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

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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) Characterization of Expansive Soils treated with Lignosulfonate

The current study examines the potential of lignosulfonate to enhance the engineering behaviour of two locally available expansive soils. The expansive soils were collected from Vijayawada and Amaravathi, located in the Capital Region of Andhra Pradesh, India. The soils were treated with four different percentages (0.5, 1, 2, and 4) of lignosulfonate and were allowed to interact for 7 and 28 days. A series of laboratory tests such as unconfined compressive strength, cation exchange capacity and scanning electron microscopy were carried out on the soil specimens. The results indicated that lignosulfonate has significant influence on the strength behaviour of expansive soils. The amount of fines content present in soils defines the optimum percentage of lignosulfonate. Lignosulfonate treatment resulted in reduced negative surface charge of soils and formation of Polymer chain microstructure along with flocculated or aggregated particle microstructure, which may attribute to the enhanced strength of the expansive soils.

ii) Consolidation and Hydraulic conductivity of High-Plastic Clay Reinforced with Waste Tire Fibres

Extreme shrinkage, high swelling, excessive settlement, and low shear strength are some undesirable properties of clayey soils. Stabilizing the clayey soil by means of chemical admixtures has been widely adopted in the past. As an alternative to these traditional techniques, the present study proposes an economical and environmentally friendly solution that involves the use of waste tire fibres in clayey soil. The waste tire fibres of three aspect ratios of 9, 6.4, and 4.5 were mixed with four different contents, i.e., 0.25, 0.50, 0.75, and 1.00 %, in clayey soil. In the present study, the one-dimensional consolidation behaviour of fibre-reinforced clayey soil was investigated with the help of various consolidation parameters. Test results have confirmed that the swelling nature of clayey soil can be controlled remarkably well with the addition of waste tire fibres. The significant reduction in the settlement was

observed for the low aspect ratio fibres. The results show that the rate of consolidation of clayey soil increases considerably with the addition of longer and thicker fibres. Thus, the time required for 90 % consolidation is reduced from 64 to 40 minutes for untreated clayey soil. With an increase in fibre content and size, the void ratio in fibre-reinforced clayey soil increased, which further leads to an increase in hydraulic conductivity. It can be stated that the utilization of waste tires as a reinforcing material in clayey soil can be an economical option for the construction industry mainly because it is an eco-friendly use of tire disposal.

iii) Cyclic behaviour of precast reinforced concrete sandwich slender walls

Experimental investigation on the performance of full scale precast RC sandwich slender walls under reversed cyclic loading is reported. Eight full scale precast 3D sandwich slender walls, with two different aspect ratios of 3.0 and 2.63, under in-plane lateral loading were tested. Four of them were designed with end stiffeners, while the remaining was without stiffeners. In each of four stiffened and four unstiffened walls, only two were provided with additional longitudinal reinforcement, consisting of 12 mm diameter HYSD steel rebars at 300 mm c/c spacing along on two vertical faces. All the sandwich walls were subjected to constant axial load in addition to the lateral incremental monotonic and cyclic loading using displacement control system. The performance of precast sandwich slender walls using lateral load vs. lateral displacement, pattern of cracking, displacement ductility, stiffness degradation and energy dissipation has been evaluated. The experimental results have been validated with the predicted lateral strength predicted by various codes of practice. The additional longitudinal reinforcement and end stiffeners significantly improved the lateral strength, cracking resistance, stiffness, ductility, and energy dissipation of the precast sandwich slender walls under lateral cyclic loading. The precast sandwich slender walls designed with additional longitudinal reinforcement and end stiffeners exhibited marginal improvement in the stiffness under lateral loading. The energy dissipation in the precast sandwich walls decreases in subsequent cycles of lateral displacements. The seismic base shear capacity of the precast sandwich slender walls seems to be better and comparable with the conventional RC walls.

iv) Evaluation of Compressive Strength of High Volume Fly ash Concretes by using Multivariate Adaptive Regression Splines

Fly ash, an industrial by-product, a supplementary cementitious material used in civil engineering construction. Addition of fly ash reduces production of carbon dioxide and disposal problem. This paper presents an advanced statistical model, Multivariate adaptive regression splines (MARS) to predict the compressive strength of fly ash concretes. MARS is formulated based on nonlinear and nonparametric regression approach. Dependent variables have been identified from the extensive experimental investigations on fly ash concrete. According to the output and input parameters adopted, MARS establishes appropriate relations by using the concept of divide and conquers strategy. Using the compressive strength data on various concrete mixes, MARS models were developed. About of the experimental data has been used for development of MARS models and remaining data for verification and validation of the developed models. In these models, all associated and interrelated variables and their limits have been taken into account. Three MARS models have been developed to evaluate the compressive strength of fly ash concrete at 28, 56 and 90 days. It is observed from the validation studies that the predicted compressive strength concrete for various periods exhibits good agreement with the experimental results.

v) Studies on bio-cementation of mortar and identification of causative bacteria

A major challenge for construction industry is the durability of structures. A lot of work is being done to strengthen structures. Microbially induced calcium carbonate precipitation (MICCP) or bio-cementation is an innovative technology, which uses ureolytic bacteria to precipitate CaCO3 to strengthen cementitious materials. In this research, the effect of a bio-solution incorporated with soil as microbial source on the mechanical properties of mortar was studied. Cost reduction in the process was done by using natural ingredients. A considerable increment in compressive strength and a decrement in water absorption of the bio-mortar specimens were observed. Two ureolytic bacteria were identified, viz. Bacillus cereus and Enterobacter cloacae. The effect of these identified ureolytic pure cultures on mortar was also studied.

vi) Ultimate bearing capacity of strip footing resting on soil bed strengthened by wraparound geo-synthetic reinforcement technique

In the recent past, the wraparound geo-synthetic reinforcement technique has been recommended for constructing the geo-synthetic-reinforced soil foundations. This paper presents the development of an analytical expression for estimating the ultimate bearing capacity of strip footing resting on soil bed reinforced with geo-synthetic reinforcement having the wraparound ends. The wraparound ends of the geo-synthetic reinforcement are considered to provide the shearing resistance at the soil-geo-synthetic interface as well as the passive resistance due to confinement of soil by the geo-synthetic reinforcement. The values of ultimate load-bearing capacity determined by using the developed analytical expression agree well with the model footing load test values as reported in the literature.

vii) Investigation On Seismic Performance Of Bed Joint Reinforced Solid Brick Masonry Walls

The paper reports on a comprehensive review of state of art on the performance of bed joint reinforced masonry walls for structural applications under lateral loadings. In severe seismic zone regions still need to improve performance of masonry buildings. In current scenario lack of design and construction on reinforced masonry walls and experimental investigations on bed joint reinforced shear walls to study the effect of reinforcement on deformation, stiffness and strength. In past international and national literature reviewers shown that bed-joint reinforcement provides only marginal improvement of in-plane shear capacity, but satisfactory improvement in ductility capacity. In the unreinforced masonry walls crack distribution with large energy dissipation to prevent this one should go with horizontal reinforcement. However, almost no research on bed joint reinforced, shear wall is available. The current study includes the analysis & experimental study on full-scale solid burnt brick masonry walls of different aspect ratio, with and without bed-joint reinforcement, through displacement- controlled in-plane cyclic loading to understand the difference in performance

of unreinforced masonry walls, walls with IS 4326 (1993) detailing and reinforced masonry walls in terms of strength, stiffness, ductility and energy dissipation.

viii) Analytical Study on Seismic Performance of Bed Joint Reinforced Concrete Shear walls

It is notable that brick work structures endure a lot of harm during seismic tremors, prompting huge loss of lives. Practically 75% of the disaster, credited to seismic tremor in a century ago, is because of breakdown of workmanship structures [1]. A greater part of the apartments in India are Unreinforced Masonry (URM) structures that are powerless and helpless much under moderate quakes and due to high wind forces out-of-plane action is acting on the wall which makes a severe damage at high wind loads and it is well known that Reinforced masonry construction has got a significant number of advantages than the masonry without reinforcement, whose application is very less in Indian construction practices and still there are no specified codes prescribed and in most constructions there been used shear walls instead of reinforced masonry walls even at the moderate earthquakes [2]. On the other hand, a great need to focus on understanding masonry buildings that are subjected to both axial loaded and seismic loads [3]. The main objective of this paper is to study the methods available in the literature to obtain the seismic vulnerability of un-reinforced masonry walls using linear static analysis [4]. To achieve this, analysis (Staad.Pro software) have been carried out as a part of this research. Two walls with same dimensions with an unreinforced and bed type reinforced masonry were analysed under uniaxial loading. A constant axial compressive load was maintained for each specimen during the analysis [5]. Idealized Load vs Deflection plots are used to describe the wall deflections and maximum stresses evolved by using STAAD.Pro. The final outcome of this performance analysis declares the efficiency of Reinforced masonry walls over the masonry walls without reinforcement under both axial and seismic loads (Load vs Maximum shear stress).

ix) Mechanical properties of Recycled aggregate concrete with Portland slag cement

This paper presents the results of experimental research using concrete produced by replacing, part of the natural coarse aggregates with recycled aggregates from concrete demolition. The amount of construction waste increases annually. Also modern technology is given a chance to improve recycling usage in sustainable concrete industry. In modern technology world, recycling plays a vital role to protect the natural resources in our planet The influence of quality of the recycled aggregate, the percentage of replacement on the targeted quality of the concrete to be produced (strength and workability) has been evaluated. The following properties of recycled concretes were analyzed i.e compressive strength, split tensile strength and flexural strength. Several factors were influenced on strength and workability i.e the type of aggregate, the percentage of replacement, the type of sieve curve. The type of aggregate and the percentage of replacement were the only factors that showed a clear influence on most of the properties. Compressive strength will be clearly affected by the quality of recycled aggregates. If the water–cement ratio is kept constant and the loss of workability due to the effect of using recycled aggregate is more .In present studies W/C ratios were modified based on grade of concrete. The improvement of sustainable concrete, by using recycled coarse aggregates has an important role to ensure the minimization of damages towards environment. This research carries out a thorough investigation of RCA concrete, strength, thermal performance with 30% recycled coarse aggregate content for M20, M25, M30, M35 grades by using slag. It provides a clearer understanding on how it can be applied to improve the usage of 30% RCA content in concrete for sustainable development.

x) Ground Granulated Blast- Furnace slag as a cement replacing material in concrete- A Review

As we know concrete is a mixed composition of cement, fine aggregates, coarse aggregates and water. It plays a white cell roll in development of vast infrastructure i.e., construction of buildings, highways, bridges etc. Ordinary Portland cement is the main ingredient used for the production of concrete. Due to usage of lime in the manufacturing

process of cement, a large volume of carbon dioxide emission causes greenhouse effect and global warming. Hence to reduce such emissions, and alternate you material must be used in each production. One of the beneficiary materials was ground granulated blast furnace slag, which is obtained from the blast furnace of iron and can be used in concrete production. This paper reviews the utilization and efficiency of GGBS which affects the properties of concrete. Number of studies was done with the help of previous journals in partial replacement of GGBS concrete. Which include properties like flexible strength, compressive strength, split tensile strength, workability, electrical conductivity, and sulphate attack and chloride resistance. This study reviews the usage of GGBS as partial replacement of cement in concrete. GGBS as an eco-friendly product was found to enhance the properties of concrete and to be utilized in the production of concrete without dumping onto the ground

xi) Comparative Analysis of Unburied and Buried Pipeline Structure in Seismic Zone Using CAESAR II

The pipelines are the transfer medium wand economical linkage in the countries development and infrastructures. Pipelines are useful for transporting water for drinking or irrigation over long distances when it needs to transport over hills, or where canals or channels are poor choices due to considerations of evaporation, pollution, or environmental impact. Oil pipelines are made from steel or plastic tubes which are usually buried. Seismic waves, being a lead role in the destruction of pipeline networks. There different types of supports used to create stiffness. Distribution of bending moments, axial forces, displacements and deformations along the pipeline and supports are studied for a set of important parametric variations. A good representation of the pipeline displacements is shown using CAESAR II.

xii) Failure of Aluminum Honeycomb Sandwich Panels

As an efficient lightweight structure, composite honeycomb sandwich panel has been widely utilized in many industries. The composite honeycomb sandwich structure with stringer reinforcement could even be a replacement quite sandwich structure. This paper investigated the damage and failure behavior of composite honeycomb sandwich structure

with stringer reinforcement under in-plane compression condition. Three differing types of debonding damage of interface between sheet and core were considered the failure modes also because the entire failure process was obtained by numerical simulation. Advanced sandwich structure is typically an outsized thickness of honeycomb core bonded with composite sheets. With larger in-plane stiffness and strength, the material faceplate is especially wont to bear the axial load, bending moment and shearing action, while the honeycomb core, subject to bending and shear load, is especially wont to maintain the steadiness the relative position of sheets and transfer lateral load. With the benefits of high specific stiffness and specific strength, the structure can get high flexural stiffness and compressive yield strength under the condition of low relative density. The existence of interfacial debonding, local buckling will occur within the debonding area, and cause the ultimate broken. With the rise of the compression loading, the displacement of bulging outward increasing gradually and therefore the debonding propagation gradually extends to the interface of sheet/core near the initial debonding propagation of sheet/stiffener.

xiii) Comparative Study on Seismic performance of Multi Storied Building with and without Shear Wall

As the demand for construction of high rise buildings increased day by day, it is very much necessary to ensure the safety and stability of the structures against lateral forces caused by earthquake. The most predominantly used structural element which resists the lateral forces and imparts the stiffness to the structure is shear wall. Shear walls are specially designed reinforced structural walls to resist all types of lateral forces caused by wind, earthquake. In this thesis our main focus is to compare the seismic performance G+14 storey irregular planned structure with and without shear wall using Response spectrum method. Analysis was carried out by using E-TABS for seismic zone Ⅳ in India.

2. CONFERENCES ATTENDED BY FACULTY

i) Mineralogical and morphological transformations of alkali contaminated kaolinitic soils

Understanding the transformation behavior of soils contaminated with alkalis is absolutely necessary to identify its remarkable changes on mineralogy and morphology. This present work focuses on the effect of alkali interaction on soils by increase in concentration for a particular period and by increase in interaction period for a particular concentration. Considerable attempts have been made to perceive the mineral transformations during different interaction periods. Two different kaolinitic soils were considered for the study. Red earth (RE) and China clay (CC) were allowed to interact with four different concentrations (0.1 N, 1 N, 4 N and 8 N) of sodium hydroxide solutions under different interaction periods of 7, 28 and 100 days. All artificially contaminated samples were analyzed using X-ray diffraction technique and supported by scanning electron microscopy for mineralogical and morphological changes. New mineral formations of the zeolite group were explicitly identified in long term interaction periods under highly concentrated NaOH solutions.

ii) A study on the fibre distribution characteristics of hybrid fibre reinforced high strength concrete with steel and glass fibres

High strength concrete (HSC) blended with fibres will enhance the ductility of the structure, thereby making it a feasible solution in large infrastructure projects. The number of fibres bridging the cracks, and their orientation in the fracture plane will affect the mechanical behaviour and therefore assessment of fibre distribution characteristics is crucial in the calculation of mechanical properties of Fibre Reinforced High Strength Concrete (FR-HSC). In this study an experimental investigation using image analysis was carried out to ascertain the Fibre distribution characteristics (Fibre dispersion coefficient and Fibre orientation factor) of the M70 grade Mono Glass Fibre Reinforced High Strength Concrete (MGFR-HSC), Mono Steel Fibre Reinforced High Strength Concrete (MSFR-HSC), Graded

Fibre Reinforced High Strength Concrete (GrFR-HSC), Hybrid Fibre Reinforced High Strength Concrete (HyFR-HSC) and Hybrid Graded Fibre Reinforced High Strength Concrete (HyGrFR-HSC). The effects of fibre distribution characteristics are quantified based on the fibre type, fibre volume, fibre length, and grading of the fibres. From the results it can be observed that graded fibres (steel/glass) specimens have exhibited higher distribution characteristics than specimens with mono fibres. Among HyGrFR-HSC and HyFR-HSC mixes, better fibre distribution characteristics was noticed in HyGrFR-HSC specimens, and this may be attributed towards better fibre dispersion without clumping in HyGrFR-HSC mixes. From this investigation, it can be concluded that the mixing of glass and steel fibres of different lengths into the concrete has shown a considerable improvement in the fibre distribution characteristics.

iii) Assessment of fibre distribution characteristics in the hybrid fibre reinforced concrete – An experimental study

Assessment of fibre distribution characteristics is critical in the determination of the mechanical properties of the Fibre Reinforced Concrete (FRC). In this study an experimental investigation was carried out to ascertain the Fibre distribution characteristics (Fibre dispersion coefficient and Fibre orientation factor) of the M30 grade Mono Glass FRC (MGFRC), Mono Steel FRC (MSFRC), Graded FRC (GrFRC), Hybrid FRC (HyFRC) and Hybrid Graded FRC (HyGrFRC). Two lengths of glass fibres and two lengths of steel fibres were blended into the concrete to obtain MGFRC, MSFRC, GrFRC, HyFRC, and HyGrFRC mixes. An image analysis technique using an optical microscope was used to determine the dispersion coefficient and orientation factor of all the mixes, as mentioned earlier. Effect of fibre length, fibre type and fibre grading on the fibre distribution characteristics of the FRC mixes were discussed. The fibre distribution characteristics were improved by the addition of glass and steel fibres, where glass fibres enhance the dispersion coefficient, and steel fibres enhance the orientation factor. Graded FRC specimens exhibited better fibre distribution than Mono FRC specimens. HyGrFRC specimens showed better fibre distribution characteristics when compared to HyFRC specimens, and this may be due to the more uniform distribution of fibres without clumping in HyGrFRC mixes due to the grading of fibres. From this study, it

can be inferred that the blending of graded glass and graded steel fibres in a hybrid form into the concrete have shown a remarkable enhancement in the fibre distribution characteristics.

iv) Analytical Study on Seismic Performance of Bed Joint Reinforced Solid Brick Masonry Walls

It is notable that brick work structures endure a lot of harm during seismic tremors, prompting huge loss of lives. Practically 75% of the disaster, credited to seismic tremor in a century ago, is because of breakdown of workmanship structures. A greater part of the apartments in India are Unreinforced Masonry (URM) structures that are powerless and helpless much under moderate quakes and due to high wind forces out-of-plane action is acting on the wall which makes a severe damage at high wind loads and it is well known that Reinforced masonry construction has got a significant number of advantages than the masonry without reinforcement, whose application is very less in Indian construction practices and still there are no specified codes prescribed and in most constructions there been used shear walls instead of reinforced masonry walls even at the moderate earthquakes. On the other hand, a great need to focus on understanding masonry buildings that are subjected to both axial loaded and seismic loads. The main objective of this paper is to study the methods available in the literature to obtain the seismic vulnerability of un-reinforced masonry walls using linear static analysis. To achieve this, analysis (Staad.Pro software) has been carried out as a part of this research. Two walls with same dimensions with an unreinforced and bed type reinforced masonry were analysed under uniaxial loading. A constant axial compressive load was maintained for each specimen during the analysis. Idealized Load vs Deflection plots are used to describe the wall deflections and maximum stresses evolved by using STAAD.Pro. The final outcome of this performance analysis declares the efficiency of Reinforced masonry walls over the masonry walls without reinforcement under both axial and seismic loads (Load vs Maximum shear stress).

v) Experimental investigation on M50 grade concrete beams with influence of aggregate interlocking and dowel action under flexural loading

The shear strength of the concrete beam without shear reinforcement is usually determined by shear strength of concrete compression zone, shear force due to dowel action and shear force due to aggregate interlock. The existing theories, predict shear strength of concrete beams based on geometric theories related to beam action and arch action, neglecting the influence of aggregate interlock and dowel action, as not much research information is available. The current research mainly focuses on an extensive experimental investigation on eight reinforced concrete beams with M50 grade concrete were cast and tested under flexural loading. Out of eight test specimens, four beams were provided with predetermined shear cracks having width of 5 mm, 170 mm height and inclination of 45° on either side of test specimen, whereas remaining four test specimens were not provided with predetermined shear cracks as parametric study. In eight test specimens, two beams were cast without provision of shear and flexural reinforcement and the remaining six beams were cast with increase in percentage of flexural reinforcement at 30%, 60% and 90%. Clear span of the beam was 2200 mm and cross section of the beam was 150 mm × 300 mm. The behavior of aggregate interlocking has been investigated in terms of applied load vs displacement response, stress-strain behavior, normalization curve, stiffness degradation and energy dissipation. From the test results on M50 grade reinforced concrete beam, ultimate load carrying capacity is increased with increase in percentage of flexural reinforcement for beams with predetermined shear cracks than without predetermined shear cracks. The beams with predetermined shear cracks and with additional increase in flexural reinforcement showed significant strength and stiffness.

vi) Performance analysis on synthesized reinforced carbon steel for structural applications

In the current scenario, excellent material properties of steel play a considerable role in civil engineering applications. The modified compositions and processing of materials

are used to achieve excellent material properties. This research work can satisfy the demand for modified carbon steel which is used in structural applications. The continuous casting method is used to synthesize carbon steel. Molybdenum carbide (Mo2C) and tantalum carbide (TaC) are used for reinforcement in the manufacturing of developed carbon steel. The responses have been noted when carbon contents are varied from 0.25 to 1.25 wt%. The various experiments such as continuous casting process, evaluation of material properties, wear test, and deflection test is conducted on reinforced carbon steel.

vii) Effect of biocementation on concrete using different calcium sources

Nowadays, in the various engineering applications, a new technology known as microbially induced calcium carbonate precipitation (MICCP) or biocementation is used widely. A large number of soil microorganisms exhibit urease producing ability. Urease (enzyme) catalyses hydrolysis of urea to produce ammonia (NH_3) and carbon dioxide (CO_2). This reaction can be used to generate calcium carbonate ($CaCO_3$) in the existence of calcium ions. The $CaCO_3$ gets precipitated and can be used to enhance the mechanical strength of construction materials. In the present research study, influence of biocementation on concrete was studied using bacterial solution. An attempt has been made to investigate the influence of different types of calcium sources like calcium chloride ($CaCl_2$) and calcium sulphate ($CaSO_4$) on biocementation. The bacterial concrete specimens were subjected to biocementation using these two calcium sources and it was found that among the calcium sources, calcium sulphate showed more promising results exhibiting considerable enhancement in compressive strength and decrement in water absorption capacity.

viii) Mechanical Properties of Partial Replacement of Cement with sugarcane baggase ash

Current study focuses on mechanical properties of Sugarcane Baggase Ash (ScBA) as a cementitious material and as pore filling material in concrete. With depleting natural resources these industrial waste materials not only helps as replacement material but

also provides in numerous alternate benefits such as protecting environment, land fill compounds, saving energy etc. Difficulty of disposing of ScBA is already an environmental hazard. ScBA imparts high strength in early replacements and also reduces concrete permeability, also presence of silica in chemical composition imparts high chloride resistance and corrosion resistance. Mechanical properties were studied for 5%, 10%, 15% and 20% replacement with cement, compressive strength, split tensile and workability were studied and optimum was found to be at 10% replacement. Also durability studies were performed by conducting Rapid Chloride Penetration Test (RCPT) and durability is found to be higher than conventional concrete.

ix) Case studies on condition assessment and repairs for fire damaged reinforced cement concrete structures

In India, the shift in the mode of construction of structures from load bearing walled to framed, started in the early eighties. Concrete is highly durable and has very good compressive strength, but is expensive compared to the materials used for load bearing walled structures. Inspite of the cost, since the durability is more, most of the structures being constructed are RCC structures. However, concrete structures are damaged due to the action of fire. Though concrete has good resistance to fire, it is not completely fireproof. This study presents two case studies on structures damaged by fire. The condition assessment, Non Destructive Testing for quality evaluation of the concrete and the suggested repair techniques are discussed.

x) Effect of epoxy resins on CBR improvement of soft clayey sub grade mixed with coconut coir fibers

Road infrastructure is a key factor for the development of an economy. For construction of road pavements, good sub grade soil is a major feature which influences the design, construction and durability of the pavement. Pavements built on soft subgrade soils experience faster degradation due to the low strength and high compressibility of soft soil.

Replacement of soft soil with good soil is not sustainable, since it is expensive and also impacts the environment. Stabilization of soft soil is a sustainable alternative which can be used to improve the properties of soft soil in-situ. The use of various additives can improve the properties of soft soils. In this study, the effect of using coconut coir in combination with polymeric resin on the improvement of properties of soft soil is studied. Coconut coir is a waste material which can be used as bio-fibers, but since they are decomposable, are used in combination with polymeric resin. The effect of random percentages of coconut coir along with polymeric resin on the compaction and penetration behaviour of soil is presented.

3. PATENTS BY FACULTY

i) Utilization of snail shells for enhancement of mechanical properties of cement through reduction of impacts on environment

Snail shells are the discarded bio-shell of waste from the restaurants and eateries creates a serious environmental problems with the economic loss. The utilization of these wastes will reduce the environmental threats. This research mainly focuses on the usage of SSP (snail shell powder) in the replacement of cements in constructions to avoid the excess usage of Cement which results the reducing of pollution threat from Bio-Waste, and Cement. The research majorly focuses on the micro-level analysis of SSP used in the deteriorated structures. The tests on the SSP-Cement mortar, viz. compressive strength Test, XRD Analysis, SEM Analysis, and EDS analysis have been performed to know the characteristics. The utmost strength values are obtained for SSP-Cement Mortar at 30% replacement. The more C-S-H Gel, Ettringite gel and AFm formations are observed at 30% replacement.

Summary of the invention:

The Investigation Objective:

• Utilization of Snail Shells for Enhancement of Mechanical Properties of Cement through Reduction of Impacts on Environment.

Materials used and Methods:

The unused materials were used in replacement of cement to reduce the pollution in the environment. Snail shells are one of the waste materials from the coastal areas that consume huge sea foods. The snail shells are prepared by the following procedure steps. First, Snail shells were collected with a size of 4cm to 5cm which is represented in figure 1.The collected shells are free from organic and inorganic matter like sand and dirt and dried under sun-light but not in oven. Because, the bond is the shell molecule will break due to oven

heating. This results improper binding of mortar. These were broke into smaller pieces and grinded to fine powder. Finally, 90μm sieve mesh was used to get the fine powder from the shell and stored in an air- tight container to avid the reactions with air, which are confirmed with ASTM C618.The moisture in shell powder is must be less than 0.5%.Ordinary Portland cement of 53 Grade which is confirmed to ASTM C150, C150M-19a, 2019 has been used as a binding agent together with the other constituents. The fine aggregates are considered and confirmed with BIS, IS 383-2016.

The major materials were used in the mortar,

- Cement
- Snail Shell Powder (90μ)
- Fine Aggregate (Sand)

Mortar is the wide range material which is used for the construction works in the world. Mortar is a composite material primarily consists of cement, sand and water. Cement is the major constituent which acts as a binding material which helps to improve the strength. The environment is getting destroyed due to excessive release of Carbon Di-oxide during the production of Cement.

Claims:

1. It 30% addition of snail shell powder attained maximum strength and the formations of C-S-H, AFm gel and Ettingite leads to the impenetrable microstructures.
2. The pores of 30% replaced snail mortar are closely packed in the SEM images. It was observed that from SEM and EDS images, the mechanical properties were improved with the replacement of snail shell powder.
3. There may further get a chances to get crystalline state was found from the micro structural analysis. This is due to presence of elements, namely Ca, Si, Al and O.
4. The replacement of cement is to decrease the excess release of CO2 to the atmosphere and to overcome the deteriorations in structures