal configuration
- Shear Forces: Distributed across the triangulated framework

This reduces bending moments and increases structural efficiency.

Diagrid Module and Angle Optimization

The structure is divided into triangular modules, and the angle of diagonal members plays a crucial role.

- Optimal angle: 60° to 70°
- Lower angles provide better shear resistance
- Higher angles improve bending stiffness

Proper selection of angle ensures minimum material usage and maximum stability.

IV. ADVANTAGES OF DIAGRID STRUCTURES

- Reduction in steel usage (up to 20%)
- Column-free interior spaces
- Improved natural lighting due to fewer obstructions
- High structural efficiency and stiffness
- Aesthetic and modern architectural appearance

V. DISADVANTAGES

- Complex node design and construction
- Higher fabrication and labor costs

- Requirement of skilled workers
- Difficulty in standardizing windows and façade elements

VI. APPLICATIONS AND EXAMPLES

Diagrid systems are widely used in iconic buildings such as:

- Swiss Re Tower, London
- Hearst Tower, New York
- CCTV Headquarters, Beijing
- Capital Gate, Abu Dhabi

These structures demonstrate the efficiency and beauty of diagrid design.

VII. CONCLUSION

The diagrid structural system represents a significant advancement in the field of civil engineering. It offers a perfect blend of strength, efficiency, and architectural elegance. Despite some challenges in design and construction, its benefits make it an ideal choice for high-rise buildings. As technology evolves, diagrid systems will continue to shape the skyline of modern cities.

Base Isolation and Seismic Dampers in Buildings

Mrs. Sushree sasmita Sahoo
Lecturer

I. INTRODUCTION

Earthquakes are one of the most destructive natural disasters, causing severe damage to buildings and infrastructure. To reduce the impact of seismic forces, modern civil engineering has developed advanced techniques such as **base isolation** and **seismic dampers**. These technologies enhance the safety and performance of structures during earthquakes, making them essential in earthquake-prone regions.

Need for Earthquake-Resistant Structures

During an earthquake, ground motion generates vibrations that travel through a building, causing stress and deformation. Traditional structures may fail if these forces exceed their capacity. Therefore, it is necessary to:

- Minimize structural damage
- Protect human lives
- Ensure functionality after earthquakes
- Reduce repair and reconstruction costs

II. BASE ISOLATION

What is Base Isolation?

Base isolation is a technique in which a building is separated from the ground using flexible supports or isolators. These isolators reduce the transfer of seismic energy from the ground to the structure.

Working Principle

- Isolators are placed between the foundation and superstructure
- They absorb and deflect seismic waves
- Reduce acceleration and vibration in the building

As a result, the building moves less compared to the ground motion.

Types of Base Isolators

- Lead Rubber Bearings (LRB)
- High Damping Rubber Bearings (HDRB)
- Friction Pendulum Systems (FPS)

- **Advantages of Base Isolation**
- Significant reduction in seismic forces
- Protection of structural and non-structural elements
- Improved safety and comfort
- Suitable for important buildings like hospitals and bridges

Limitations

- High initial cost
- Requires careful design and installation
- Not suitable for all soil conditions

III. SEISMIC DAMPERS

What are Seismic Dampers?

Seismic dampers are devices installed in buildings to absorb and dissipate earthquake energy, similar to shock absorbers in vehicles.

Working Principle

- Dampers reduce the amplitude of vibrations
- Convert kinetic energy into heat or other forms
- Control structural movement during seismic activity

Types of Seismic Dampers

- Viscous Dampers: Use fluid resistance
- Friction Dampers: Use friction between surfaces
- Tuned Mass Dampers (TMD): Use mass to counteract motion
- Metallic Dampers: Use deformation of metals

IV. ADVANTAGES OF SEISMIC DAMPERS

- Reduces structural vibrations
- Enhances stability and durability
- Can be used in both new and existing structures
- Cost-effective compared to reconstruction

V. LIMITATIONS

- Requires maintenance
- Design complexity
- Effectiveness depends on proper placement

VI. APPLICATIONS

- High-rise buildings
- Hospitals and emergency centers
- Bridges and flyovers
- Historical monuments

VII. CONCLUSION

Base isolation and seismic dampers are revolutionary techniques in earthquake engineering. They significantly reduce the impact of seismic forces, ensuring safety and durability of structures. As civil engineers, adopting these technologies is essential for building a resilient and disaster-resistant future.

“Earthquakes cannot be prevented, but their impact can be minimized through smart engineering.”

THE STONE GIANT: A Structural Master class of Angkor Wat

Mrs. Rameswari Dash

Lab Assistant

I. INTRODUCTION

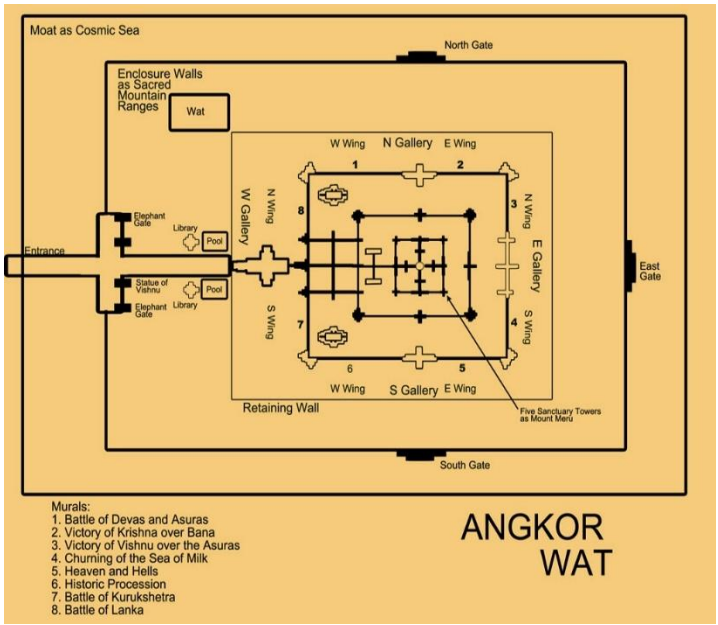
The Engineering Soul of a God-King's Vision

Deep within the Cambodian jungle stands a monument that defies the standard laws of longevity. Angkor Wat, built in the early 12th century, is not merely a religious icon; it is one of the most sophisticated civil engineering projects in human history. While modern skyscrapers are designed for a 100-year lifespan, this "Stone Giant" has weathered nearly a millennium of tropical monsoons, shifting sands, and seismic tremors.

II. THE "FLOATING" FOUNDATION: ENGINEERING WITH WATER

The most brilliant stroke of Khmer engineering isn't what you see, but what lies beneath. Angkor Wat sits on a massive "floating" foundation.

- **The Moat as a Regulator:** The 190-metre-wide moat surrounding the temple isn't just a defensive or symbolic barrier; it is a **hydraulic stabilizer**. It keeps the groundwater level constant year-round.
- **Preventing Subsidence:** By keeping the underlying sand layers perpetually saturated, the moat prevents the foundation from shrinking during the dry season or swelling during the monsoons. This maintains a steady bearing capacity of **150 kN/m²**, preventing the massive sandstone towers from sinking into the soft flood plain.



III. MATERIALS: THE CORE AND THE SHELL

Khmer builders utilized a strategic "Core and Cladding" method that balanced structural economy with artistic grandeur.

- **Laterite (The Muscle):** The hidden internal walls and foundations are made of laterite—a local, iron-rich clay that is soft when quarried but hardens like iron when exposed to air.
- **Sandstone (The Skin):** Over 5 million blocks of sandstone were transported from the Kulen Mountains (50km away). These blocks were ground against each other until the joints were **less than 0.5mm apart**, creating a mortarless fit so precise that the structure relies entirely on gravity and friction.

IV. THE "BREATHING" TEMPLE: MODERN FEM ANALYSIS

Using Finite Element Method (FEM) simulations and InSAR satellite data, modern structural engineers have discovered that Angkor Wat is actually a "living" building.

- **Thermal Dilation:** The temple "breathes." As the sun hits the sandstone, the towers expand; as they cool at night, they contract.
- **The 3mm Shift:** Data shows an absolute deformation rate of roughly **3mm per year**. While this sounds small, over centuries, this thermal fatigue creates "hotspots" of stress, particularly at the cross-shaped corridor junctions, leading to the micro-cracks seen today.

V. SEISMIC RESILIENCE: THE ART OF THE "ROCKING" JOINT

Unlike modern concrete buildings that are rigid and prone to snapping under seismic tension, Angkor Wat is a **multi-body system**.

Because the stones are not glued together with mortar, they can slide and "rock" slightly during an earthquake. This movement dissipates seismic energy through friction. With a low natural frequency of **2.8 Hz**, the temple effectively "dances" with the earth rather than resisting it, which is why it has survived centuries of regional tremors.

VI. THE FUTURE: IOT AND DIGITAL GUARDIANS

To preserve this masterpiece for the next thousand years, engineers are now deploying IoT-based Structural Health Monitoring (SHM).

- **Wireless Sensor Networks:** Dozens of tiny, solar-powered sensors now live on the temple walls, measuring tilt, vibration, and moisture levels in real-time.

- **AI Alerts:** If a crack expands by even a fraction of a millimeter beyond the seasonal norm, an automated alert is sent to conservation teams. This shifts maintenance from "reactive repair" to "predictive preservation."

Emerging Trends in Geotechnical Engineering and Soil Mechanics

Mr. Sangram Mishra
Lecturer

I. INTRODUCTION:

Geotechnical engineering and soil mechanics form the foundation of civil engineering, providing critical insights into the behaviour of soil and rock materials. As infrastructure demands evolve and environmental challenges intensify, emerging trends in geotechnical engineering are reshaping the way engineers approach site characterization, foundation design, and risk assessment. This article explores the latest developments in geotechnical engineering and soil mechanics, highlighting innovative techniques and technologies that are driving progress in the field. 1. Advanced Site Characterization: Traditional methods of site investigation often rely on boreholes, test pits, and laboratory testing to characterize soil properties. However, emerging technologies such as remote sensing, geophysical surveys, and unmanned aerial vehicles (UAVs) are revolutionizing site characterization by providing high-resolution data over large areas. Ground-penetrating radar (GPR), LiDAR, and satellite imagery offer valuable insights into subsurface conditions, geology, and terrain morphology, enabling engineers to make informed decisions and mitigate risks during the design and construction phases.

II. DATA-DRIVEN MODELLING AND SIMULATION:

The integration of data-driven modelling and simulation techniques is transforming geotechnical engineering practices, allowing engineers to simulate complex soil-structure interactions and predict performance with greater accuracy. Finite element analysis (FEA), computational fluid dynamics (CFD), and discrete element modelling (DEM) enable engineers to model soil behaviour under various loading conditions, assess stability, and optimize design solutions. These advanced modelling tools enhance the efficiency, reliability, and safety of geotechnical designs for infrastructure projects.

III. SUSTAINABLE GROUND IMPROVEMENT TECHNIQUES:

As urbanization intensifies and environmental concerns grow, there is increasing demand for sustainable ground improvement techniques that minimize environmental impact and promote long-term resilience. Innovations such as bio-cementation, microbial-induced calcite

precipitation (MICP), and soil stabilization using recycled materials offer environmentally friendly alternatives to traditional ground improvement methods. These sustainable techniques enhance soil strength, reduce erosion, and mitigate liquefaction risks, supporting sustainable development and climate resilience in geotechnical engineering projects.

IV. GEOSYNTHETICS AND REINFORCED SOIL STRUCTURES:

Geo Synthetics, including geotextiles, geogrids, and geomembranes, are playing a vital role in modern geotechnical engineering projects, providing cost-effective solutions for soil stabilization, erosion control, and slope reinforcement. Reinforced soil structures, such as mechanically stabilized earth (MSE) walls and reinforced slopes, leverage geosynthetic materials to improve stability and withstand lateral loads. These innovative solutions offer versatile, durable, and sustainable alternatives to conventional earth-retaining structures, enabling engineers to address challenging geotechnical conditions with confidence.

V. RISK-INFORMED DECISION MAKING:

In an era of increasing climate variability and uncertainty, risk-informed decision-making is becoming increasingly important in geotechnical engineering practice. Probabilistic methods, reliability analysis, and risk assessment techniques help engineers evaluate and manage uncertainties associated with geotechnical parameters, loading conditions, and environmental factors. By quantifying risks and uncertainties, engineers can optimize design solutions, allocate resources effectively, and minimize the likelihood of unforeseen failures during construction and operation.

VI. RESILIENCE-CENTERED DESIGN :

Resilience-centered design principles are gaining prominence in geotechnical engineering, emphasizing the importance of designing infrastructure to withstand and recover from extreme events, such as earthquakes, floods, and climate change impacts. By integrating resilience considerations into geotechnical design processes, engineers can enhance the 11 robustness, adaptability, and sustainability of infrastructure systems. Resilience centered approaches prioritize redundancy, flexibility, and adaptive capacity, enabling infrastructure to maintain functionality and serviceability in the face of adversity.

VII. CONCLUSION:

In conclusion, emerging trends in geotechnical engineering and soil mechanics are shaping the future of civil engineering by offering innovative solutions to complex challenges. From

advanced site characterization techniques and data-driven modelling to sustainable ground improvement methods and resilience-centered design principles, these trends are driving progress in the field and enabling engineers to tackle diverse geotechnical issues with greater efficiency, reliability, and sustainability. As infrastructure demands evolve and environmental pressures intensify, the continued advancement and adoption of these emerging trends will be essential in building resilient, sustainable, and future-ready infrastructure for generations to come.

Role of Young Civil Engineers in Nation Building

Mr. Tapas Kumar Mallick
Lecturer

I. INTRODUCTION

Civil engineering is one of the oldest and most important branches of engineering, playing a vital role in the development of any nation. From roads and bridges to dams and smart cities, civil engineers are the backbone of infrastructure growth. Young civil engineers, with their fresh ideas, modern knowledge, and enthusiasm, have a significant role to play in shaping a strong and sustainable nation.

II. INFRASTRUCTURE DEVELOPMENT

Infrastructure is the foundation of economic growth. Young civil engineers contribute by:

- Designing and constructing roads, bridges, railways, and buildings
- Improving transportation networks
- Supporting urban and rural development

Their innovative thinking helps in building durable and cost-effective infrastructure.

III. PROMOTING SUSTAINABLE DEVELOPMENT

Today's engineers must focus on sustainability. Young civil engineers are actively involved in:

- Using eco-friendly materials like green concrete
- Implementing water conservation techniques
- Designing energy-efficient buildings

These practices help protect the environment and ensure long-term development.

IV. ADOPTION OF MODERN TECHNOLOGY

With the advancement of technology, young engineers are quick to adapt and implement modern tools such as:

- AutoCAD and Building Information Modeling (BIM)
- Drones for surveying
- Artificial Intelligence in project planning

This improves accuracy, efficiency, and productivity in construction projects.

V. DISASTER MANAGEMENT AND RESILIENCE

Natural disasters like earthquakes, floods, and cyclones pose serious threats to infrastructure. Young civil engineers play a key role in:

- Designing earthquake-resistant structures
- Planning flood control systems
- Strengthening disaster management strategies

Their efforts help in minimizing damage and saving lives.

VI. CONTRIBUTION TO RURAL DEVELOPMENT

A nation cannot progress without the development of its rural areas. Young engineers contribute by:

- Designing rural roads and irrigation systems
- Improving sanitation and water supply
- Supporting government development schemes

This helps in reducing the gap between urban and rural regions.

VII. ETHICAL RESPONSIBILITY AND PROFESSIONALISM

Young civil engineers must follow ethical practices in their profession. They should:

- Ensure quality and safety in construction
- Avoid corruption and malpractice
- Work with honesty and dedication

Ethical engineering leads to trust and long-lasting infrastructure.

VIII. INNOVATION AND RESEARCH

Young minds bring creativity and innovation. They are involved in:

- Research on new construction materials
- Development of cost-effective techniques
- Solving real-world engineering problems

Innovation is key to national progress and global competitiveness.

IX. CONCLUSION

Young civil engineers are the future builders of the nation. Their knowledge, skills, and dedication play a crucial role in infrastructure development, sustainability, and technological advancement. By working with responsibility, innovation, and integrity, they can contribute significantly to nation building and create a better tomorrow.

"Engineers build the nation, but young engineers shape its future."

STUDENT SECTION

CONTENTS

3D DESIGN OF G+5 BUILDING USING REVIT SOFTWARE

Soumendra Dash
3rd Year,Civil

I. INTRODUCTION

In the modern construction industry, the use of advanced software tools has become essential for accurate planning, designing, and execution of building projects. Traditional 2D drafting methods are gradually being replaced by intelligent 3D modeling techniques that provide better visualization, coordination, and efficiency. One of the most powerful tools used in this field is Autodesk Revit, which is based on Building Information Modeling (BIM) technology. Revit enables engineers, architects, and designers to create detailed 3D models of buildings along with all necessary components such as walls, floors, roofs, doors, windows, and structural elements. It also allows integration of architectural, structural, and MEP (Mechanical, Electrical, Plumbing) designs into a single model, reducing errors and improving coordination.

A G+5 building refers to a structure consisting of a ground floor and five upper floors. Such buildings are commonly constructed in urban areas to efficiently utilize limited land space and accommodate increasing population demands. Designing such multi-storey buildings requires careful planning, accurate modeling, and proper understanding of structural and architectural concepts.

This project focuses on the use of Revit software to create a complete 3D model of a G+5 building, providing a practical understanding of modern design techniques used in civil engineering and architecture.

II. PROJECT OVERVIEW

The main objective of this project is to develop a 3D model of a G+5 building using Revit software and to understand the application of BIM technology in building design. The project includes the creation of detailed architectural components such as floor plans, elevations, sections, and a fully developed 3D view of the building.

The process begins with setting up levels and grids corresponding to each floor of the building. After that, various building elements such as walls, floors, doors, windows, and staircases are created using Revit tools. Special attention is given to space planning, structural alignment, and proper dimensioning.

The project also involves basic structural modeling, including placement of columns and beams, to ensure stability and realistic representation. Revit's parametric features allow easy modification of design elements, making the process more efficient and flexible. In addition, the model is enhanced using materials, textures, and rendering techniques to achieve a realistic appearance. This helps in better visualization and presentation of the building design.

Overall, this project demonstrates how Revit software can be effectively used to design a multi-storey building with improved accuracy, coordination, and visualization, making it a valuable tool in modern construction practices

III. METHODOLOGY

The methodology of this project follows a systematic approach for creating a 3D model of a G+5 building using Revit software. Initially, the project setup is carried out by selecting appropriate units and defining levels for each floor, including the ground floor and five upper floors. These levels serve as reference planes for placing all building components. After defining levels, grids are created to ensure proper alignment and positioning of structural elements such as columns and beams. This helps in maintaining accuracy and consistency throughout the model.

The next step involves developing the basic layout of the building. Walls are created using suitable thickness and materials, followed by the addition of floors at each level. Doors and windows are then placed according to functional requirements to ensure proper ventilation and lighting.

Staircases and lift areas are designed to provide vertical circulation within the building. All components are carefully positioned and adjusted using Revit tools to achieve a precise and organized model.

Finally, the model is reviewed and refined. 3D views are generated, and materials along with lighting effects are applied to enhance the visual appearance of the building.

IV. DESIGN PROCESS

The design process begins with conceptual planning, where the overall layout and structure of the G+5 building are decided. Important factors such as space utilization, functionality, and basic architectural principles are considered at this stage.

After planning, detailed modeling is performed in Revit. Architectural elements such as walls, floors, roofs, doors, and windows are created with proper dimensions and alignment. These elements are designed to meet both functional and aesthetic requirements.

Structural components such as columns and beams are then added to represent the load-bearing system of the building. Their placement is based on the grid system to ensure structural stability.

Additional features such as balconies, parapets, and roof structures are included to enhance the overall design. Revit's parametric modeling feature allows easy modification of elements, making the design flexible and efficient.

Once the modeling is complete, different views such as plans, elevations, sections, and 3D views are generated. Materials and textures are applied to improve the visual quality, and rendering is done to create realistic images.

Overall, the design process ensures that the building is well-planned, structurally stable, and visually appealing, demonstrating the effective use of Revit software in modern construction.

V. RESULT

The project results in a complete 3D model of a G+5 building using Revit software. The model includes all major components such as walls, floors, doors, windows, staircases, and basic structural elements. Along with the 3D model, 2D drawings like floor plans, elevations, and sections are also generated. The model is accurate, well-organized, and provides a clear visualization of the building design.

VI. ADVANTAGES

- High accuracy and reduced errors
- Easy and fast modifications
- Better coordination of all building elements
- Automatic updates in the model Clear 3D visualization and rendering
- Saves time and improves productivity

VII. CONCLUSION

The project successfully demonstrates the use of Revit software in designing a G+5 building. It helps in understanding modern 3D modeling techniques and BIM concepts. Overall, Revit proves to be an efficient tool for creating accurate, well-planned, and visually appealing building designs.

STUDY THE EFFECT OF POLYPROPYLENE FIBER IN CONCRETE

Bharati Priyadarshini

3rd Year,Civil

I. INTRODUCTION

The fiber dispersion into concrete is one of the technique to improve the building properties of concrete. Polypropylene fibers are synthetic fibers obtained as a by-product from textile industry. These are available in different aspect ratios and are cheap in cost. Polypropylene fibers are characterized by low specific gravity and low cost. Its use enables reliable and effective utilization of intrinsic tensile and flexural strength of the material along with significant reduction of plastic shrinkage cracking and minimizing of thermal cracking. It provides reinforcement and protects damage of concrete structure and prevents spalling in case of fire. The fibers are manufactured either by the pulling wire procedure with circular cross section or by extruding the plastic film with rectangular cross-section. They appear either as fibrillated bundles, mono filament. The fibrillated polypropylene fibers are formed by expansion of a plastic film, which is separated into strips and then slit. The fiber bundles are cut into specified lengths and fibrillated. In monofilament fibers, the addition of buttons at the ends of the fiber increases the pull out load.

Cracks play an important role as they change concrete structures into permeable elements and consequently with a high risk of corrosion. Cracks not only reduce the quality of concrete and make it aesthetically unacceptable but also make structures out of service. If these cracks do not exceed a certain width, they are neither harmful to a structure nor to its serviceability. Therefore, it is important to reduce the crack width and this can be achieved by adding polypropylene fibers to concrete. Thus addition of fibers in cement concrete matrix bridges these cracks and restrains them from further opening. In order to achieve more deflection in the beam, additional forces and energies are required to pull out or fracture the fibers. This process, apart from preserving the integrity of concrete, improves the load-carrying capacity of structural member beyond cracking. In this project polypropylene fibers of blended (24mm, 40mm, 55mm) type is used.

II. OBJECTIVE OF THE STUDY

- To evaluate the effect of polypropylene fiber on concrete strength
- To study crack resistance and durability
- To determine the optimum fiber content in concrete
- To compare normal concrete with fiber-reinforced concrete

III. MATERIALS USED

- Cement (OPC)
- Fine aggregate (sand)
- Coarse aggregate
- Water
- Polypropylene fibers

IV. PROPERTIES OF POLYPROPYLENE FIBER

- Low density (lightweight)
- High tensile strength
- Chemically inert
- Non-corrosive
- Good resistance to cracking

V. METHODOLOGY

1. Prepare concrete mix (e.g., M20/M25 grade)
2. Add polypropylene fibers in different percentages (0%, 0.25%, 0.5%, 0.75%, 1%) by volume
3. Mix thoroughly to ensure uniform distribution
4. Cast specimens (cubes, cylinders, beams)
5. Cure specimens for 7, 14, and 28 days
6. Perform tests:
    - Compressive strength test
    - Split tensile strength test
    - Flexural strength test

VI. EFFECTS OF POLYPROPYLENE FIBER IN CONCRETE

1. Workability
   - Slight decrease in workability as fiber content increases
   - Requires proper mixing or use of admixtures
2. Compressive Strength
   - Minor increase or sometimes no significant change
   - Improvement depends on fiber percentage
3. Tensile Strength
   - Significant improvement observed
   - Fibers bridge cracks and prevent sudden failure
4. Flexural Strength
   - Noticeable increase in flexural strength
   - Enhances ductility of concrete
5. Crack Resistance
   - Reduces shrinkage cracks
   - Controls propagation of micro-cracks
6. Durability
   - Improves resistance to impact and abrasion
   - Reduces permeability
   - Enhances long-term performance

Optimum Fiber Content

- Generally found between 0.25% to 0.5% by volume
- Higher percentages may reduce workability and cause balling effect

VII. ADVANTAGES

- Improves tensile and flexural strength
- Controls cracking
- Enhances durability
- Lightweight and easy to use
- Cost-effective solution

VIII. DISADVANTAGES

- Reduced workability
- Difficulty in uniform mixing at higher content
- Requires proper quality control

IX. APPLICATIONS

- Pavements and roads
- Industrial floors
- Precast elements
- Tunnel linings
- Water-retaining structures

X. CONCLUSION

The inclusion of polypropylene fibers in concrete significantly improves its performance, especially in terms of crack resistance, tensile strength, and durability. Although it slightly affects workability, the overall benefits make it a valuable material in modern construction. Proper selection of fiber content ensures optimal results and enhances the life of structures.

“Fiber-reinforced concrete is not just stronger—it is smarter and more durable.”

3D Residential Building (2-Storied) Using AutoCAD

Sanjay Kumar Pradhan

3rd Year

I. INTRODUCTION

In the modern construction industry, the use of computer-aided design (CAD) software plays an important role in planning and designing buildings. AutoCAD is one of the most widely used software tools for creating accurate 2D drawings and 3D models.

This project focuses on designing a two-storied (G+1) residential building using AutoCAD. It helps in understanding the basic concepts of building planning, drafting, and 3D visualization. The use of AutoCAD makes the design more precise, clear, and easy to modify.

II. PROJECT OVERVIEW

The project involves the creation of a 3D model of a residential building with two floors. The design includes all essential components such as walls, doors, windows, slabs, staircase, and roof.

The ground floor and first floor are planned with proper space utilization, including rooms like living room, bedrooms, kitchen, and bathrooms. The model is first created in 2D and then converted into a 3D structure using various AutoCAD tools.

III. METHODOLOGY

The methodology of this project follows a systematic approach. First, the AutoCAD workspace is set to 3D modeling mode, and units are defined.

A 2D floor plan is created using basic commands like line, rectangle, and offset. After completing the plan, the walls are converted into 3D using the extrude command.

Openings for doors and windows are made using box and subtract commands. Then slabs and staircase are added, followed by creating the roof. Finally, materials and rendering options are applied to enhance the visual appearance.

IV. DESIGN PROCESS

The design process starts with planning the layout of the building according to required space and functionality. The outer structure is drawn first, followed by internal partitions.

The 2D drawing is then transformed into a 3D model by giving height to walls. Additional components like doors, windows, and stairs are added carefully.

The first floor is created by copying the ground floor and modifying it as needed. The final step includes adding roof and applying realistic materials.

V. RESULTS

The final result of this project is a complete 3D model of a two-storied residential building. The model clearly shows all parts of the structure including walls, floors, staircase, and roof. It provides a realistic view of the building, making it easier to understand the design and layout. The model can be viewed from different angles using AutoCAD's 3D viewing tools.

VI. ADVANTAGES

Provides high accuracy in design

Easy to modify and update

Saves time compared to manual drawing

Better visualization through 3D modeling

Improves design quality and presentation

VII. CONCLUSION

In conclusion, the project successfully demonstrates the design of a 3D two-storied residential building using AutoCAD. It helps in developing practical knowledge of drafting and modeling. The use of AutoCAD makes the design process efficient and accurate. This project is useful for understanding real-world building design and can be applied in future construction and architectural works.

Stabilization of soil using rice Husk Fiber

Gyanaranjan Behera

3rd Year, Civil

I. INTRODUCTION

Soil stabilization is a process of improving the engineering properties of soil such as strength, durability, and bearing capacity. Weak soils often cause problems in construction like settlement and failure.

Rice husk is an agricultural waste obtained from rice milling. It is abundant, low-cost, and eco-friendly. Using rice husk in soil stabilization helps reduce waste and improves soil properties.

II. PROJECT OVERVIEW

This project focuses on studying the effect of rice husk on soil stabilization. The main aim is to improve the engineering properties of weak soil by adding rice husk in different proportions. The project involves mixing rice husk with soil and conducting various laboratory tests to evaluate the improvement in soil strength and stability.

This study highlights the usefulness of rice husk as an economical and sustainable material for soil stabilization.

III. OBJECTIVES

To study the properties of soil mixed with rice husk To improve soil strength and bearing capacity To reduce soil settlement and moisture variation To compare normal soil with stabilized soil To determine the optimum percentage of rice husk

IV. MATERIAL USED

The materials used in this project include:

- Soil: Natural soil collected from a site
- Rice Husk: Agricultural waste obtained from rice mills Rice husk has the following properties: Lightweight
- High silica content
- Good insulating properties
- Eco-friendly and biodegradable
- Easily available and low cost

V. PROPERTIES OF SOIL

Before stabilization, soil may have:

- Low bearing capacity

- High compressibility
- High moisture sensitivity
- The addition of rice husk helps to improve these properties by increasing stability and reducing moisture effects.

VI. METHODOLOGY

- Soil sample was collected from a selected site.
- Rice husk was cleaned and dried before use.
- Rice husk was mixed with soil in different percentages (5%, 10%, 15%,).
- The mixture was prepared uniformly.
- Samples were tested using: Compaction test California Bearing Ratio (CBR) test Shear strength test
- Results were compared with normal soil to evaluate improvement.

VII. ADVANTAGES

- Low cost and easily available
- Eco-friendly and sustainable
- Improves soil strength and stability
- Reduces settlement
- Useful waste material utilization

VIII. LIMITATIONS

- Biodegradable (may reduce long-term durability)
- Lower strength compared to chemical stabilizers
- Requires proper proportioning

IX. APPLICATIONS

- Road subgrade stabilization Embankments
- Rural road construction
- Lightweight fill material
- Soil improvement in agricultural areas

X. CONCLUSION

From this study, it can be concluded that rice husk is an effective and economical material for soil stabilization. It improves the strength, bearing capacity, and moisture resistance of soil. The use of rice husk also helps in waste management and promotes sustainable construction practices. An optimum percentage should be used to achieve the best results.

Stabilization of Soil Using Coconut Coir Fiber

Jatin kumar Pradhan

3rd Year, Civil

I. INTRODUCTION

Soil is one of the most important materials in civil engineering, as it forms the foundation for all types of structures. However, not all soils have sufficient strength and stability to support construction. Weak soils may lead to problems such as settlement, cracks, and structural failure.

To improve the engineering properties of soil, a process known as soil stabilization is used. Soil stabilization involves modifying soil properties to enhance its strength, durability, and load-bearing capacity. In recent years, natural fibers have been widely used for soil stabilization due to their eco-friendly and cost-effective nature. One such material is coconut coir fiber, which is obtained from the outer husk of coconut.

Coconut coir fiber is biodegradable, easily available, and has good tensile strength. When mixed with soil, it helps in improving the soil structure, reducing erosion, and increasing stability.

II. PROJECT OVERVIEW

This project focuses on studying the effect of adding coconut coir fiber to soil and analyzing its impact on soil properties. The main aim is to improve the strength and stability of weak soil using a natural and sustainable material.

Different percentages of coconut coir fiber are mixed with soil samples, and various tests are conducted to evaluate the improvement in soil properties. The study helps in understanding the effectiveness of coir fiber as a soil stabilizing material in construction and geotechnical engineering.

III. OBJECTIVES

- To study the properties of soil with coconut coir fiber
- To improve soil strength and stability
- To reduce soil erosion and settlement
- To compare normal soil with stabilized soil
- To determine the optimum percentage of coir fiber

IV. MATERIALS USED

- The materials used in this project include: Soil: Natural soil collected from a site

- Coconut Coir Fiber: Extracted from coconut husk
- Coconut coir fiber has the following properties: High tensile strength
- Lightweight
- Biodegradable and eco-friendly
- Good water absorption capacity
- Low cost and easily available

V. PROPERTIES OF SOIL

- Low bearing capacity
- High compressibility
- Poor shear strength
- High susceptibility to erosion
- By adding coir fiber, these properties can be improved significantly.

VI. METHODOLOGY

- Soil sample was collected from the site.
- Coconut coir fibers were cleaned, dried, and cut into small pieces.
- Fibers were mixed with soil in different percentages (3%, 6%, 9%)
- The mixed samples were prepared properly.
- Laboratory tests such as compaction test, CBR test, and shear strength test were conducted. Results were compared with normal soil to analyze improvement..

VII. ADVANTAGES

- Eco-friendly and biodegradable
- Low cost and easily available
- Improves soil strength and stability
- Reduces soil erosion
- Sustainable construction material

VIII. LIMITATIONS

- Biodegradable nature may reduce long-term durability
- Requires proper mixing
- Limited use in heavy load structures

IX. APPLICATIONS

- Road subgrade stabilization
- Embankments and slopes

- Rural road construction
- Soil erosion control
- Foundation improvement for light structures

X. CONCLUSION

From this study, it can be concluded that coconut coir fiber is an effective natural material for soil stabilization. It improves the shear strength, bearing capacity, and erosion resistance of soil.

The use of coir fiber is economical and environmentally friendly, making it suitable for sustainable construction practices. An optimum percentage of fiber should be used to achieve the best results.

Overall, soil stabilization using coconut coir fiber is a promising technique in geotechnical engineering.

To Study The Properties of Foam Concrete

Sonu Nayak

2nd Year, Civil

I. INTRODUCTION

In today's modern construction industry, engineers are constantly searching for materials that are lightweight, efficient, and sustainable. Foam concrete has emerged as one of the most innovative solutions that meets these demands. This unique type of concrete is produced by mixing a cement slurry with a stable foam, resulting in a material that is significantly lighter than conventional concrete.

The presence of millions of tiny air bubbles inside foam concrete not only reduces its weight but also enhances its thermal and sound insulation properties. Due to these advantages, foam concrete is becoming increasingly popular in residential, commercial, and infrastructure projects. It is especially useful in areas where reducing structural load is critical.

II. OBJECTIVE OF THE PROJECT

1. To study the properties of foam concrete.
2. To design suitable mix proportions for required density and strength.
3. To determine compressive strength at 7 and 28 days.
4. To compare foam concrete with conventional concrete.
5. To evaluate its suitability for lightweight construction.

III. MATERIALS USED

Cement

Composite Cement is used . Cement is provides binding properties.

Fine Aggregate-

River sand is used .it is used for Improves strength and reduces shrinkage

Water-

The water is Clean and portable .water Should satisfy standard requirements

Foaming Agent-

Protein-based foam agent is used .It is the

IV. MANUFACTURING PROCESS OF FOAM CONCRETE

Preparation of Slurry

Cement, water, and fine aggregate are mixed to form a uniform slurry.

Foam Generation

Foam is produced using a foam generator by mixing foaming agent with water and air.

Mixing

The generated foam is added to slurry and mixed gently to maintain bubble stability.

Casting

The mixture is poured into molds or directly placed at site.

Curing

Water curing or air curing

Typical curing period: 7 to 28 days

V. PROPERTIES OF FOAM CONCRETE

Density-

The density of foam concrete is much lower than that of normal concrete and generally ranges from 300 kg/m³ to 1800 kg/m³. This variation depends on the amount of foam added to the mix. Lower density results in lighter concrete but reduces its strength.

Compressive strength -

The compressive strength of foam concrete depends on its density and mix proportion. It generally ranges from 1MPa to 25MPa. As the Density increases, the strength also increases, but it remains lower than conventional concrete.

Workability-

Foam concrete has very high workability due to its fluid nature. It is self-leveling and self-compacting, which means it does not require vibration during placement. This property makes it easy to handle and place.

Thermal Insulation-

Foam concrete provides excellent thermal insulation because of the presence of air voids within the structure. These air pockets reduce heat transfer, making it suitable for use in roofs and walls.

Sound Insulation-

Foam concrete has good sound insulation properties as it can absorb sound waves effectively. This makes it useful in buildings where noise reduction is required.

Water Absorption-

Foam concrete has higher water absorption compared to normal concrete due to its porous structure. Proper curing and use of admixtures can help reduce this effect Shrinkage.

Durability-

Foam concrete shows good durability when properly designed and cured. It is resistant to fire, frost, and pests, making it suitable for various environmental conditions.

8-Shrinkage

Foam concrete experiences higher drying shrinkage compared to conventional concrete. This occurs due to the loss of moisture over time and can be controlled by proper mix design and curing.

VI. ADVANTAGES

Foam concrete offers several advantages such as lightweight structure, ease of placement, and excellent insulation properties. It reduces the dead load on structures and is also economical for large-scale construction.

VII. DISADVANTAGES

Foam concrete has some limitations, including lower compressive strength and higher water absorption. It is not suitable for heavy load-bearing structures and requires careful mix design.

VIII. APPLICATION

1. Roof insulation
2. Void filling

3. Road embankments
4. Partition walls
5. Precast blocks

IX. CONCLUSION

Foam concrete is a modern lightweight construction material with excellent thermal, acoustic, and economic benefits. Its low density and high workability make it ideal for many civil engineering applications, although its low strength requires careful use or modification.

Department of Civil Engineering

Government Polytechnic, Nayagarh

Ghasadeipur, Odogaon, Odisha,India. Pin-752081

Email: principalgpnayagarh@gmail.com