VELAGAPUDI RAMAKRISHNA
SIDDHARTHA ENGINEERING COLLEGE
(AUTONOMOUS) (Sponsored by Siddhartha Academy of General & Technical Education)
Approved by AICTE | Affiliated to JNTUK Kakinada | An ISO 9001:2015 Certified Institution
NAAC A+ GRADE
BAND EXCELLENCE

CIVIL ENGINEERING

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About the College:

Velagapudi Ramakrishna Siddhartha Engineering College was established in the year 1977, as the first self-financing Engineering College in the composite state of Andhra Pradesh. The college is in Autonomous Status from 2006 onwards granted by UGC, permanently affiliated to JNTUK and approved by AICTE. The institute is accredited by NAAC with A+ grade in 2021. All the UG programs are accredited by NBA under OBE Tier-I format and 5 PG in Engineering programs are also accredited once. The institute was ranked at 178 in NIRF-2021, 156 in NIRF-2020 and 171 in NIRF-2019 by MHRD and also stood at good rankings given in various surveys by national magazines. The institute was ranked in band A' (6-25 Rank) in 'ATAL Ranking of Institutions on Innovation Achievements (ARIA) in 2020 and was ranked ‘Excellent’ band by MHRD, GOI in 2021. The college received AICTE - CII Indpact award from MHRD for best I-I-I in civil engineering and was rated platinum for four consecutive years 2017-2020. The institute is recognized as' SIRO' by DSIR, MST, GOI. This is the only private college granted with "Margadarshan Scheme " project by AICTE in the state of AP. The institute wad rated PLATINUM by AICTE-CII survey for the last four years. The college has 20+ collaborative labs & COE's supported by Siemens, Dassault, IBM, DST, NI. Oracle, Apple, CISCO etc., The college is offering consultancy services in A.P. and earned more than Rs.12 crores during the last 5 years. The institute received R&D projects worth more than Rs.5.0 crores for the last 6 years funded by UGC, AICTE, DST, DRDO etc. The college has a worthy placement record, competent faculty with more than 135 PhDs. The strong presence of Alumni was felt across the Globe as Entrepreneurs, CEOs, Academic leaders etc. Six departments of the institute were recognized as Research centres by JNTUK, Kakinada. The institute has more than 60 MOUs with industry partners and more than 1000 publications by faculty for the last 3 years in National, International Journals and Conferences. Industry relevant curriculum is offered involving MOOCs Industry based courses, Internship Skill development, and Personality Development & Student practice courses. The college has NSS & NCC units in the campus recognized by State and Central Governments. There are quite a good number of visiting and adjunct faculties from foreign universities and industry. The

Laboratories in the Civil Engineering department are also accredited by NABL which is rare in academic institutions.

About the Department :

The Department of Civil engineering of Velagapudi Ramakrishna Siddhartha Engineering College was established in 1977 at the inception of the college. The under graduation program was started with an intake of 60 later increased to 120 in 2007 and further increased to 180 in 2011. The Department started offering Postgraduate courses Structural Engineering from 1999 and Geotechnical Engineering from 2016 with an annual intake of 18 each. The department has state of the art advanced laboratories to cater the needs of students, research and consultancy. The department has total faculty of over forty-five, with fifteen doctorates and seventeen more pursuing PhD. The department takes pride in its highly experienced faculty specialized in all major specializations of Civil Engineering.

Department Vision :

To impart teaching, research and develop consultancy that serves the society and to strive continuously for excellence in education.

Department Mission :

To provide quality education for successful career and higher studies in Civil Engineering that emphasizes academic and technical competence in profession and research, effective communication, team work and leadership to meet the challenges of the society.

Table of Contents

1. PAPER PUBLICATIONS OF THE FACULTY

i) Stress distribution around the conduit buried within a soil slope – An experimental investigation

The use of conduits for transportation of utilities is very common around the world. The safe design and installation of these conduits depend upon the understanding of the soil-conduit interaction and the resulting stress distribution. This research paper presents a laboratory model test investigation of the effect of crest distance of the conduit buried within a sandy soil slope on the stress distribution around it and its structural response to the applied surface pressure. The crest distance of the conduit was varied from to ; being the outer diameter of the conduit. The results show that the stress distribution around the conduit buried within the soil slope differs significantly as compared to the conduit buried under the horizontal ground. The crest distance of the conduit from the slope edge and the resulting soil-conduit interaction governs the stress distribution and its structural response to the applied pressure. The graphical presentations, and the predicted soil-conduit interactions, as included in this paper, can be used routinely by the practicing engineers for the safe design and installation of the conduits buried within a soil slope.

ii) Load-settlement response of a footing over buried conduit in a sloping terrain: a numerical experiment-based artificial intelligent approach

Settlement estimation of a footing located over a buried conduit in a sloping terrain is a challenging task for practicing civil/geotechnical engineers. In the recent past, the advent of machine learning technology has made many traditional approaches antiquated. This paper investigates the viability, development, implementation, and comprehensive comparison of five artificial intelligence-based machine learning models, namely multilayer perceptron, Gaussian processes regression, lazy K-Star, decision table, and random forest (RF) to estimate the settlement of footing located over a buried conduit within a soil slope. The pertaining dataset of 3600 observations was obtained by conducting large-scale numerical simulations via

the finite element modeling framework. After executing the feature selection technique that is correlation-based subset selection, the applied load, total unit weight of soil, constrained modulus of soil, slope angle ratio, hoop stiffness of conduit, bending stiffness of conduit, burial depth of conduit, and crest distance of footing were utilized as the influence parameters for estimating and forecasting the settlement. The predictive strength and accuracy of all models mentioned supra were evaluated using several well-established statistical indices such as Pearson's correlation coefficient (r), root mean square error (RMSE), Nash–Sutcliffe efficiency (NSE), scatter index (SI), and relative percentage difference (RPD). The results showed that among all the models employed in this study, the multilayer perceptron model has shown better results with r, RMSE, NSE, SI, and RPD values of (0.977, 0.298, 0.937, 0.31, and 4.31) and (0.974, 0.323, 0.928, 0.44, and 3.75) for training and testing dataset, respectively. The sensitivity analysis revealed that all the selected parameters play an important role in determining the output value. However, the applied load, constrained modulus, unit weight, slope angle ratio, and hoop stiffness have the highest strength with the relative importance of 18.4%, 16.3%, and 15.3%, 13.8%, 11.4%, respectively. Finally, the model was translated into a functional relationship for easy implementation and can prove useful for practitioners and researchers in predicting the settlement of a footing located over a buried conduit in a sloping terrain.

iii) Numerical simulation of the dynamic response of batter piles and pile groups

Batter piles are most commonly used to resist large lateral loads caused by winds, tidal waves and soil pressure as experienced by offshore structures, bridges, and towers in general. The details in literature on the dynamic behaviour of these batter piles based on in-situ tests are limited. The present study focused on dynamic lateral behaviour of single batter piles and batter pile groups subjected to machine induced vibrations using 3D finite element (FE) analysis. The coupled soil-pile system consisting of soil mass, pile/pile groups, and oscillator motor assembly mounted on the top of the pile cap has been modelled using ABAQUS. The soil mass was considered as a half space through appropriate model dimensions and absorbing boundary conditions (using infinite element). A hybrid modelling approach was adopted to obtain the bending moment along the length of the pile. The 3D FE models were developed

based on the field tests conducted by the authors on bored cast in-situ batter piles (three batter angles 0°, 10° and 20°) and pile groups (0° and 20°). Dynamic lateral loads were applied on the pile cap in the form of sweep loads for varying force levels of excitation separately. The responses of the 3D FE models were obtained in terms of displacement time histories at mid height of pile cap, displacement, and bending moment profile along the pile length for all the considered cases. This study show that single batter piles (batter angles 10° and 20°) attract the bending moments three times more than single vertical piles.

iv) Structural optimization of steel plate shear wall with different perforations configurations and locations

Steel Plate Shear Walls (SPSW) can be used as an effective lateral load resisting system for highly seismic zones. The Present aim of study is to identify the optimum perforations pattern in SPSW. The behaviour of the Steel Plate Shear Walls with different shapes and locations of perforations is studied in the present work and compared with three configurations, i.e., diagonal, partially stripped, fully stripped openings. A 30 m × 30 m plan of a building with SPSW with perforations at specified locations for 5 storey, 10storey,15storey and 20 stories is considered. Time period, lateral stiffness, lateral displacements and maximum story drift due to different earthquake time histories and wind loads is performed using non-linear time history analysis. The responses are compared and the optimum opening configuration is found to be middle strip SPSW system shows with better performance against seismic loads and full strip SPSW systems shows better performance against wind loads.

v) Bamboo geocell for prevention of heavy rainfall-induced soil slope failure

Slope failures due to heavy rainfall are likely to occur during or after a certain period of rainfall. The present study aims at finding the possible soil slope failures when the slopes of different angles were exposed to heavy rainfall. Slopes of 30, 45, and 60° were made in a model test tank. It was found that the 60° slope was highly prone to failure in the event of heavy rainfall. Further, the present investigation aims at improving the 60° slope by reinforcing it with a low-cost natural geocell (bamboo geocell). Bamboo geocell of 50-mm

thickness was covered on the surface of the 60° slope. It was evident that the 60° slope was protected with bamboo geocell has revealed no visible failure after exposure to a prolonged period of about 13 h of heavy rainfall.

vi) Changing scenario of municipal solid waste management in kanpur city, India

Generation of municipal solid waste (MSW) depends upon lifestyle, urbanization and income level of population. Solid waste management is one of the essential parameters for the sustainable development of any city. Kanpur is one of the Indian cities with a population greater than 4 million having critical environmental and socio-economic issues of municipal solid waste management. Earlier some of the researchers highlighted the prevailing flaws and loopholes of the system, leading to poor controlled practices in the city till 2008. They also urged some remediates to the policymakers to fortify the system. In the present scenario, a daily waste generation amounts to be 1500 metric tonnes per day. This solid waste collection and transportation to the dumping site costs nearly 0.21 billion Rupees in a year. In the present paper, an attempt has been made to review the quality, physical and chemical composition, and policy of government authorities to manage the MSW year-wise year. The effect of open dumping of MSW on and nearby ground and surface water bodies in the study area is also highlighted. A comparative study between open dumping and engineered landfills is also made mainly with a focus on their suitability. The average net calorific value of the municipal solid is estimated as 2288 kcal/Kg which is significant to convert Waste to Energy (WtE). This work concludes with the possibilities of changing greenhouse gases to landfill gasses and their collection mechanism, electrical energy generation as per the composition and type of waste collected at the waste management plant. The suggestive measures equipped in this paper may lend a hand to the decision-makers/ municipal authorities to get an effective and environment-friendly MSW management system.

vii) Strength Prediction of self-consolidating concrete containing steel fibre with different fibre aspect ratio

The present study presents the effects of steel fibre aspect ratio on the fresh and strength properties of self-consolidating concrete (SCC). Steel fibre having three different aspect ratios (50, 65 and 80) with the inclusion rate of 0.2%, 0.4%, 0.6%, 0.8%, and 1.0% was considered, and the effects of aspect ratio and the fibre inclusion rate on the fresh and strength properties of SCC were investigated. Central composite design (CCD) of RSM modeling was considered to propose a regression model to predict the 28-day compressive strength of SCC and steel fibre-reinforced SCC (SFSCC) incorporating different supplementary cementitious materials (SCMs). 94 data sets retrieved from various literatures and the experimental data set (SCC and SFSCC) of this present study have been used to develop the regression model. Further, cement content, powder content, water to binder ratio, and coarse aggregate to fine aggregate ratio were considered as basic variables to propose the model, and their influence on the strength properties of SCC was prioritized using analysis of variance (ANOVA) and Pareto chart. The findings of regression model have been compared with the results of 94 data sets, and the experimental data set of this present study and the comparisons confirm that the proposed regression model are very realistic and precise to predict the compressive strength of SCC and SFSCC with different aspect ratio.

viii) Properties and performance of steel fiber reinforced concrete beam structure – Review

In present days, different types of steels were used to improve the performance of concrete structures. The steel fibers are used to increase the strength and structural integrity of the concrete beam. The performance of concrete structures was enhanced due to the accumulation of steel fiber reinforced elements. The economical steel fiber reinforced concrete structure was developed with exceptional ultimate strength and shear strength. The dissipation of energy and stress were uniformly distributed along the beam under different cyclic loading. The present topic was used to review the properties and performance on steel fiber reinforced concrete beam structure. The compressive and flexural strength was increased by 20% using

steel fiber reinforcement in concrete. The reinforcement mechanism and composition of concrete was the most influential factor on quality and performance of the concrete beam structure.

ix) Seismic Evaluation of Advanced Reinforced Concrete Structures

Many reinforced concrete frame buildings were developed and constructed in Coimbatore zone III before 2002. In 2002, the seismic code IS 1893 was updated. As a result, structures constructed earlier in 2002 do not meet the codal criterion. The majority of structures through infilled walls were nondesigned with infills in consideration. This paper goal is to appraise seismic exposure of an advanced reinforced present concrete building with infilled and without infilled frames. A pushover analysis was used to conduct this analysis. According to ATC40, the analysis shows the comportment levels of several building components for various stated concert objectives.

2. CONFERENCES ATTENDED BY FACULTY

i) Comparative study on strength and durability of concrete upon partial substitution of fly ash and bagasse ash in conventional concrete

The need for concrete is continuously increasing which also leads to a proportional increase in cement demand. The percentage increase of cement manufacturing is 3% per annum. Due to the augmented consumption of cement, the emission of carbon-di-oxide is increasing day by day. CO2 accounts for approximately 65% of global warming among greenhouse effect. The notorious impacts caused due to the cement utilization gave direction to this research for the partial replacement of class F fly ash and bagasse ash burnt at 1000°C in the conventional concrete. Comparative study is performed by casting mix with fly ash replaced at 0% to 40% at 5% interval and accordingly other mixes with bagasse ash replaced with 0% to 40% at 5% interval by weight of cement in the concrete and cured for 28, 56, and 90 days. Experimental investigations were carried out to determine mechanical parameters like compressive strength, split tensile strength, flexural strength, and durability aspects like resistance to chloride ion permeability, acid attack. Micro-structural investigations were carried out to determine the presence of peak, the composition of elements through X-ray Diffraction (XRD). Based on the research, it was concluded that fly ash can be replaced up to 40% and bagasse ash up to 15% in the concrete in terms of both strength and durability aspects. Fly ash replacement resulted in the maximum later strength achievement of 74 MPa at 30% replacement while the bagasse ash incorporation resulted in maximum early strength attainment of 61.9 MPa at 15% replacement.

ii) Evaluation of Strength Properties of the Concrete Prepared from Class F Fly Ash

Cement is a hazardous and expensive material that is used in the production of concrete, where the cost of the concrete is minimized by replacing the cement with similar cementitious materials. According to the report of the national thermal power corporation, the production of fly ash is rising each year as a result of increasing demand for electricity. In this

research paper, an attempt has been done by replacing cement with fly ash as an alternative material. The concrete samples are prepared with different compositions by using different percentages (0%, 10%, 20%, 30%, 40%, 50%, and 60%) of fly ash. In this research, the behaviour of the fly ash concrete is investigated by different strength-related properties; compressive strength, splitting tensile strength, and flexural strength at various curing time periods of 7, 28, 56, 90, and 180 days. In the experimental section, the developed fly ash concrete obtained maximum compressive strength of 83.50N / mm2, a flexural strength of 6.60N / mm2 and a splitting tensile strength of 4.90N / mm2 on the 180th day in the composition of 450kg/m3 and 0.4W/B ratio. Percentage gain of compressive, split, tensile and flexural tests for 450 kg/m3 at 0.4 W/B ratios at 180 days curing is 13%, 9% and 13% with 30% fly ash replacement when compared to 350 kg/m3 binder content. Proportional increase of cement content also leads to increase fly ash content in concrete. Fly ash has potential of filling pores because of having finer particles and performs pozzolanic action which resulted in attaining high strength even after optimum replacement when compared to conventional concrete.

iii) Numerical Simulations of Composite Materials

Throughout the last decade, the usage of fibre reinforced polymer (FRP) reinforcements in civil infrastructure has risen exponentially, owing to its superior corrosion protection, high durability, and non-magnetization characteristics. Furthermore, as a result of the poor modulus of elasticity of the FRP composites and its non-yielding properties, significant deflection and broad fractures are seen in the FRP reinforced concrete components under consideration. The emphasis of present study is on the behaviour of FRP-reinforced concrete beams. The total of nine finite element-based simulations was carried out (ABAQUS). The concrete damage plasticity modelling was considered while performing the analysis. Three different kinds of FRP bars such as CFRP, BFRP, and GFRP, were utilized as reinforcement in longitudinal and transverse direction for concrete beams. Literature was used to validate the numerical findings, and the parametric research has been carried out for varying factors, such as the diameter size, number of bars, the kind of FRP bars used, and the longitudinal arrangement of FRP bars. When CFRP bars were utilized, the load capacity

increased by anywhere from 8.88% to 62.92%. Beams that have been reinforced with CFRP carry more weight than beams reinforced with GFRP and BFRP. The increase in CFRP bars tends to give some ductility to the beam via the bi-linear load-to-ductility curve. In similarly, the GFRP reinforced beams improve the ductility of the structure as a whole.

iv) A Study on Strength Characteristics of Steel-Boron Composites as Reinforcement Bars in Reinforced concrete Beam

Metal matrix composites are the most widely used materials in automotive, aerospace, defence industries etc. The engineering properties of metal matrix composites [MMC] are well known. By relying on MMC'S, civil engineering field has lot of benefits. MMC'S are not well-versed in civil engineering discipline, due to lack of awareness and cost complexes. This paper deals with the study of strength characteristics of steel - boron fiber composite as reinforced bars in concrete beam. For this, steel-boron reinforcement was modelled by assembling the boron fibres [reinforcement] in steel bars [matrix], using ABAQUS software further this steel boron bars were assembled in concrete beam and analysed under required support and loading conditions. From the results it is observed that the strain in conventional steel beam is more than in MMC reinforced beam, therefore, tensile strain capacity of beam increased by increasing the boron fibres in steel reinforcement.

v) Strength Enhancement of Mortar using Bio-cementation Technique

Bio-cementation is a technique in which calcium carbonate ($CaCO_3$) gets deposited with the help of ureolytic bacteria. In this study, an attempt has been made to augment the properties of mortar utilizing bacterial solution made with soil bacteria and other nutrients. The consequence of bacterial solution was noticed in two methods. In the first method the bacterial solution is used in preparing the bacterial mortar specimens and in the second method the bacterial solution is used in surface treatment of mortar. Considerable enhancement of 20.08% in compressive strength and 10.52% decrement in water absorption of bacterial mortar over conventional mortar was observed at the end of 56 days of curing period.

vi) Stability analysis of Contiguous pile

Nowadays in modern construction, large-scale structures with greater heights that need deeper excavation are more popular. At present, the new structures from residential buildings to commercial complexes are keen on adopting basement floors for more underground utilities. These new structures with the need for basements are going for deeper excavation close to the existing buildings surrounding the proposed site of construction. In this case, understanding the behaviour of soil profile based on load-bearing capacity, settlement, density, and angle of friction are important to safeguard the adjacent structures from being damaged. Very often deep excavations are supported by pile wall systems. In the literature, it appeared that pile walls are analysed and designed for active and passive earth pressures. Recent investigations paved the way for my research to consider and implement the contiguous piles based on soil-structure interaction to eradicate soil sliding from the adjacent large buildings during the process of deeper excavation at the worksite. In the present study, the pile is analysed by considering active and passive earth pressures using Rankine's theory and Brinch Hansen's technique respectively. Together with passive earth pressure, horizontal subgrade modulus is also considered using Trezaghi's concept. With these forces, the stability of the pile is analysed using the STAAD. Pro software. For parametric study three different pile diameters of 0.45m, 0.6m and 0.9m are considered. Deflections, shear force, and bending moment of the pile are computed. It is inferred that 0.9m diameter pile wall is stable for the given loadings.

vii) Performance evaluation of expansive clay subgrade stabilized with synthetic rubber

In our everyday lives, transport plays an important part. An important necessity for the building of pavements is the existence of a decent subgrade. Soil stabilization is the process of improving the physical qualities of the soil in order to enhance its strength, durability etc. Soil stabilization gives an option to enhancing its strength and capacity to carry load. The many ways utilized to stabilize the soil Subgrade. However, the carbon footprint for most of the chemical stabilizations is enormous, which made researchers to find some sustainable alternatives. Present study focuses on the applicability of styrene butadiene rubber

(SBR), a synthetic rubber, which is an easily accessible adhesive that may be used to improve the characteristics of soil. Soils combined with chemical stabilizer (SBR) in varied percentages have been tested for Standard Proctor Test, and California Bearing Ratio Test. As a consequence of the stabilization, the OMC was lowered and MDD of the soil increased. The results were satisfactory till the addition of 12% chemical, which means that SBR can be used as a stabilizer for improving the properties of expansive clay subgrade.

viii) Geotechnical characteristics of polypropylene macro fibre reinforced black cotton soil treated with potassium hydroxide

Synthetic fibres are increasingly being used as reinforcement to help stabilise expanding soils. This work is an attempt to stabilise the black cotton soil with the reinforcement of polypropylene macro fibre in which potassium hydroxide (KOH) is utilised as an alkali activator as a contribution to this field. The KOH concentrations of 3%, 4%, and 5% with 10M were assumed, and the tests were carried out. It is also reinforced with varying percentages of polypropylene macro fibre (PP macro fibre), such as 0.3, 0.6, 0.9, 1.2, 1.5, and 1.8. California Bearing Ratio (CBR), Unconfined Compression Strength (UCS), and swell pressure experiments are carried out in the laboratory. Overall, it concluded that the addition of KOH to the soil decreased the swelling percentage of the soil by changing its mineral structure because of the presence of K ions. There was also a decrease in the shrinkage of the soil. The optimum moisture content is decreased, and the maximum dry density is increased. By reinforcing the soil with the PP macro fibre, it increased the strength of the soil.

ix) Numerical Investigation of RC Beam Using Externally Bonded Fibre Reinforced Polymer Laminate Using Ansys Software

Due to its exceptional properties such as good tensile strength, serviceability, corrosion resistant, and light weight, externally bonded Fibre reinforced polymer (FRP) is increasingly being utilized to support reinforced concrete (RC) structures. De-lamination of FRP-plate with concrete cover owing the most prevalent type of failure is due to different stress concentration at the bonded plate's end (stresses at end). The behaviour of the FRP-concrete interface is an important component in preventing debonding failures in RC

structures. As a result, for the safe and cost-effective design of externally bonded FRP systems, a deeper understanding of FRP behaviour for concrete interfaces is necessary. The primary goal of this research is to investigate the behaviour of the FRP-concrete interface. Finite element (FE) simulations utilising the ANSYS Finite Element software are used to investigate the interaction behaviour. For the parametric investigation, FE simulation models are built to investigate the impact of various variables on the binding behaviour of FRP and concrete surfaces by altering the width and thickness of the FRP laminate. Different thickness of FRP 2 mm, 4 mm, 6 mm and different widths 75 mm and 100 mm are taken. Based on the results the multi variable nonlinear regression and multi variable logarithmic Finite element (FE) simulations utilising the ANSYS Finite Element software are used to investigate the interaction behaviour. For the parametric investigation, FE simulation models are built to investigate the impact of various variables on the binding behaviour of FRP and concrete surfaces. Regression study is conducted out, and the best fit for the parameters under evaluation is found. The above analysis results are compared with the published work for validation.

x) Analysis and Design of Composite Single Span Psc-I Girder Bridge Using Midas Civil

With the ever-increasing sophistication of the population and the usage of vehicles, the number of modern road and bridge construction projects in India is increasing. To facilitate traffic flow, composite bridges are increasingly being implemented on a wide scale for highway building. In addition, new technology and equipment were gradually applied to road and bridge building. But, at the same time, there are several flaws in the structures due to the high technical requirements of bridge building, particularly the composite type of sections. The paper discusses the analysis and design of the Composite Single Span PSC-I Girder Bridge under IRC loadings using MIDAS. The analysis was carried out to get various outputs such as bending moment, shear force, and time-dependent characteristics like creep and shrinkage. At the construction stage, the PSC (pre-stressed) design of the span is carried out according to IRC standards to get output parameters such as principal stresses for pre-stressing tendon. The design involves calculation of the section properties, primary and secondary

moments, magnitude and location of the pre-stressing force, profile of the tendons, losses due to pre-stressing and shear stresses on the section. The structure is designed in accordance with IRC guidelines.

xi) Comparative Study on Slab Deflections

Slabs are one of the most common structural components in RC-framed structures, usually analysed under transverse loading. In the analysis, the thickness of the slab generally governs the serviceability requirement for deflection. The thickness of the slab controls the weight of the building since its contribution is nearly 50% of the total weight of the building. In order to minimize the weight of the building, proper analysis of the slab ensures minimum thickness satisfying deflection criteria. For a given loading, span, and assumed thickness of the slab, analysis will be performed using the material properties such as modulus of elasticity and Poisson's ratio. Several theories, including the Rankine-Grashoff theory, Timoshenko's plate theory, Marcus, and other methods have been proposed over the years using the same concept. These methods do not consider the participation of reinforcement in deflection estimation. IS code 456 – 2016 specifies limiting span to depth ratios with suitable modification factors based on percentage of tension reinforcement and stress level in steel for satisfactory serviceability criteria of deflection. In the present study, an attempt was made to compare the slab deflections analytically and experimentally with and without reinforcement contribution for the exactness of proposed theories. It concludes that, in one-way simply supported slabs, theoretical values differ by 45% from experimental values in reinforced concrete (RC) slabs. In two-way simply supported plain concrete (PC) slabs, the Rankine-Grashoff theory is in good agreement with the experimental values. Theoretical values of the two-way slabs when compared with experimental (RC slab) values are in good agreement with plate theory.

3. BOOK CHAPTERS BY FACULTY

i) Performance Evaluation of Glass Fibre Reinforced Concrete

Over the period of time, mechanical properties of natural as well as synthetic fibre have been used to reinforce concrete albeit extensively, to enhance the mechanical properties of concrete. Many investigations were carried out to evaluate the engineering characteristics and explore the applications of a variety of fibres leaving a few. The present study thus involves the determination of optimum % of glass fibre reinforcement (wt./wt. ratio) with the best compressive strength, split tensile strength, impact strength. With the addition of glass fibre, (1) compressive strength was found to increase by 14% for 0.8% glass fibre, (2) flexural strength was found to increase by 7.84% for 0.8% glass fibre and (3) Schmidt rebound hammer number was found to increase by 14% for 0.8% glass fibre (4), split tensile strength value is found to increase by 37% for 0.8% glass fibre, (5) ultra-sonic pulse velocity was found to increase by 24% for 0.8% glass fibre. Glass fibre in the concrete medium thus enhanced the properties of concrete in general but split tensile strength in particular.

ii) Possible Utilization of Expansive Soil Incorporated with Bagasse Ash and Bagasse Fibre

In today's world, the major geographical areas of India are covered with expansive soil that possess poor strength which cause undue settlements. The soil used in construction has to sustain adverse climatic conditions and different loads. To enhance the engineering parameters of sub grade soil one effective technique is soil stabilisation. In this paper, agricultural wastes like bagasse ash and bagasse fibre are used at varying percentages, like 2% to 8% and 0.5% to 2% respectively are used to treat. To evaluate the properties, laboratory tests like Atterberg limits, compaction properties, unconfined compression, and Soaked California bearing ratio test have been performed on untreated and treated samples. In addition to that micro structural study was conducted using scanning electron microscopy and X-ray diffraction to examine the structure growth of untreated and treated soil. The results indicate that an improvement in

maximum dry, California bearing ratio and compressive strength of up to 1.16, 4.55 and 2.55 times are observed with 2 + 0.5% bagasse ash and fibre.

iii) Improving the Geotechnical Properties of Silty Sands by Using GGBS and Coir Fibre

The construction of any infrastructure over a weak or cohesion less soil, which experiences, low shear strength, high compressibility, differential settlements, low stiffness, and ductility is one of the key constraints faced by geotechnical engineering. In case high rise of buildings and pavements built on cohesion less soils, improving the load bearing capacity of soil is critical. In the past, various methods like stabilisation, ground improvement techniques, and the use of reinforcement were used to improve the load bearing capacity of soil. The laboratory output of Silty sands admixed with GGBS and reinforced with coir fibres is investigated in this paper. The Silty sands have been considered by using percentages of GGBS such as 5, 10, 15, 20% and 2, 4, 6, 8% of coir fibres. The optimum values increased at 15% of GGBS and 6% of coir fibres, and the effect of curing time was considered for 3, 7, 14 days to investigate the compressive strength through unconfined compression test. To pavements, California bearing ratio test is performed under soaked and unsoaked conditions. In this paper, the key use of GGBS and Coir fibres is for improving soil properties and utilising the industrial waste material and natural waste material to reduce cost effective process.

iv) Performance Evaluation of Potassium Based Additives for Black Cotton Soil Stabilization

The black cotton soil covers more than a quarter of India’s geographical area. This black cotton soils retains features like highly shrinking and swelling character and low bearing capacity depending on the changes in moisture content present in atmosphere and this is because of montmorillonite mineral that is present in black cotton soil. In order to control these issues that are associated with black cotton soils, wide variety of techniques are available. Chemical stabilization is the most widely used stabilization technique all over the world due to its high efficiency. In present study investigates about the efficiency of soil stabilization by

potassium chloride in black cotton soils is investigated. The binder percentages of 5, 10, 15 and 20% were considered basing on the earlier literature. The experimental findings of index, engineering and microstructures properties of the KCL blended soils at different percentages are presented in this paper. The results showed the increase of 5% blended samples of curing periods compressive strength in different intervals of days as 0, 7 and 28 days respectively. In curing times from 5 to 20% ranges there is decrease with increase in blinder content for Unconfined Compressive Strength (UCS). Hence an optimum binder content of 5% is selected as the optimum binder dosage for stabilization. The microstructure changes occurred in 5% blended sample which are analysed by XRD patterns. The strength of soil of black cotton is increased successfully because of the conversion of montmorillonite to illite mineral as this is the main aim of our work. This current study clearly represents the efficiency of KCL in treating and stabilization of black cotton soil.

v) Prediction of Population Density & Poverty Rate using Moosaiks with Satellite Imagery

This research work involves combination of Random Forest optimization along with Satellite Imagery (SIML) which is having potential for addressing major global problems by remotely accessing socioeconomic and meteorological conditions in data poor areas, although SIML's resource requirements will limits its access and utilization. The Random Forest along with Satellite Imagery (SIML) is enabling better characterizations for population densities and poverty Rates. Further, this Random Forest Applications proves to be a path which is effective to convert such huge amount of unformed image data into formed assess of conditions of ground. The satellite images are collected from GIS (Geographic information system) and then process collected images to RFO for removing mosaic with regression concept. This proposed model generates accuracy 98.78%, recall 97.34%, throughput 97.75% sensitivity 98.45% and efficiency 96.25%. The following outcomes has been competed with present technology and outperformers the methodology.

vi) Algorithm Based saptio-temporal study on identification of pure bamboo vegetation using LULC classification

Bamboo is a natural air purifier that helps to keep the surroundings clean. Bamboo forests, which are an essential source of socioeconomic life for rural communities and an integral part of the ecosystem, are undergoing substantial changes. In order to plan and manage resources effectively, it is crucial to assess bamboo producing regions. In the mapping and identification of natural resources, space technology has been extremely useful. The objective of classification is to divide down a large subject into fewer, more manageable fractions. Classification can be performed either by using supervised or unsupervised techniques. Land use and land cover change has now become a critical component of current natural resource management and environmental monitoring systems. For the Land use and Land cover, four Supervised Learning methods namely Naive Bayes, Random Forest, Support Vector Machine and Decision Tree are used. Their overall accuracies will be compared inorder to obtain the best algorithm. Land cover mapping and monitoring were carried out to preserve current natural resources and to better understand the causative factors of land use in the study region i.e., East Garo Hills, a district of Meghalaya for the 2018 data.

4. PATENT BY FACULTY

i) A method of preparation of foamed glass powder geoplymer blocks

The present invention relates a composition for preparing foamed glass powder geo polymer blocks and method of preparation thereof. The proposed invention provides foamed glass powder geopolymer blocks manufactured with waste glass powder and fly ash as primary ingredients. In the present invention the raw materials utilized to produce the foamed glass powder geopolymer blocks are; glass powder (GP), fly ash (FA), sodium silicate (SS), sodium hydroxide (SH), crusher dust (CD) and alumina powder. The thermal performance of the developed blocks having low thermal conductivity values, provide the thermally efficient solution for the buildings reducing the overall energy requirements of the building.

Following invention provides a composition for preparing foamed glass powder geopolymer blocks and method of preparation thereof. The proposed invention provides foamed glass powder geopolymer blocks manufactured with waste glass powder and fly ash as primary ingredients. In the present invention the raw materials utilize to produce the foamed glass powder geopolymer blocks are; glass powder (GP), fly ash (FA), sodium silicate (SS), sodium hydroxide (SH), crusher dust (CD) and alumina powder. GP, FA and crusher dust are mixing in the ratio of 30:40:30. A mixture of sodium silicate and sodium hydroxide in the ratio of 1:2.4 is using as the alkaline solution. The mixture is preparing one day prior to the preparation of wet geopolymer mix. Further, in order to lower the density of geopolymer blocks, protein-based pre-foam is injecting using foam pressure injector. The pressure of injection of foam into the slurry is keeping at 75 psi. The slurry is then transferring into the moulds. The blocks are demoulding after 12 hours and heat5 cured in an oven maintained at 60°C for 12 hours. The physical, mechanical, and thermal testing is conducted to analyse the performance of foamed geopolymer blocks.

Best method of performance of the invention:

- GP, FA and crusher dust are mixing in the ratio of 30:40:30.
- A mixture of sodium silicate and sodium hydroxide (12M) in the ratio of 1:2.4 is using as the alkaline solution.
- The mixture is preparing one day prior to the preparation of wet geopolymer mix.
- In order to lower the density of geopolymer blocks, protein-based pre-foam is injecting using foam pressure injector.
- The percentage volume of foam injecting is 57.6% to obtain the target density of 500 kg/m3.
- The pressure of injection of foam into the slurry is keeping at 75 psi.
- Slurry is then transferring into the moulds of 100 x 100 x 100 mm.
- The blocks are demoulded after 12 hours and heat cured in an oven maintained at 60°C for 12 hours.
- The developed blocks are then test for verification and validation

Therefore, the advantage of present product is to tackle twin issues of20 sustainability and thermal performance of wall system. Proposed thermally efficient product i.e. foamed glass powder geopolymer (FGPG) is developed from waste glass powder and fly ash as an alumina-silicate source material as a primary ingredient. Due to the usage of waste and elimination of cement for development of present product for building material, it proves to be sustainable in nature.25

The many features and advantages of the invention are apparent from the detailed specification, and thus, it is intended by the appended claims to cover all such features and advantages of the invention which fall within the true spirit and scope of the invention. Further, since numerous modifications and variations will30 readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation illustrated and described, and accordingly, all suitable modifications and equivalents may be resorted to, falling within the scope of the invention.

Claims:

A method of preparation of composition for preparing foamed glass powder geo polymer blocks comprises of following steps;

a) Intermixing sodium silicate and sodium hydroxide (12 M) in a ratio of 1: 2.4 for forming an alkaline solution one day prior to the preparation of wet geopolymer mix;

b) Next day mixing of the solid ingredients the glass powder, fly ash and crusher dust in ratio of 30: 40: 30;

c) Protein-based pre-foam is injecting (57.6% by volume) using foam pressure injector, wherein the pressure of injection of foam into the slurry is keeping at 75 psi;

d) Transferring the slurry into the moulds of 100 x 100 x 100 mm;

e) Finally demoulding the blocks after 12 hours and heat cured in an oven maintained at 60°C for 12 hours.