

NATIONAL CONFERENCE ON

RECENT

ADVANCEMENTS

IN

CIVIL ENGINEERING RESEARCH

(RACER 2023)

18th - 20th OCTOBER, 2023

PROCEEDINGS

Organized by

THE DEPARTMENT OF CIVIL ENGINEERING



MEA ENGINEERING COLLEGE
P E R I N T H A L M A N N A

VENGOOR - PATTIKKAD P.O, PERINTHALMANNA, MALAPPURAM DISTRICT, KERALA - PIN 679325



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MEA ENGINEERING COLLEGE
P E R I N T H A L M A N N A

VENGOOR - PATTIKKAD PO, PERINTHALMANNA, MALAPPURAM DISTRICT, KERALA - PIN 679325



ABOUT THE COLLEGE

MEA Engineering College, the first NAAC accredited self-financing engineering college in Malappuram district is committed to provide excellent and value-based education with a flair for ethics and professionalism. The College is located amidst panoramic natural beauty over-looking the hills and valleys at Nellikunnu, near Perinthalmanna – a town of various educational institutions – on the Perinthalmanna- Melattur road. The College is easily accessible by road, rail and air. The College is governed by the MEA sponsored by the ‘Samastha Kerala Jammiyyathul Ulama’, a society instituted by top class intellectuals of the Muslim community. Janab Panakkad Sayyid Haydar Ali Shihab Thangal is its charismatic head. The institution is affiliated to the APJ Abdul Kalam Technological University and approved by the AICTE. The college offers 6 B.Tech programmes, 3 M.Tech programmes and Ph.D programmes. The College Management has chosen this backward area for establishing the College with the aim of sharing the responsibility of uplifting the people of the area by making technical education affordable and within reach. The Management has no motive of making profit from the College but aims at creating a Center of Excellence in Engineering and Technology.

VISION

To provide top class education to the community by achieving excellence in engineering education and mould world class engineers with competence, integrity and social commitment.

MISSION

To provide the best faculty, excellent infrastructure, commendable facilities for excellent academic ambiance to encourage research and development and to strengthen employability and campus placements.

ABOUT THE DEPARTMENT

The Department of Civil Engineering started in the year 2011 and the first batch of students passed out in the year 2015. The Department offers undergraduate course in Civil Engineering. In all, there are around 480 students in undergraduate programme. It has faculty with expertise in diverse fields. Presently, the department has 23 qualified, sincere and dedicated teaching faculty members. The Department has established a state-of-the-art experimental facilities and laboratories in different fields of Civil Engineering. The Department strongly believes in continuous efforts to strive for excellence by exploring new frontiers of knowledge, imparting the latest technical knowledge to the students and conducting high quality research.

VISION

Emerge as an excellent centre for Civil Engineering education by building up professionally competent Civil Engineers

MISSION

- Develop professionally competent and socially committed Civil Engineers with ethical values, entrepreneurship, and leadership qualities.
- To impart quality education by implementing state-of-the-art teaching-learning methods to enrich the academic competency, credibility and integrity of the students.
- Inspire and create interest towards learning the subjects, and train diverse students to achieve academic excellence.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

- Be employed in industry, government, or entrepreneurial endeavors to demonstrate professional advancement through significant technical achievements and expanded leadership responsibility.
- Demonstrate the ability to work effectively as a team member and/or leader in an ever-changing professional environment.
- Progress through certificate programs, advanced degree, and research in Civil engineering and other professionally related fields.

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RAACER'23

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RACER'23**National Conference on Recent Advancements in Civil Engineering Research - 2023**

Department of Civil Engineering, MEA Engineering College Perinthalmanna - 679325

Platform for conference: Google Meet (<https://meet.google.com/kyu-expb-rzb>)**DAY 1: 18.10.2023 WEDNESDAY****Inauguration Session:
10.00 AM – 10.45 AM**

Prayer	:	
Welcome Address	:	Dr Hema Nalini AV Dean Research & HoD, Department of Civil Engineering, MEAEC
Presidential Address	:	Dr G Ramesh Principal MEAEC
Inaugural Address	:	Dr Ramesh Nayaka Assistant Professor Department of Civil and Infrastructure Engineering, IIT Dharwad
Felicitation	:	Mr Zubair CK Administration Manager MEAEC
	:	Prof Haneesh Babu KT Vice Principal MEAEC
	:	Prof Sreeram S Dean Academics MEAEC
Vote of Thanks	:	Dr Sivakumar B Professor, Department of Civil Engineering, MEAEC

**KEYNOTE ADDRESS:
10.50 AM – 12.00 NOON****New Horizons in Civil Engineering Research**

Dr Ramesh Nayaka, Assistant Professor, Department of Civil and Infrastructure Engineering, IIT Dharwad

Meeting link: <https://meet.google.com/kyu-expb-rzb>

About the Chief Guest:



Dr Ramesh Nayaka has obtained his Ph.D. in Structural Engineering and Materials from University of Malaya (UM) in Malaysia (2016-2019) and He was also given a thesis excellence award in 2019. He did his MTech. in Building Technology and Construction Management (2011-2013) from IIT Madras and B.Eng. in Civil Engineering (2007-2011) from VTU Karnataka (BEC Bagalkot).

His research interests include Building and Construction Materials, 3D Concrete Printing and its structural performance, Sustainable Construction Materials and Techniques,

Structural Behavior of Materials, Low-Cost Housing, Life Cycle Cost and Environmental Analysis, Building Information Modelling (BIM), Functional Design of Buildings and Optimization Techniques.

Dr Nayaka started his 10yrs long career as Assistant Professor in the Department of Civil Engineering at NIT Warangal (2019-2023), MAHE, Manipal, Karnataka, and NIT Calicut before joining the IIT Dharwad. He has guided more than 21 PG dissertations and 6 UG final year projects and currently supervising 6 Ph.D. research scholars.

Dr Nayaka has research articles published in esteemed journals and research initiatives supported by SERB. He had contributed to a number of projects, including Environmentally friendly building materials consisting of local waste materials for affordable housing, green hollow blocks, Low Carbon Footprint Precast Concrete Products for An Energy Efficient Built Environment (lowcoprecon), BIM Approach in Life Cycle Cost and Environment Assessment of FRC Slabs and Innovative Development of Sustainable Wall Cladding Systems to Curtail the Heat Ingress.

Dr Nayaka is a Chartered Engineer (C.Eng.) (IEI, India), a journal reviewer, and a member of ASCE, Project Management Institute (PMI), RILEM, the Institute of Structural Engineers, and the Association of Civil Engineers (UK).

DAY 1: 18.10.2023 WEDNESDAY**Inauguration Session:
10.00 AM – 12.00 NOON****Technical Session – 1
02.00 PM onwards****Chair: Dr Biju, Assistant Professor, Dept. of Civil Engineering, NSS College of Engineering, Palakkad****Member: Ms Farhana, Assistant Professor, Dept. of Civil Engineering, MEA Engineering College**

Sl No	Paper Title	Authors
1	Analysis and resilience enhancement of water distribution network using EPANET	Ashna SS and Dr Indulekha K P
2	Flood plain mapping due to dam break	Karthik U and Dr Indulekha K P
3	Optimization of Water Distribution System of New York City	Smrithi S and Dr Indulekha K P

Meeting link: <https://meet.google.com/kyu-expb-rzb>

DAY 2: 19.10.2023 THURSDAY**Invited Talk: 09.30 AM – 10.30 AM****Dr PR Sreemahadevan Pillai, Director, Ahalia School of Engineering & Technology, Palakkad****Technical Session – 2
11.00 AM onwards****Chair: Dr Bharati Raj J, Assistant Professor, Dept. of Civil Engineering, NSS College of Engineering, Palakkad****Member: Ms Arthana, Assistant Professor, Dept. of Civil Engineering, MEA Engineering College, Perinthalmanna**

SI No	Paper Tittle	Authors
1	Effect of rubber reinforced sandy soil on load settlement response of footing	Ardra SB and Prof Sini T
2	Effect of Saw dust Ash on strength properties of clayey soil	Athira M Nair and Bindu J
3	Evaluation of flexural behaviour of coir geocell reinforced soil	Diya SS and Prof. Sini T
4	Numerical study of slope stabilisation using soil nailing	Archana RV and Dr Ajitha AR
5	Study on improvement of coir geotextiles with latex coating <i>(This paper has been withdrawn from the abstract list by the authors)</i>	Dr Jaya V and Aiswarya Madhupal
6	Study on stress distribution under square footings in layered soils	Nimna VS and Dr Arvee Sujil Johnson
7	3D FEM analysis of construction demolition waste composed stone column	Gayathri BG and Renjith S Anand

**Technical Session – 3
02.00 PM onwards****Chair: Dr Suresh PS, Professor and HoD, Dept. of Civil Engineering, St Thomas College of Engineering and Technology, Chengannoor****Member: Mr Anees K, Assistant Professor, Dept. of Civil Engineering, MEA Engineering College, Perinthalmanna**

SI No	Paper Tittle	Authors
1	Pavement prioritization using AHP in Perinthalmanna	Fathima Hiba and Nikhil B
2	Study on fiber reinforced concrete utilising medical tablet blister pack waste and partial replacement of cement by fly ash	Dilfa CP and Riya Pious
3	Water quality analysis of Velliyar river and purification using bamboo charcoal and madidrop ceramic tablet	Juzaila and Nusfa Karuvattil
4	Virtualisation of Civil Engineering structure through virtual reality	Aromal and Sabitha K

Meeting link: <https://meet.google.com/kyu-expb-rzb>

DAY 3: 20.10.2023 FRIDAY**Technical Session – 4
10.00 AM onwards****Chair: Dr Mohammed Fasil, Post Doctoral Research Fellow, King Fahd University of Petroleum and Minerals, Saudi Arabia****Member: Dr Jeeja Menon, Associate Professor, Dept. of Civil Engineering, MEA Engineering College, Perinthamanna**

SI No	Paper Title	Authors
1	Stiffened coir geocell system for bearing capacity improvement	Sini T and Sishan Sharafudeen
2	Bio mimetic Innovations in Civil Engineering: Nature-Inspired Solutions for Sustainable Infrastructure	Dr. Priya A Jacob, Muhammed Subin, Ali Jafer, Shajan Johnson, Adwaith R
3	Manufacture of solid concrete blocks using waste plastics	Noufida P, Reneesh J Bright, Riyamol PE, Vandana Purushothaman and Asha B

Invited Talk: 02.00 PM – 02.30 PM**Dr. George. K. Varghese, Associate Professor, Department of Civil Engineering, NIT Calicut****Technical Session – 5
02.30 PM onwards****Chair: Dr George K Varghese, Associate Professor, NIT Calicut****Member: Ms Sudhanya, Assistant Professor, Dept. of Civil Engineering, MEA Engineering College, Perinthamanna**

SI No	Paper Title	Authors
1	Performance of seed-based bio coagulants in water treatment	Aiswarya JB and Dr Sumi S
2	The relation between land use changes and the landslide disaster in Ponmudi, Kerala	Nisna Nizar and Dr Bindu J
3	Water filtration through fly ash sand and charcoal filter	Favas VM, Gopika CB, Lubaba UP, Fathima Rasun EK, Yasmin N
4	Performance study of landfill liner using local soil	Sarath S and Ajitha AR

Meeting link: <https://meet.google.com/kyu-expb-rzb>

LIST OF PAPERS PRESENTED	
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P3	Floodplain mapping due to dam break
P4	Optimization of water distribution system of New York city
P6	Effect of rubber reinforced sandy soil on load settlement response of footing
P6	Effect of saw dust ash on strength properties of clayey soil
P7	Evaluation of flexural behaviour of coir geocell reinforced soil
P8	Numerical study of slope stabilisation using soil nailing
	Study on improvement of coir geotextiles with latex coating <i>(This paper has been withdrawn from the abstract list by the authors)</i>
P10	Study on stress distribution under square footings in layered soils
P11	3D FEM analysis of construction demolition waste composed stone column
P13	Pavement prioritization using AHP in Perinthalmanna
P14	Study on fiber reinforced concrete utilising medical tablet blister pack waste and partial replacement of cement by fly ash
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P17	Stiffened coir geocell system for bearing capacity improvement
P18	Bio mimetic innovations in civil engineering: nature-inspired solutions for sustainable infrastructure
P19	Manufacture of solid concrete blocks using waste plastics
P21	Performance study on seed-based bio coagulants in water treatment
P22	The relation between land use changes and the landslide disaster in Ponmudi, Kerala
P23	Water filtration through fly ash sand and charcoal filter
P24	Performance study of landfill liner using local soil

TECHNICAL SESSION – 1

ANALYSIS AND RESILIENCE ENHANCEMENT OF WATER DISTRIBUTION NETWORK USING EPANET

Ashna S S¹ and Dr Indulekha K P²

¹PG student, Hydraulics Engineering, Department of Civil Engineering, College of Engineering Trivandrum

²Associate Professor, Department of Civil Engineering, College of Engineering Trivandrum

ABSTRACT

The proper dimensioning of pipe components within water distribution network is a critical aspect of designing an efficient water supply system. This process involves careful consideration of factors such as pressure, efficiency, pipe quality, and workmanship to ensure that consumers receive adequate water pressure at their faucets for a specific flow rate in a cost-effective manner. Consequently, it becomes imperative to address the network's resilience during the water distribution system's design phase. The fundamental strategy employed to enhance resilience revolves around increasing the pipe diameter throughout the pipeline to maximize flow velocity. Enlarging the diameters of pipes within an optimally designed or pre-existing network significantly boosts system efficiency by increasing its resilience index. This study explores into two distinct approaches for enhancing network resilience using the EPANET software. The chosen network for this investigation is the Hanoi network, situated in the capital city of Vietnam, Hanoi. The first approach is increasing the pipe size, while the second one is parallel piping approach. Hydraulic analysis was successfully conducted for each network. In the case of the network employing the parallel piping approach, there was a remarkable 3.26 times increase in the resilience index, 1.37 times increase in the modified resilience index and 1.1 times increase in the power efficiency index compared to the existing network. Moreover, the additional cost incurred for this parallel piping approach was minimal, amounting to only a 4.3% increase compared to the original network. The study's outcomes indicate that parallel piping approach is better than increasing pipe size approach in terms of resilience enhancement and cost effectiveness.

Keywords: Water distribution systems, Pipe sizes, Resilience.

FLOODPLAIN MAPPING DUE TO DAM BREAK

Karthik U¹ and Dr Indulekha K P²

¹PG student, Hydraulics Engineering, Department of Civil Engineering, College of Engineering, Trivandrum.

²Associate Professor, Department of Civil Engineering, College of Engineering, Trivandrum.

ABSTRACT

Dams provide numerous advantages for our society, but they have also contributed to some of the worst calamities of the past 200 years, including floods brought on by built-dam failures. Costa cites foundation flaws, piping and seepage, overtopping caused by insufficient spillway capacity, and these as the main causes of failures. Simulating dam breach events and the ensuing floods is essential for identifying and minimizing the risks associated with possible dam failures. A dam failure might cause a flood wave that is up to tens of meters deep and moves quickly along a valley. Such a tsunami can have a disastrous effect on established communities. If warning and evacuation were not feasible, the loss of life from such destructive force is unavoidable. Prediction of the reservoir outflow hydrograph and routing of that hydrograph down the downstream valley are the two main problems in the study of a dam breach. Predicting the breach features, such as shape, depth, width, and rate of breach creation, as well as routing reservoir storage and inflow through the breach, are further subsets of predicting the outflow hydrograph. Most of the commonly used computer models handle the routing chores via the breach and across the downstream valley using various one-dimensional routing techniques. The programs approaches to the breach simulation process, however, vary greatly. The breach is not directly simulated by many models.; rather, the user determines the breach characteristics independently and provides that information as input to the routing model.

Keywords: Flood plain mapping, Dam break modelling, HEC-RAS Model.

OPTIMIZATION OF WATER DISTRIBUTION SYSTEM OF NEW YORK CITY

Smrithi S¹ and Dr Indulekha K P²

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²Associate Professor, Department of Civil Engineering, College of Engineering Trivandrum

ABSTRACT

Over the recent years, water loss through water distribution system poses one of the major threats to the supply of water, despite the growing population and rapid urbanization. The New York City has been chosen as the study area, since the city has seen a significant number of pipe breaks during recent years. The study is focused to assess and improve the city's current water distribution system by analyzing the system, using Water GEMS CONNECT edition. From the hydraulic analysis of existing network, it was observed that the pressure values fall within the range of 50 – 90 mH₂O and the water age values fall within the range of 0.2 – 19 hours (for pipes) and 0.6 – 21 hours (for nodes) for a total duration of 24 hours considered. The analysis of system revealed that the system has to be optimized to manage pressure through the system. Multi objective trade-off has been carried out for the network and the optimized network has been obtained. From the hydraulic analysis of optimized network, it was observed that the pressure values fall within the range of 40 – 70 mH₂O and the water age values fall within the range of 0.2 – 6 hours (for pipes) and 0.6 – 7 hours (for nodes) for a total duration of 24 hours considered. The results obtained have found to produce favorable results in terms of performance assessment parameters (pressure and water age) of network.

Keywords: Pressure management, Optimization algorithm, Performance assessment parameter

TECHNICAL SESSION – 2

EFFECT OF RUBBER REINFORCED SANDY SOIL ON LOAD SETTLEMENT RESPONSE OF FOOTING

Ardra S B¹ and Prof Sini T²

¹PG student, Geotechnical Engineering, Department of Civil Engineering, College of Engineering Trivandrum

²Assistant Professor, Department of Civil Engineering, College of Engineering Trivandrum

ABSTRACT

In recent decades, the amount of scrap tyres are increasing all around the world due to increasing population and thereby increasing vehicle usage. Increasing vehicles on the road has results in the piling up of waste tyres. These tyres are disposed either by incineration or landfilling which cause major environmental problems. As a solution to this, tyres are used in the form of rubber fibers, chips, granules etc to improve geotechnical properties of soil. This study focus on the effect of rubber granules on the bearing capacity of sandy soil by varying relative densities. Different proportions of rubber granules (4%, 8% & 12% by weight of reinforced depth) of size less than 4.75mm was used in this experiment. Relative density of sand bed was kept as constant as 30% and relative density of 1B depth of sand layer was varied by 30%, 50% and 70%. Totally 8 plate load tests, three on unreinforced sandy soil and five on reinforced sandy soil was done. Results showed that as rubber content increases bearing capacity of sand increases and settlement decreases. 12% rubber reinforced sandy soil with relative density 50% shows high bearing capacity ratio than 12% rubber reinforced sand with relative density 30% and 70%.

Keywords: Load-settlement curve, Relative density, Rubber granules

EFFECT OF SAW DUST ASH ON STRENGTH PROPERTIES OF CLAYEY SOIL

Athira M Naira¹ and Bindu J²

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²*Professor, Department of Civil Engineering, College of Engineering Trivandrum*

ABSTRACT

The rapid urbanization worldwide has led to a significant accumulation of sawdust, necessitating sustainable disposal alternatives. This study explores the potential of sawdust ash (SDA) as a soil improvement agent through extensive experimentation, including California bearing ratio (CBR) and unconfined compression strength tests. The results demonstrate a substantial enhancement in both CBR and unconfined compressive strength upon the addition of SDA. Notably, the CBR values fall within the recommended limits for Highway sub-base and sub-grade by the Asphalt Institute. Consequently, this research concludes that SDA, an industrial waste, proves to be a cost-effective and effective stabilizing agent for clayey sub-grades, with potential for further improvement when combined with bonding materials like lime. This presents an eco-friendly solution for reducing construction costs in road development, particularly in rural areas.

Keywords: Saw dust ash, Clay soil, Unconfined compressive strength

EVALUATION OF FLEXURAL BEHAVIOUR OF COIR GEOCELL REINFORCED SOIL

Diya S S¹ and Prof Sini T²

¹PG student, Geotechnical Engineering, Department of Civil Engineering, College of Engineering Trivandrum

²Assistant Professor, Department of Civil Engineering, College of Engineering Trivandrum

ABSTRACT

Pavement cracking is a pervasive and concerning issue in the field of civil engineering and infrastructure management. Reducing pavement cracking is essential to extend the lifespan of road surfaces, minimize maintenance costs, and ensure safe and efficient transportation networks. Various methods and strategies are employed to mitigate pavement cracking. Geosynthetics offer cost-effective and sustainable materials for pavement construction which enhances pavement construction. Among different geosynthetics, geocell are most widely used to reinforce pavements. The use of coir geocells in pavement construction and rehabilitation offers several significant benefits, contributing to the durability and sustainability of road infrastructure. The flexural behavior of pavements is an important aspect of their design and performance. In this study flexural behaviour of Coir geocell reinforced material was investigated by three layered beam model set up. Coir geocell with varying aspect ratio (0.5, 0.62 and 0.87) and different infill material (sand and aggregate) was compared with unreinforced one. Geocell with aspect ratio 0.87 shows lesser deflection irrespective of infill materials used. As height of geocell increases deflection in the beam reduced. Geocell with aggregate infilled material shows lesser deflection compared with sand. At maximum load level the deflection is reduced by 6.3%, 12.3% and 20.9 % respectively for sand and about 12.8 %, 23% and 32.6% respectively for aggregate infill material reinforced with geocell of aspect ratio 0.5, 0.62 and 0.87 when compared with unreinforced one.

Keywords: Coir geocell, Infill materials, Aspect ratio, Flexural behaviour

NUMERICAL STUDY ON SLOPE STABILISATION USING SOIL NAILING

Archana R V¹ and Dr Ajitha A R²

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²Assistant Professor, Department of Civil Engineering, College of Engineering Trivandrum

ABSTRACT

Slope instability may be a result of change in stress conditions, rise in groundwater table and rainfall. Similarly, many slopes that have been stable for several years can abruptly fail due to changes in geometry, weak soil shear strength or as an external forces effect. Debris flows (i.e. slope failures) take place without any warning and can have devastating results. So, it is vital to understand the slope failure mechanism and adopt safety prevention measures. Soil nailing is one of the widely used stabilization techniques for soil. The behavior of the earth nailing system is dependent on soil and nailing characteristics, such as the spacing between nails, the orientation, length, and method of installation of nails, soil properties, slope height and angle, and surcharge loading, among others. A parametric study was conducted to understand the effects nail orientation, nail length and surcharge variation on slope stability. Numerical study on soil nailing was conducted Plaxis 2D using the available data from the literature. It was observed that there is a reduction in the lateral movement of slope and footing settlements with an increase in length. The increase in length and inclination of the soil nails decreased the vertical, horizontal stress and footing settlement, while the increase in spacing of the nails increased the vertical and horizontal stress behind the soil mass. The effectiveness of soil nailing on layered soil is studied and it was found that stability of slope increased by providing soil nailing.

Keywords: Slope instability, Soil nailing, Plaxis 2D

STUDY ON STRESS DISTRIBUTION UNDER CIRCULAR FOOTING IN LAYERED SOILS

Nimna V S¹ and Dr Arvee Sujil Johnson²

¹*PG student, Geotechnical Engineering, Department of Civil Engineering, College of Engineering Trivandrum*

²*Professor, Department of Civil Engineering, College of Engineering Trivandrum*

ABSTRACT

Generally, soils exist in the form of different stratum in earth and are not homogeneous in nature as assumed in the conventional elastic theories in soil mechanics. These stratified deposits usually consist of a series of parallel layers, with the thickness and properties of the layers varying with depth in either a random or systematic alternative pattern. Each of these layers may have a thickness varying between several millimetres to several metres or more. Boussinesq's and Westergaard's elastic theories are still being generally used in soil mechanics in order to obtain the stress distribution in soil mass because of externally applied loads. But both these elastic theories are assumed to be applicable only on elastic materials. Geotechnical engineers are normally challenged with the design of foundations on layered soil profiles mainly due to the lack of well-established methods and solutions in order to analyse the soil behaviour in such profiles under different loading conditions. The objective of this project is to study the behaviour of the layered soil profile under vertical loading conditions using PLAXIS 2D which is a finite element software. The motivation behind this research is to study the stress distribution in the layered soil profiles. For this purpose, numerical modelling is done using the PLAXIS 2D software.

Keywords: Layered soils, Stress distribution.

3D FEM ANALYSIS OF CONSTRUCTION DEMOLITION WASTE COMPOSED STONE COLUMN

Gayathri B G¹ and Renjith S Anand²

¹PG student, Geotechnical Engineering, Department of Civil Engineering, College of Engineering Trivandrum

²Assistant Professor, Department of Civil Engineering, College of Engineering Trivandrum

ABSTRACT

Construction and Demolition Waste (CDW) has emerged as a valuable resource in geotechnical engineering, particularly in the context of stone column construction. This study presents a comprehensive 3D Finite Element Analysis (FEM) of CDW-Geosynthetic Encased Stone Columns (CDW-GEC-SC) and offers a comparative assessment with Ordinary Geosynthetic Encased Stone Columns (GEC-SC). The analysis focuses on settlement behavior, engineering economy, sustainability, resource optimization, and overall performance. The numerical investigation employs advanced software to simulate the behavior of CDW-GEC-SC under embankment loading conditions. The study substantiates CDW-GEC-SC's remarkable settlement mitigation capabilities, revealing a settlement of 0.45 meters, significantly outperforming the 0.519 meters settlement observed in Ordinary GEC-SC. This superior settlement control underscores CDW-GEC-SC's efficacy in ensuring embankment stability and long-term settlement management. Furthermore, the study highlights the economic benefits of CDW-GEC-SC, showcasing its potential to reduce maintenance costs and extend the service life of structures. It emphasizes the sustainability aspect, demonstrating how CDW repurposing aligns with global environmental objectives by diverting waste from landfills and promoting eco-conscious construction practices. The resource optimization achieved by utilizing CDW materials underscores the reduction in reliance on virgin resources, resulting in a reduced ecological footprint. CDW-GEC-SC's capacity to blend resilience, innovation, and environmental stewardship positions it as a transformative solution in geotechnical engineering. Thus, this 3D FEM analysis establishes CDW-GEC-SC as a superior alternative to conventional methods, offering exceptional settlement control, engineering economy, sustainability, and resource efficiency.

Keywords: Construction demolition waste geosynthetic encased stone columns, Finite element method, 3D analysis of stone columns

TECHNICAL SESSION – 3

PAVEMENT PRIORITIZATION USING AHP IN PERINTHALMANNA

C K Ajmal Irshad¹, Fathima Hiba¹, Fathima P A¹, Jenusha P K¹ and Nikhil B²

¹B. Tech Students, Department of Civil Engineering, MEA Engineering College, Perinthalmanna

²Assistant Professor, Department of Civil Engineering, MEA Engineering College, Perinthalmanna

ABSTRACT

Insufficient maintenance and improper servicing, the roads are not functioning perfectly, which adds to the city's traffic congestion. Pavement repairs are frequently carried out by decision-makers without taking the maintenance priority into account or following a specific approach. One of the best methods for prioritizing options based on crucial factors affecting pavement rehabilitation, primarily from a cost and benefit viewpoint, is the analytical hierarchy process (AHP). In this study, several fundamental scoring guidelines were created to transform the qualitative elements into a quantitative scale, and with the aid of a comparison matrix, the weighting of each of these factors was established. The benefit to cost analysis is then used to determine a priority ranking. The Perinthalmanna municipality in India was chosen as the case study location, and the overall territory was divided into 5 desom zones. The zones' maintenance priorities were determined by looking at the benefit-to-cost ratio. It was determined that the rating methodology in the AHP method successfully and readily prioritized the defective areas for maintenance based on the current conditions.

Keywords: Analytical Hierarchy process, Pavement rehabilitation, Comparison matrix, Scoring rules, Benefit to cost

STUDY ON FIBER REINFORCED CONCRETE UTILISING MEDICAL TABLET BLISTER PACK WASTE AND PARTIAL REPLACEMENT OF CEMENT BY FLY ASH

Riya Pious¹, Dilfa C P², Ayisha Hanena², Farhan Muhammed A P² and Asli Banu T²

¹Assistant Professor, Department of Civil Engineering, MEA Engineering College, Perinthalmanna

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ABSTRACT

Innovation and research are mostly concentrated on waste utilization, arriving at common motto “Wealth from waste”. Medical tablet blister packs are often disregarded waste material and are generated in high amounts at hospitals/ pharmaceuticals. Segregation of plastics being a key issue, effective utilization is not achieved in the case of medical blister packs. The addition of fly ash in concrete increase the workability of concrete and strength and durability of hardened concrete. It also reduces the amount of Portland cement and it becomes cost effective. Medical blister pack waste contributes about 15% of total share for plastics waste contribution in India. The covering of tablet is made with multi-layer packing consisting of PVC and Aluminium. The combination of plastic and aluminium can be effectively employed in fiber reinforcing technology of concrete there by offering high resistance to tension and improving durability in concrete. Using fly ash is an effective way to make concrete much more sustainable with less impact of environment, energy and reduces CO₂ emissions. Fiber reinforced concrete (FRC) is concrete containing fibrous material which increases its structural integrity. It contains short discrete fibers that are uniformly distributed and randomly oriented. Proposed study is mainly aimed in developing fiber reinforced concrete FRC, using medical blister pack from old age nursing homes. Fresh and hardened properties were performed to achieve optimum mix.

Keywords: Cement, Fly ash, Medical tablet blister pack, Fresh and hardened tests.

WATER QUALITY ANALYSIS OF VELLIYAR RIVER AND VIRTUALISATION OF CIVIL ENGINEERING STRUCTURE THROUGH VIRTUAL REALITY

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ABSTRACT

This paper examines the use of virtual reality (VR) in the virtualisation of civil engineering structures. With the help of VR technology, it is possible to create an immersive virtual environment that allows engineers to visualize and interact with structures before construction. This approach can help to identify potential design flaws and improve the construction process, ultimately leading to more efficient and cost-effective projects. The paper explores the benefits and challenges of using VR in civil engineering, including the need for specialized software and hardware, and the importance of user experience. Additionally, the paper presents several case studies that demonstrate the potential of VR in civil engineering, including the simulation of earthquake scenarios and the visualization of complex building designs.

Keywords: Virtualization, Planning, Rendering, Immersive Experience, Simulation

TECHNICAL SESSION – 4

STIFFENED COIR GEOCELL SYSTEM FOR BEARING CAPACITY IMPROVEMENT

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ABSTRACT

The bearing capacity of weak soil can be improved through the use of geocells, which are three-dimensional honeycomb-like structures made of synthetic or natural materials. In this study, we investigate the use of coir geocells, reinforced with bamboo strips, to improve the bearing capacity of weak soil. The bearing capacities are then compared with HDPE geocells and analyzed further. The coir geocells are made from coconut fibers and are an eco-friendly alternative to synthetic geocells. The bamboo strips are added to increase the strength of the coir geocells. The performance of the coir geocells with and without bamboo reinforcement was evaluated through plate load tests. Plate load tests were conducted for HDPE geocells. The results of the laboratory tests demonstrate that the bamboo-reinforced coir geocells significantly improve the bearing capacity of the weak soil. The strength of the coir geocells are increased with the addition of bamboo strips, resulting in a higher load-carrying capacity. The use of these materials offers an affordable and sustainable solution for improving the bearing capacity of weak soils in various applications, including road construction, slope stabilization, and foundation design. Overall, the findings of this study provide valuable insights into the use of coir geocells reinforced with bamboo strips as an effective and eco-friendly solution for improving the bearing capacity of weak soils. The study presents a promising approach to address the challenges of sustainable development, which requires innovative solutions that are both environmentally friendly and economically feasible.

Keywords: Bearing capacity, Bamboo reinforced coir geocell, HDPE geocells.

BIO MIMETIC INNOVATIONS IN CIVIL ENGINEERING: NATURE-INSPIRED SOLUTIONS FOR SUSTAINABLE INFRASTRUCTURE

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ABSTRACT

Globally, the construction industry is recognized as one of the key drivers of greenhouse gas emissions, energy use, freshwater use, resource use, and the production of solid waste. This is expected to increase due to rising urbanization and a constantly expanding population. As a result, attaining sustainable development in the building industry is now essential. One of the most cutting-edge ideas for the transition to sustainable practices in construction is the use of bio mimicry. Civil engineers are increasingly using bio mimicry, a design strategy that takes inspiration from nature's solutions to difficult issues, to create sustainable and resilient infrastructure. This paper provides an overview of the use of bio mimicry in civil engineering and shows how innovations influenced by nature can improve the effectiveness, robustness, and sustainability of infrastructure systems. The key focus of this paper is to investigate about the specific application of bio mimicry with regard to energy efficient buildings. The paper illustrates via case studies and examples the transformative power of nature-inspired design principles in producing infrastructure that satisfies societal requirements while preserving the planet's ecosystems. In addition to improving the performance and sustainability of civil engineering projects, these biomimetic technologies also help achieve the more general objective of balancing human growth with the natural environment.

Keywords: Bio mimicry, Civil engineering, Sustainable transportation, Nature-inspired design, Energy efficient building

MANUFACTURE OF SOLID CONCRETE BLOCKS USING WASTE PLASTICS

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ABSTRACT

Plastics are responsible for countless benefits of the modern life we enjoy today. However, they create considerable disposal problems since many plastics do not disintegrate quickly. Plastics have become a major toxic pollutant all over the world. The creation of non-decaying and low biodegradable waste materials, combined with a growing population, has resulted in a waste disposal crisis. There is no systematic way to dispose of these plastic wastes without polluting the environment. This report presents a study on the feasibility of using waste plastics to manufacture building materials. In the first phase of the study, waste plastic of polypropylene type was used in the molten state as a binder to manufacture solid blocks for wall construction. Compressive strength measurements and water absorption tests were done on the blocks. In the second phase, polypropylene granules were used to replace coarse aggregate to prepare concrete blocks. Studies have shown that solid concrete blocks prepared using plastic possess the required strength as mandated by Indian standards. Solid concrete blocks containing plastic had low density; hence, the weight of walls can also be reduced in multi-storeyed buildings.

Key words: Solid concrete blocks, Plastic waste, Safe disposal.

TECHNICAL SESSION – 5

PERFORMANCE STUDY ON SEED BASED BIO-COAGULANT IN WATER TREATMENT

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ABSTRACT

The most widely used coagulants are simple metal salts such as aluminium sulphate, ferric sulphate and ferric chloride. However, these coagulants need for more additional chemicals (usually lime, sodium hydroxide and/or soda ash) for pH adjustment and the need for more operator control/attention/time to adjust feed rates due to changing raw water quality turbidity. Also, they can cause health problems, produce non-biodegradable chemical toxic sludge, difficulty in removing nutrients, treatment cost higher. In the above circumstances, bio-coagulants assume greater significance. These can reduce the production of non-biodegradable and toxic chemical sludge to the environment and lower the sludge handling and treatment costs. The reduction in the volume of fruit waste to be discarded to landfill is an added advantage. The present study attempts to evaluate the performance of bio-coagulant prepared from Jackfruit Seed (*Artocarpus heterophyllus*) in the treatment of water. The preliminary results indicate that this bio-coagulant has comparable efficiency with that of the universal coagulant, Alum.

Key words: Coagulants, Bio coagulants, Flocculation, Turbidity.

THE RELATION BETWEEN LAND USE CHANGES AND THE LANDSLIDE DISASTER IN PONMUDI, KERALA

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ABSTRACT

Landslide inventories are useful for analysing the density of landslides in a specific area as a basis for estimating landslide probability and converting susceptibility maps into hazard maps, which is required for risk assessment. They are also critical for establishing local rainfall thresholds, which serve as the foundation for early warning systems, as well as determining which land use and land cover changes are associated with landslide occurrence. Land use and land cover changes (LULCCs) in mountainous areas may increase the susceptibility to landslides due to modifications of topography, vegetation, and material characteristics. Understanding the relation between LULCCs and landslide occurrences is important for landslide prevention and land resources management. In this study, relatively complete landslide inventories from 1990 to 1992 for ponmudi region in the state of Kerala, India were generated. A collaborative mapping approach based on the visual interpretation of pre- and post-event high-resolution satellite images (HRSIs) available from Google Earth and landslide data from GSI portal were used. ArcGIS software was used for the analysis. Landslide Inventory Map displaying the precise location of landslide within the study area was plotted. Following this, Elevation Map, Aspect Map, Slope Map and contour map were prepared. The results showed that Majority of the landslides occurred on vegetation area rather than build up area. Most of landslide locations are situated at higher elevation with steep slope facing south, southwest directions. The results show that there aren't any noticeable land use land cover changes in the study area. The analysis of the LULCCs from 1990 to 2020 for each landslide initiation point indicates that only a small percentage of landslides occurred in locations with recent LULCCs. This study of LULCCs of landslide initiation points showed that there were no clear relations between landslide occurrences and LULCCs for a short period.

Keywords: Landslides, Land use changes, LULCCs

WATER FILTRATION THROUGH FLY ASH, SAND AND CHARCOL FILTER

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ABSTRACT

This project focuses on the implementation of a sequential filtration system using fly ash, sand, and activated charcoal filter beds to treat contaminated quarry water and contaminated cleaning water from a rubber factory. The objective is to reduce the levels of various contaminants present in the wastewater and improve its overall quality. To begin, the project involves the collection and characterization of the wastewater samples, including parameters such as pH, chloride, biochemical oxygen demand (BOD), chemical oxygen demand (COD), turbidity, hardness, dissolved oxygen, and conductivity. This step provides a clear understanding of the initial contamination levels and aids in the evaluation of the filtration system's effectiveness. Ensuring the availability of the necessary filter media, namely fly ash, sand, and activated charcoal, is another important aspect. These materials are chosen for their filtration properties and compatibility with the wastewater being treated. The filter beds are then prepared, taking into consideration the appropriate sizing and arrangement of the filter media. Subsequently, the wastewater undergoes treatment using the sequential filtration process. The water flows through the fly ash bed, where larger particles and impurities are initially removed. It then moves on to the sand bed, which further removes suspended solids and finer contaminants. Finally, the water passes through the activated charcoal bed, where organic compounds and residual contaminants are adsorbed, resulting in further purification. After treatment, the characteristics of the treated wastewater are evaluated and compared to the initial values. The results reveal a significant reduction in parameters such as COD, BOD, pH, chloride, and turbidity, indicating the successful removal of contaminants through the filtration process. Overall, this project demonstrates the effectiveness of the sequential filtration system using fly ash, sand, and activated charcoal filter beds in reducing contamination levels and improving the quality of the wastewater. The findings suggest that this filtration approach holds promise as a potential solution for wastewater treatment in various industrial and environmental applications.

Keywords: Water filtration, Activated charcoal, Fly ash, COD

PERFORMANCE STUDY OF LANDFILL LINER USING LOCAL SOIL

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ABSTRACT

Rapid population growth has led to depletion of natural resources and it causes reduced carrying capacity of the environment. Waste disposal has become one of the most serious modern environmental problems in developed and developing countries all over the world. Landfills are highly engineered waste containment facilities, designed to minimize the impact of solid waste on the environment and human health. Leachates produced by these landfills possess a serious threat to the ground water resources. In order to prevent the groundwater from contamination, a barrier is provided in the form of liner. Liner in a landfill plays an important role to prevent contaminant migration in to groundwater. Liner should have hydraulic conductivity less than 10^{-7} cm/sec and its minimum thickness should be 600mm suggested by USEPA (United States of Environmental Protection Agency). Clayey soils are widely used in landfill areas due to their lower permeability. Also, mixing sand with an adequate amount of clay/bentonite has been a common practice for creating mixtures for hydraulic and waste containments. The combination of mixing sand and bentonite can be able to provide a very low permeability because of the ability of bentonite to swell and then fill the voids between sand particles. In this study, Thonnakkal clay was mixed with bentonite to find the effectiveness of this combination as a landfill liner. By mixing 5 % bentonite to Thonnakkal clay, the hydraulic conductivity of the mix meets the liner requirements like plasticity index, permeability and Unconfined Compressive Strength. Also, batch adsorption study using synthetic leachate (lead) on Thonnakkal Mix was conducted and adsorption isotherms were plotted. The results confirm the ability of the liner to adsorb contaminants.

Keywords: Landfill liner, Contaminant migration