SONA COLLEGE OF TECHNOLOGY

DEPARTMENT OF CIVIL ENGINEERING

SONA CREA

Thirteenth Issue | December 2024

I am gratified to know that the Department of Civil Engineering is bringing out the Thirteenth issue of their technical magazine SONA CREA of this academic year (2023 - 2024). This is a productive technical material and subsidiary skill-developing tool for the students. I wish the Civil Engineering Department a very big success in all their ventures. I also applaud the coordination and efforts behind the team to bring out this issue. I wish them all success.

PRINCIPAL'S MESSAGE

Prof.Dr. S.R.R. SENTHIL KUMAR,
Principal

Dr. R. MALATHY, HoD / Civil,

I am glad in publishing the thirteenth issue of the magazine SONA CREA of our Civil Engineering Department, which is a reference of the most recent trends and activities in the field of AEC. This should serve as a source of guidance for the entire fraternity for building themselves with the beautiful colors. I acknowledge the efforts of the Editorial team who did a mind-blowing job in compiling activities for a year and disseminate them through this Magazine as well as on the website. I am feeling cherished in welcoming students with more innovation in bringing the article with more bright concepts and ideas in the next issue. I wish them success in to be colorful in their future.

A. MEENACHI
AP/ CIVIL | ISTE Students Chapter Coordinator

This issue marks the thirteenth issue of our Newsletter SONA CREA, that aims to keep our students past and present updated about the trending one in our Civil Fraternity. This newsletter will feature about the programs, articles, achievements of our students and faculties. We have particularly designed this newsletter also as a platform for the students to update their talents and get exposed to the current technologies. So, I request everyone to use this in an efficient manner. In future expecting more contributions from the entire team to make it more useful and a vibrant one.

We may not always be able to construct the future for our youth, but we can surely construct our youth to shape the future.

Dear juniors and fellow learners, As budding civil engineers, you are not just students – you are future builders of this nation. You will design cities, lay the foundations of progress, and shape skylines that tell the story of a strong and sustainable India. You are the backbone of development, the catalysts of innovation, and the hands that will turn blueprints into reality.

B. Sri Ramanan
Third Year
ISTE Student Chapter Chairman

VISION & MISSION OF THE DEPARTMENT

To become a school of excellence that brings out civil engineers with high technical competencies and promotes high-end research to meet the current and future challenges in Civil Engineering.

MD1 : To become a school of excellence that brings out civil engineers with high technical competencies and promotes high-end research to meet the current and future challenges in Civil Engineering.

MD2: To provide quality education through Centre of Excellence in Research and Consulting with emerging technologies to industry and societal problems.

MD3: To impart knowledge and activities to students with emphasis in developing the leadership qualities and teamwork.

MD4: To impart knowledge and activities to students with emphasis in developing the leadership qualities and teamwork.

MD5: To encourage students to pursue higher education, take competitive exams and industry career with required training.

PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

To encourage students to pursue higher education, take competitive exams and industry career with required training.

PEO 1: To encourage students to pursue higher education, take competitive exams and industry career with required training.

PEO 2: To analyze data and technical concepts pertaining to the development of infrastructure, design, sustainability, construction management and any other related field of civil engineering.

PEO 3: To analyze data and technical concepts pertaining to the development of infrastructure, design, sustainability, construction management and any other related field of civil engineering.

PROGRAMME OUTCOMES

Students in the Civil Engineering programme should, at the time of their graduation be able to:

a) **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to offer a solution to complex engineering problems..

b) **Problem analysis:** Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using the first principles of mathematics, natural sciences, and engineering sciences

c) **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental property.

d) **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

e) **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations

f) **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

g) **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of and need for sustainable development.

h) **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

i) **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

j) **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

k) **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one s own work, as a member and leader in a team, to manage projects in multidisciplinary environments.

l) **Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES

On completion of the B.E (Civil Engineering) degree, the graduates will be able to:

- Plan, analyze, design, prepare cost estimates and execute all kinds of Civil Engineering Projects.
- Apply modern construction techniques, equipment and management tools so as to complete the project within specified time and funds.

SRI RAMANAN B

III - YEAR , CIVIL A

BUILDING INFORMATION MODELING (BIM): REVOLUTIONIZING THE FUTURE OF CONSTRUCTION

WHAT IS BIM?

Building Information Modeling (BIM) is a digital representation of the physical and functional characteristics of a facility. It is not just a 3D model, but a collaborative process that enables architects, engineers, and construction professionals to plan, design, construct, and manage buildings and infrastructure more efficiently.

BIM integrates multi-disciplinary data into one coherent system. It acts as a shared knowledge resource, forming a reliable basis for decisions throughout the project lifecycle—from conceptual design to demolition.

WHAT ARE THE USES OF BIM?

- Design Visualization: Creating accurate 3D models for client presentations and design validation.
- Clash Detection: Identifying conflicts between structural, architectural, and MEP (mechanical, electrical, plumbing) elements.
- Cost Estimation (5D BIM): Integrating cost data with models to provide real-time budget control.
- Construction Scheduling (4D BIM): Linking time schedules to the model for efficient project planning.
- Facility Management (6D BIM): Supporting the operation and maintenance phase post-construction.
- Sustainability Analysis (7D BIM): Analyzing energy performance and environmental impact.

HOW IT WORKS

- DATA INPUT: EACH DISCIPLINE (ARCHITECTURAL, STRUCTURAL, MEP) ADDS THEIR COMPONENTS INTO A SHARED MODEL.
- MODEL COORDINATION: BIM SOFTWARE DETECTS INCONSISTENCIES OR CLASHES BETWEEN ELEMENTS.
- SIMULATION & ANALYSIS: TOOLS SIMULATE CONSTRUCTION PROCESSES, ENERGY USAGE, LIGHTING, AND OTHER FACTORS.
- DOCUMENTATION: AUTOMATED GENERATION OF CONSTRUCTION DOCUMENTS (PLANS, SECTIONS, ELEVATIONS).
- LIFECYCLE MANAGEMENT: MODEL IS USED FOR FACILITY OPERATION AND MAINTENANCE LONG AFTER CONSTRUCTION IS COMPLETE.

BENEFITS OF BIM

- Improved Collaboration: Centralized model encourages teamwork and reduces miscommunication.
- Reduced Errors and Rework: Early detection of design conflicts saves time and cost.
- Enhanced Visualization: Stakeholders can “see” the project before it’s built.
- Faster Project Delivery: Automated workflows speed up design, documentation, and construction.
- Better Cost Control: Real-time quantity take-offs and budget tracking.
- Sustainability: Supports green building practices through analysis and optimization.

BIM TOOLS

AUTHORING TOOL

- AUTODESK REVIT
- ARCHICAD
- BENTLEY SYSTEMS

ANALYSIS TOOL

- NAVISWORKS (CLASH DETECTION)
- GREEN BUILDING STUDIO
- TEKLA STRUCTURES

COORDINATION TOOL

- BIM 360
- TRIMBLE CONNECT

VISUALIZATION TOOL

- Enscape
- Twinmotion
- Lumion

CONCLUSION

BIM is more than a technology—it is a paradigm shift in how buildings are designed, constructed, and managed. Its collaborative and data-rich approach transforms the traditional linear workflow into an integrated and efficient process. As the AEC industry continues to embrace digital transformation, BIM stands at the forefront, enabling smarter, sustainable, and more cost-effective project execution.

S . NISHA
II ND YEAR

S.P. FELCI
II ND YEAR

GREEN CONSTRUCTION IN CIVIL ENGINEERING: BUILDING A SUSTAINABLE FUTURE

INTRODUCTION

Green construction, also known as sustainable construction, is revolutionizing the civil engineering sector. With growing concerns about climate change, resource depletion, and environmental degradation, the construction industry is under pressure to adopt eco-friendly practices.

Green construction aims to reduce the environmental footprint of buildings and infrastructure by emphasizing sustainability, efficiency, and innovation

WHAT ARE THE USES OF BIM?

- Green construction refers to the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's life cycle.
- This includes planning, design, construction, operation, maintenance, and even demolition.
- The goal is to reduce negative impacts on the environment and human health,while improving building performance.

KEY PRINCIPLES OF GREEN CONSTRUCTION

1. Energy Efficiency: Using advanced insulation, efficient HVAC systems, solar panels, and smart lighting to reduce energy consumption.
2. Sustainable Materials: Incorporating recycled, renewable, or locally sourced materials like bamboo, recycled steel, and low-VOC paints.
3. Water Conservation: Installing rainwater harvesting systems, low-flow fixtures, and efficient irrigation techniques.
4. Waste Reduction: Minimizing construction waste through proper planning, recycling, and reuse of materials.
5. Healthy Indoor Environment: Improving air quality by using non-toxic materials and

ROLE OF CIVIL ENGINEERING

CIVIL ENGINEERS PLAY A CRUCIAL ROLE IN PROMOTING GREEN CONSTRUCTION. THEY ARE RESPONSIBLE FOR DESIGNING SUSTAINABLE INFRASTRUCTURE,SELECTING,ENVIRONMENTALLY FRIENDLY MATERIALS, AND ENSURING ENERGY EFFICIENCY IN PROJECTS. THEY ALSO WORK WITH ARCHITECTS AND ENVIRONMENTAL CONSULTANTS TO ENSURE COMPLIANCE WITH GREEN BUILDING STANDARDS SUCH AS LEED (LEADERSHIP) IN ENERGY AND ENVIRONMENTAL DESIGN) AND BREEAM (BUILDING RESEARCH ESTABLISHMENT,ENVIRONMENTAL ASSESSMENT METHOD).

BENEFITS OF GREEN CONSTRUCTION

ENVIRONMENTAL: REDUCES CARBON FOOTPRINT, CONSERVES NATURAL RESOURCES, AND MINIMIZES WASTE.

ECONOMIC: LOWERS ENERGY AND WATER BILLS, REDUCES MAINTENANCE COSTS, AND INCREASES PROPERTY VALUE.

SOCIAL: PROMOTES HEALTHIER LIVING ENVIRONMENTS AND IMPROVES THE QUALITY OF LIFE FOR OCCUPANTS.

CHALLENGES AND THE WAY FORWARD

Despite its benefits, green construction faces challenges such as higher upfront costs, limited availability of sustainable materials, and lack of awareness. However, with increasing government incentives, technological advancements, and public demand, the future of green construction looks promising.

CONCLUSION

Green construction is not just a trend—it's a necessary shift in the civil engineering field. By adopting sustainable practices, civil engineers can lead the way toward a more resilient and environmentally friendly future.

Seismic retrofit of historic buiding structures

N Bavadharani
II year

ABSTRACT

Buildings with historic values are regional cultural assets worth preserving. The design technologies and building materials and methods that went into the original construction of these buildings are often drastically different from their contemporary counterparts, their structural renovation or retrofit brings forth many technical challenges to the design professional.

This paper provides a generalsurvey of the technical issues pertaining to theseismic retrofit of historic buildings, and exploresvarious design procedures and constructionmethods for that purpose, including innovative technologies such as post tensioning, seismic isolation, composite wraps, etc

Evolution of building materials

Building materials have evolved gradually throughout theconstruction history, and the pace of the evolution is accelerated throughout the past century. Improvements in conventional building materials used both in historic and contemporary structures are described as:

Masonry, stone, and adobe buildings

Bearing wall buildings were the dominant type of structures till late years of nineteenth century, when theywere replaced by steel frame skeleton as the typicalstructural form in large buildings.

Wood and timber

Wood, as a natural building material, has not been subjected to any major change, but modern technologyprovides strength grading methods, wooden panelproducts, preservation treatment process and wood protection.

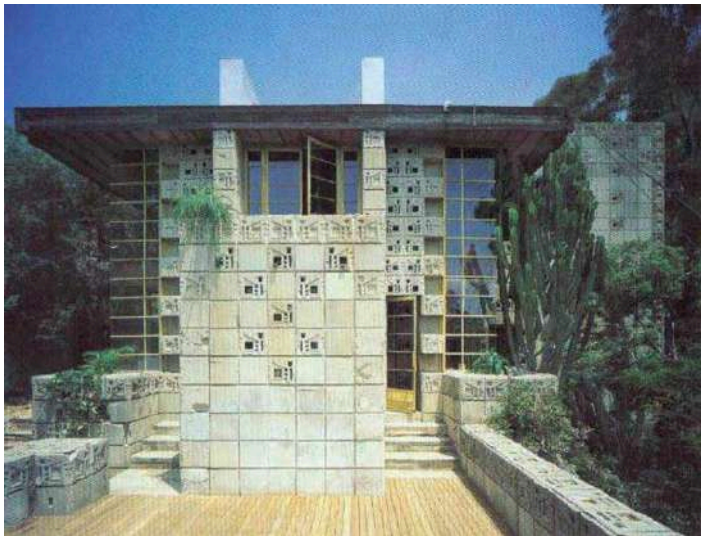
Concrete

Concrete has been subjected to significant evolution during twentieth century. Improved ingredients, qualitycontrol, preparing, and casting process offered strongerand more durable concretes. Improvements in concrete technology.

Challenges of retrofitting historic fabric

Minimizing noise, disturbance, and damage to thesurrounding buildings and providing temporary shoring and support are typicalchallenges involved in most retrofit projects.

Depending on the extends of retrofitting, assessedrisk, technical limitations, structural historic
value, and economical constraints, the preferred retrofitstrategies are studied and prioritized to preserve the authenticityof historic fabrication and minimize removal of architecturalmaterial.



Cost implications, comparison of retrofitting versus newconstruction premium

Many factors affect the cost for retrofitting a historic structure. It requires information collection, special engineering procedures, trained workers and unconventional building materials. Depending on theproject objectives, the retrofit design may target one offour performance levels

References

Applied Technology Council, 1992. Evaluation of the performance ofseismically retrofitted buildings,
Applied Technology Council, 31, Redwood City, CA.

Brockenbrough, R. L., 2002, AISC rehabilitation and retrofitguide; a reference for historic shapes and specifications, American Institute of Steel Construction.

STUDENTS ACHIVEMENTS

SHORT FLIM


KSR College of Engineering

K.S.R. COLLEGE OF ENGINEERING
(AUTONOMOUS)
Affiliated to Anna University, Chennai & Approved by AICTE, New Delhi
Accredited by NAAC with 'A++' Grade and Eligible Course Accredited by NBA
K.S.R. Kalvi Nagar, Tiruchengode, Namakkal (DT), Tamil Nadu- 637 215.

DEPARTMENT OF CIVIL ENGINEERING
A NATIONAL LEVEL TECHNICAL SYMPOSIUM
SPRING FEST – 2K'24
EL – DORADO – 2K'24
CERTIFICATE OF MERIT

This is to certify that Mr./Ms. S. Harineesh of Sona College of Technology has won I Prize in the Short Film event held in the National Level Technical Symposium, SPRING FEST - 2k'24 on 26th September 2024 at K.S.R. COLLEGE OF ENGINEERING, Tiruchengode.

CONVENER PRESIDENT PATRON

S. HARINEESH, A SECOND-YEAR CIVIL ENGINEERING STUDENT PARTICIPATED AT KSR COLLEGE OF ENGINEERING IN TIRUCHENGODE, HAS CLINCHED THE FIRST PRIZE FOR HIS SHORT FILM AT THE PRESTIGIOUS NATIONAL LEVEL SYMPOSIUM HELD DURING SPRING FEST-2K'24.

SPEAKER FORUM

FIRST-YEAR STUDENTS **M. SANJAY, S. S. KISHORE KUMAR, AND PRANITHA** HAVE BEEN SHORTLISTED AS BEST SPEAKERS AT THE SPEAKER FORUM CONDUCTED BY SONA COLLEGE OF TECHNOLOGY. THEIR EXCEPTIONAL COMMUNICATION SKILLS, CONFIDENCE, AND CLARITY OF THOUGHT IMPRESSED THE PANEL AND AUDIENCE ALIKE, EARNING THEM WELL-DESERVED RECOGNITION.

FOOTBALL

SECOND YEAR STUDENT **S.SHIVAPRAKASH** PARTICIPATED IN ANNA UNIVERSITY ZONE 8 **FOOTBALL MEN TOURNAMENTS**, SELVAM COLLEGE OF TECHNOLOGY NAMAKKAL(WINNERS)

SPORTS ACHIVEMENT

THIRD YEAR STUDENT **K.OMPRAKASH** PARTCIPATED AND SECURED 5000METERS RUN GOLD, 1500METERS RUN GOLD, 4*400M RELAY BRONZE IN OVERALL CHAMPIONSHIP 4TH PLACE

SECOND YEAR STUDENT **APROSE.A** PARTICIPATED ANNA UNIVERSITY INTER ZONE FOOTBALL MEN, RUNNER(KONGUNADU COLLEGE OF ENGINEERING AND TECHNOLOGY)

SECOND YEAR STUDENT **S.SHIVAPRAKASH** WON IST PLACE IN TENNIS AT ZONAL LEVEL HELD AT PAAVAI COLLEGE

SECOND YEAR STUDENT **K. KISHORE ARUNACHALAM** WON FIRST PRIZE IN ALL INDIA BADMINTON TOURNAMENT HELD AT CHENNAI

AWARD RECEIVED BY OUR FACULTY

ASIA RESEARCH AWARD IN THE CONFERENCE "INTERNATIONAL SCIENCE, TECHNOLOGY & RESEARCH AWARDS CONGRESS 2024"

Papers Published

SONA CREA/ DECEMEBER 2024

1. D. JEGATHEESWARAN - INNOVATIVE USE OF MICROBIALLY INDUCED CALCITE PRECIPITATION AND ZEOLITE FOR ENHANCED SELF-HEALING CONCRETE - REVISTA MATERIA

2. M.N.A. GULSHAN TAJ - EXAMINING FOUNDRY SAND'S POTENTIAL AS A PARTIAL SUBSTITUTE FOR M-SAND THROUGH EXPERIMENTAL AND NUMERICAL RESEARCH - REVISTA MATERIA

3. K. RAJA - INVESTIGATION ON REINFORCED CONCRETE BEAMS WITH HIGH-STRENGTH FRP COMPOSITE- JOURNAL OF ENVIRONMENTAL NANOTECHNOLOGY

4. K. RAJA - STRENGTH CHARACTERISTICS OF BENTONITE NANO CLAY STABILIZED WITH ADDITION OF LIME, FLY ASH, AND SILICA FUME FOR SOIL ENVIRONMENTAL SUSTAINABILITY- JOURNAL OF ENVIRONMENTAL NANOTECHNOLOGY

5. M.N.A. GULSHAN TAJ - TRAFFIC STUDY USING UNMANNED AERIAL VEHICLE & SIMULATION OF TRAFFIC FLOW AT CONGESTED JUNCTIONS OF SALEM CITY USING HYBRID APPROACH - MATEC WEB OF CONFERENCES

6. M.N.A. GULSHAN TAJ- REAL-TIME MONITORING USING UNMANNED AERIAL VEHICLE (UAV)AIP CONFERENCE PROCEEDINGS

7. M. LOGESH KUMAR - EFFECTIVE IMPLEMENTATION OF WASTE MANAGEMENT TRENDS IN CONSTRUCTION INDUSTRY: AN CONJECTURAL STUDY - AIP CONFERENCE PROCEEDINGS

8. A. MEENACHI - EXPERIMENTAL STUDY OF CEMENT CONCRETE USING EOF STEEL SLAG TO REPLACE CEMENT AS PARTIAL REPLACEMENT - AIP CONFERENCE PROCEEDINGS

9. R. MALATHY- STRUCTURAL HEALTH MONITORING OF PARTIALLY REPLACED CARBON FABRIC-REINFORCED CONCRETE BEAM - FIBERS

10. K. RAJA - NUMERICAL ANALYSIS OF DISPLACEMENTS IN CONCRETE PILE FOUNDATIONS INDUCED BY ADJACENT TUNNEL EXCAVATION IN SANDY SOILS - REVISTA MATERIA

11. N. KARUPPASAMY - EVALUATING THE MECHANICAL PROPERTIES OF MAGNETIZED WATER CONCRETE AND QUANTIFICATION OF THE HYDRATED PRODUCTS BY XRD AND SEM IN FUNCTION OF STOPPAGE HYDRATION TECHNIQUES - MULTISCALE AND MULTIDISCIPLINARY MODELING, EXPERIMENTS AND DESIGN

12. D. JEGATHEESWARAN- NANO-BOOSTED CONCRETE: REVOLUTIONIZING STRENGTH AND DURABILITY FOR MODERN CONSTRUCTION- REVISTA MATERIA

13. A. SHALINI - AN EXPERIMENTAL INVESTIGATION ON NANO- ENHANCED TERTIARY BLENDED CONCRETE INCORPORATING INDUSTRIAL WASTES - JOURNAL OF ENVIRONMENTAL NANOTECHNOLOGY

14. D. JEGATHEESWARAN - ECO-FRIENDLY CONCRETE SOLUTIONS: THE ROLE OF TITANIUM DIOXIDE NANOPARTICLES IN ENHANCING DURABILITY AND REDUCING ENVIRONMENTAL POLLUTANTS - A REVIEW - JOURNAL OF ENVIRONMENTAL NANOTECHNOLOGY

15. M. KASIVISWANATHAN - NUMERICAL INVESTIGATION ON STRUCTURAL PERFORMANCE OF GFRP COMPOSITE BRIDGE DECKS- SPRINGER NATURE

16. A. SHALINI - PREDICTION OF DURABILITY PARAMETERS ON CONCRETE CONTAINING CERAMIC WASTE AS COARSE AGGREGATE USING NEURAL NETWORK - REVISTA MATERIA

17. A. MEENACHI - DEVELOPMENT OF A NOVEL DNA -SHAPED STEEL FIBER AND ITS PERFORMANCE ON FRESH AND HARDENED CONCRETE - CONSTRUCTION AND BUILDING MATERIALS .

18. M.N.A. GULSHAN TAJ - PRECISION CRACK ANALYSIS IN CONCRETE STRUCTURES USING CNN, SVM, AND KNN: A MACHINE LEARNING APPROACH - REVISTA MATERIA

19. M.N.A. GULSHAN TAJ - EVALUATING MECHANICAL PROPERTIES OF ALSI7MG0.3/TIB2 COMPOSITE WITH DIFFERENT CASTING TEMPERATURES - SPRINGER NATURE

Research Article

Journal of Environmental Nanotechnology

Investigation on Reinforced Concrete Beams with High-Strength FRP Composite

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Received: 12.04.2024 Accepted: 09.05.2024 Published: 30.06.2024
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ABSTRACT

This study examines an advanced material called High Strength Fiber Reinforced Polymer Composite (HSFRPC). The flexural characteristics of RC beams with dimensions of 2000 × 100 × 150 mm, strengthened with a HSFRPC overlay were investigated. The control RC beam was tested under four-point bending until failure. Two test RC beams were subjected to a preload of 70% of their ultimate load, while the third one was subjected to a preload of 65% of the ultimate load of the control beam. The preloaded RC beams were reinforced by applying a HSFRPC overlay to the lower surface. The overlay was applied across the whole width of one of 70% preloaded RC beams. The overlay was applied only in the area for the other 70% preloaded and the 65% preloaded RC beam, where the bending moment is constant. Strengthened beams underwent testing using a four point bending load. During the testing process, many factors like load, deflection, cracks and failure patterns were closely monitored. The experimental investigation revealed that beams with HSFRPC overlay showed enhanced load carrying capacity and ductility compared to conventional RC beams.

Keywords: High strength FRP; Reinforced concrete; Strengthening; Overlay; Retrofitting.

1. INTRODUCTION

Concrete constructions are widely utilized worldwide due to their numerous advantages, including their ease of manipulation, cost-effectiveness, and fire resistance. Reinforced concrete (RC) structures were introduced in the late 19th century to address the weakness of concrete in stress. Reinforcement is placed on the tension side of the concrete to counteract the tensile stresses that occur in specific areas of the concrete, which could potentially cause the structure to fail (Vasudeva *et al.* 2016; Çelik *et al.* 2022). An RC structure, if designed flawlessly and executed in accordance with codal standards, will have a maximum specified life duration of 100 years. Reinforced concrete structures frequently require modifications and enhancements to their performance throughout their lifespan (Abbass *et al.* 2014). The primary elements that contribute to the deterioration of structures include changes in their usage, new design requirements, corrosion in steel caused by harsh environments, and accidental catastrophes such as earthquakes, floods, and cyclones. There are two potential approaches for enhancing an RC construction, namely full construction replacement and retrofitting. Retrofitting involves the insertion of more advanced technologies into an older structure in order to improve its durability and ability to support heavy loads. Given the current economic conditions, it is more favorable to retrofit and rehabilitate damaged concrete structures to meet the stricter limits on performance and strength set by current codes (Mistretta *et al.* 2023). Strengthening the existing concrete structures to support higher loads is a more appealing option than demolishing and rebuilding. There are multiple techniques for retrofitting that are often used worldwide to repair damaged structures, such as, the external cable method, bonding and jacketing, and overlaying. Among these three strategies, the overlaying method is receiving significant attention in the field of retrofitting (El Damatty *et al.* 2003; Sreekanth *et al.* 2022). Therefore, there has been an increase in research efforts in the field of overlay approaches in the past decade (Miruthun *et al.* 2020). Superimposition technique involves utilizing external materials that offer the required qualities to strengthen the weakest area of concrete structures through retrofitting in order to improve its ability to carry heavy loads, longevity, and visual appeal. The Carbon Fiber Reinforced Polymer (CFRP), Engineering Cementitious Composite (ECC), and Ultra High Performance Fiber Reinforced Cementitious Composite (UHPFRCC) have been the most often utilized materials (Mini *et al.* 2014; Upendra

J. Environ. Nanotechnol., Vol. 13(2), 269-273 (2024)
https://doi.org/10.13074/jent.2024.06.242060

Construction and Building Materials 451 (2024) 138689

Contents lists available at ScienceDirect

Construction and Building Materials

journal homepage: www.elsevier.com/locate/conbuildmat

Development of a novel DNA-shaped steel fiber and its performance on fresh and hardened concrete

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ARTICLE INFO

Keywords:
DNA-shaped steel fiber
Hooked end fibers
Workability
Mechanical properties
Pull-out strength
Fresh and hardened properties
Microstructure studies

ABSTRACT

Adding small discrete random fibers in concrete has enhanced concrete behavior in various ways. Diverse types of fibers are available in terms of materials, shapes, and applications. Different shapes of steel fibers are available like hooked ends, crimped, stranded, helix, spherical, etc. Having the grade of concrete and the fiber dosage added as constant, the structural behavior and performance will vary for different types of fibers. It shows that the shape of fiber has a great role in enhancing the properties of concrete. The challenges in existing two-dimensional steel fibers in concrete like the mechanism and contribution of fiber in arresting cracks developed in all directions and balling effect can be overcome by a new type of three-dimensional steel fiber. A novel three-dimensional DNA-shaped steel fiber is designed and fabricated. This paper presents the fresh concrete and hardened concrete properties of DNA-shaped fiber-reinforced concrete (DNAFRC) and compares it with hooked-end fiber-reinforced concrete (HEFRC) by incorporating a volume fraction varying from 0.5 % to 2 % of grade M30 concrete and aspect ratio of 60 for both fibers. The fresh properties of concrete were evaluated by measuring the slump for workability and wash-out test for the fiber distribution. The hardened concrete properties were assessed by compressive, split tensile, flexural, impact, shear, and pull-out strength which demonstrated considerable increase by 5 % at 1.5 % volume fraction, 32 %, 136 %, 21 %, and 35 % at 2 % volume fraction respectively for DNAFRC than the HEFRC. Scanning Electronic Microscope (SEM) images were studied on failed samples to evaluate the bonding of DNA fiber with concrete.

1. Introduction

A versatile and tailor made most commonly used material in developing infrastructure and structures is concrete. It is a robust, long-lasting substance that can tolerate challenging climatic conditions and promising mechanical properties. However, it is crucial to employ top-notch infill materials to make sure that concrete constructions are durable. The filling materials can include different aggregates [1,2] including sand, gravel, or crushed stone and other components, like fly ash, slag, or silica fume [3] are introduced during the mixing process. Filling up any holes or spaces that could be present in the concrete can increase the strength and longevity of the concrete and it can reduce the possibility of cracking or shrinkage [4–6] over time. However, it is essential to note that not all filling materials are equal and suitable materials for a specific application will depend on the intended use of the concrete and the economy. Although concrete is most consumed infrastructure material, simple to produce, and strong in compression, the tensile strength is a severe shortcoming. The mechanical qualities [7] are enhanced by adding fibers making the material more robust and more resilient.

Fiber-reinforced concrete (FRC) was founded to strengthen the tensile strength. Depending on the required specific applications of the concrete, the fibers are often added to the mixture in tiny amounts, typically ranging from 0.5 % to 5 % by volume. These fibers can be created from various materials like steel, glass, synthetic, carbon,

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https://doi.org/10.1016/j.conbuildmat.2024.138689
Received 20 July 2024; Received in revised form 7 October 2024; Accepted 8 October 2024

MATEC Web of Conferences **400**, 03006 (2024) https://doi.org/10.1051/matecconf/202440003006
SPICE 2024

Traffic study using unmanned aerial vehicle & simulation of traffic flow at congested junctions of Salem City using hybrid approach

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Abstract. The number of road accidents in 2022 increased by 11.9% compared to 2021. Similarly, the number of deaths and injuries on account of road accidents also increased by 9.4% and 15.3% respectively. Road collision incidences in India are increasing at a rate of 5% faster than the world average. Since everyone moves about a lot in their everyday lives, transportation has become a part of everyone's existence. All people, regardless of age, must travel to do their daily tasks, which causes roadways to get blocked. This research examines how urbanization and industry are causing traffic congestion in the current environment. In the Salem Corporation specified road network, 162 road links were chosen for the study and surveyed with unmanned aerial vehicles. By adopting this digital aerial survey, local authorities may overcome their challenges in estimating the varied road network required at any time from all aspects. Drone have been used to conduct extensive investigations of the condition of the Five Roads Junction, Kondalampatti, Seelanaikanpatti, Shewapett, Junction Main Roads in the Salem district. The intersections were selected because they see a higher volume of traffic, particularly during peak hours. The manual traffic study was conducted to determine the reasons for traffic congestion. Pedestrian laws, appropriate bus stops, signalized junctions, and other measures can all be used to manage traffic. Unlike conventional methods, traffic simulation software such as PTV VISSIM and Any-logic are being used in this research to minimize the identified problems since it may be the alternative approach. This research deals with the Salem district traffic issue at five complex intersections and offers some fundamental remedies.

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REVISTA MATÉRIA V.29 N.4
ISSN 1517-7076 articles e20240559, 2024

Prediction of durability parameters on concrete containing ceramic waste as coarse aggregate using neural network

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ABSTRACT

The current work utilized power tools such as artificial neural networks (ANNs) to predict the durability parameters of concrete where partial replacement for coarse aggregate crushed ceramic waste. The concrete mix were subjected to systematic evaluation of compressive strength, water absorption, chloride diffusivity, and capillary absorption, with ceramic waste replacement levels ranging from 0% to 100%. The results show that incorporating ceramic waste enhances the mechanical and durability properties up to a certain replacement level, improving compressive strength and reducing water and chloride ion penetration. On the other hand, higher replacement levels led to an increase in porosity and adversely affected long-term durability properties. In current work, ANNs with various architectures were trained and tested on the above parameters and show varying performance based on model complexity and data quality. The models with optimal complexity demonstrated strong predictive capabilities for compressive strength, water absorption, and chloride diffusivity. The current findings illustrate the potential of ANNs in optimizing concrete mix with the replacement of recycled materials, balancing performance, durability, and sustainability.

Keywords: Artificial neural networks; ceramic waste; strength; durability.

1. INTRODUCTION

The construction/cement industry has long been seeking ways to incorporate waste materials into building products, both to reduce environmental impact and to create more sustainable construction methods [1]. One such material gaining attention is ceramic waste, a byproduct of the ceramic industry. The ceramic waste from industry offers a promising solution to the dual challenges of waste management and resource conservation [2]. This paper investigates the various aspects of utilizing ceramic waste in concrete, including its properties, advantages, challenges, and potential applications.

Ceramic waste originates from various stages of ceramic production, including raw material extraction, shaping, firing, and finishing processes [3]. The waste can take many forms, such as broken tiles, defective products, ceramic dust, and excess raw materials [4]. These materials are disposed of in landfills, and cause severe environmental pollution. The inert nature and durable properties of ceramics can utilized and incorporate as a supplementary material in concrete production [5].

Ceramic waste primarily consists of silica (SiO_2), alumina (Al_2O_3), and other oxides like iron oxide (Fe_2O_3), calcium oxide (CaO), and magnesium oxide (MgO) [6]. These components contribute to high strength and durability, making it a substitute candidate for concrete. The chemical stability of ceramics also ensures that when incorporated into concrete, they do not react adversely with other components, thus maintaining the integrity of the concrete [7].

Corresponding Author: Subash Sivasandi Mayan Received on 26/08/2024 Accepted on 07/10/2024

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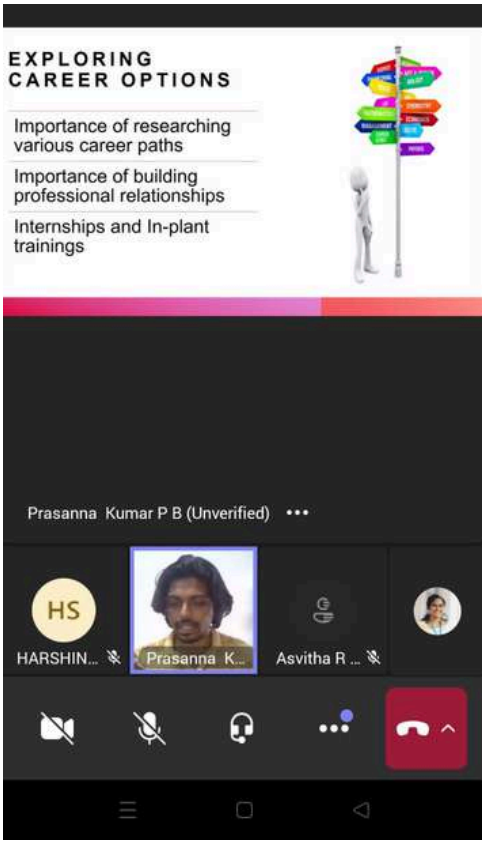

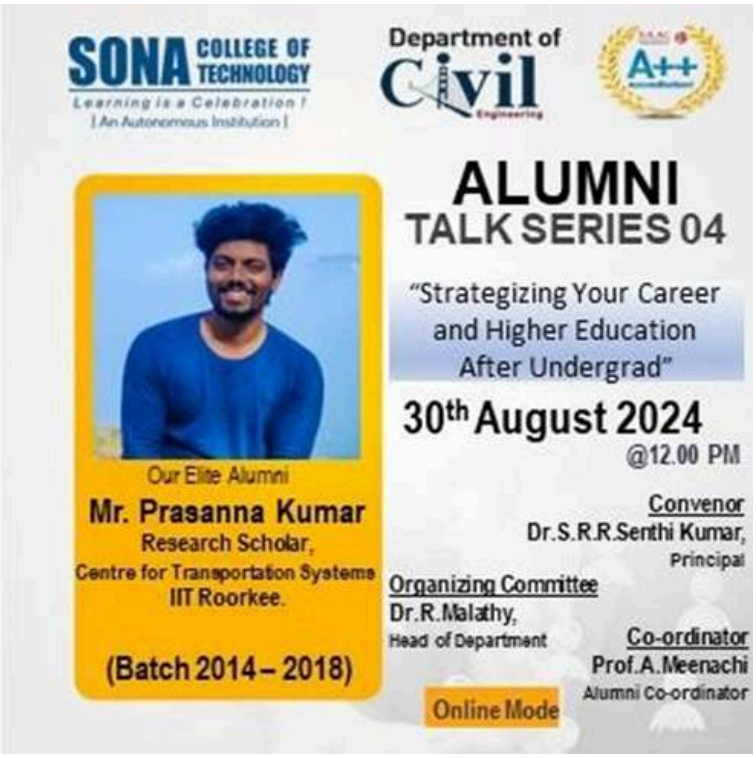

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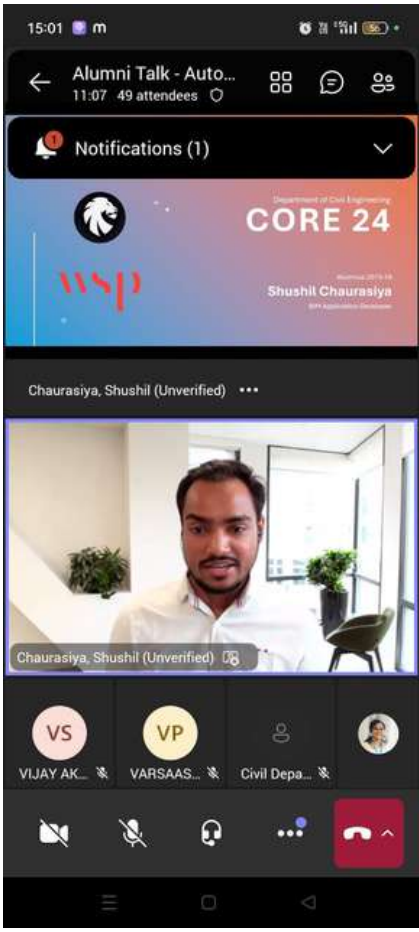
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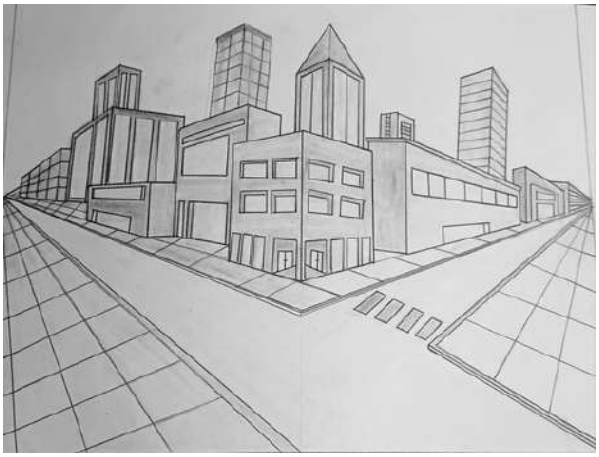

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