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

CIVIL ENGINEERING

TECHNICAL MAGAZINE

January-June 2021
VOLUME - 3
ISSUE NO. -2

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.....
2. Conferences attended by faculty.....
3. Patents by faculty ……..

1. PAPER PUBLICATIONS OF THE FACULTY

i) Modified strut & tie method and truss reinforcement for shear strengthening of reinforced concrete deep beams

The aim of this study was to evaluate and test the limitations of the Indian Standard code 456-2000 related to deep beams, given that the code does not have any provisions regarding the use of the strut and tie method (STM)of design. This study validates the use of truss reinforcement and STM-shaped reinforcements as alternatives to STM design. We conclude that horizontal web reinforcement has a greater impact than vertical shear reinforcement. Deep beams with truss reinforcement and STM-based reinforcement were shown to have the highest shear strength capacity of all the deep beams. In the present study, 21 deep beams were cast and used to analyse their shear and flexural behavior. The specimens were divided into four groups based on length, width and depth, percentage of tension reinforcement, and percentage of horizontal and vertical shear reinforcement. The results revealed that truss-type reinforcement configuration is stronger than vertical shear reinforcement, as the former can resist 20% more load than the latter.

ii) Strength and durability characteristics of red soil stabilized with foundry sand and cement

Utilisation of locally available marginal soil as a construction material is one wise choice when improve its characteristics. Foundry sand (FS) is an industrial by-product obtained from foundry industries. In the present project, an attempt has been made to enhance geotechnical characteristics of locally available marginal red soil (RS) by addition of FS in 10%, 30% and 50% to weight of dry soil. Further, the present project intends to blend a strong stabiliser like cement (C) to enhance the strength and durability of mix made with red earth and 30% FS In this regard, 2.5%, 5% and 7.5% of cement is added to above mix. Addition of 5% C mixed with 30% FS has shown unconfined compressive strength (UCS) of 1548.22 kPa. This strength has been achieved even after 12 cycles of alternate wetting–drying of specimens

prepared by blending RS + 30%FS + 5%C mix. The addition of 5% C passing the required durability criteria. Moreover, UCS of 3442.02 kPa has been achieved even after 12 cycles of alternate wetting–drying of specimens prepared by blending RS + 30% + 7.5%C. FS is a sustainable material, and it can be used as an alternative to natural river sand for enhancing geotechnical characteristics of RS.

iii) Solidification/stabilization of copper-contaminated soil using Phosphogypsum

Heavy metal contamination has become a major environmental concern worldwide. On the other hand, more than 300 million tons of annual worldwide production of phosphogypsum is leading to disposal and environmental problems. In view of this, an effort has been made in this investigation to evaluate the effectiveness of phosphogypsum-based stabilization/solidification technique to remediate copper-contaminated soil. Two concentrations of copper (630 mg/kg and 20,000 mg/kg) were selected on the basis of literature and were used to synthetically prepare the contaminated soils. A systematic testing program consisted of consistency limits, compaction, unconfined compressive strength, cation exchange capacity, X-ray diffraction, and scanning electron microscopy with EDAX was conducted on phosphogypsum-treated uncontaminated and contaminated soils. The UCS test results showed that 3% phosphogypsum was optimal for uncontaminated soil, which was used to treat the contaminated soils. An increase in strength was observed in uncontaminated soil with lower phosphogypsum content at all curing periods (3, 7, 14 and 28 days). Formation of copper sulfate-based minerals with good retention and diminutive leaching characteristics of copper in soil indicates the effectiveness of PG. Overall, phosphogypsum can be employed for effective treatment of copper-contaminated soils.

iv) Background of double tee construction and need for standardised precast double tee for Indian Building Industry

The small scale residential and commercial office spaces in India are mostly engineered and built using reinforced concrete cast-in-place design and construction methods. Even though precast concrete engineering and design methods are well developed and practiced in advanced countries, the same has not happened in India. Though some major

projects in metropolitan cities have been completed in precast engineering and construction, precast concrete engineering is still very premature for small scale residential and commercial infrastructure. Although factors such as centuries-old practice, availability of inexpensive labor have been primary causes for cast-in-place concrete construction, lack of technology and research outcome reach, unavailability of standard products and methods, inadequate shipping and handling capabilities that require reliable transportation infrastructure also weigh in towards cast-in-place construction as opposed to precast construction.

This research started with the primary objective of identifying and developing standard precast double tee concrete beam-slab members for Indian market. Precast double tee concrete members (often called as DT) are very standard flooring and roofing options in advanced countries. These members can offer very viable concrete flooring and roofing solution to most of the residential and small office spaces in India. However, the member designs for Indian market will be significantly different from standard designs seen elsewhere in other countries. Manufacturing capabilities, shipping capacities, crane handling limitations, truck sizes and highway transportation constraints being so different from advanced countries, demand for standard geometry and design that fits local needs.

In the first part of this research, a thorough background of PCI standard DT member showing its geometry and standard design is given. An introduction to PCI load tables is done showing examples on its application. After that a market survey has been conducted to understand the design and construction practices of precast double tee members supplied by some of the Indian precasters. An effort has been made to capture the preferences such as span of the members, fully precast versus partial precast with field topping, thickness of topping slab, and prestressing strand size. Also, the survey questions tried to identify shipping and handling limitations due to transportation restrictions. Finally, the results are analyzed and trends are presented. Effort is made to learn the precast practices in Indian market. It is found that there is no standardized double tee member design available for Indian precast market.

It is concluded that the idea of developing standard DT member for Indian precast segment will be a very useful contribution and encourages the authors to continue with developing standard design for typical precast prestressed DT members for small scale residential and commercial structures in India

v) Mechanical behaviour of triple-blended hybrid fiber- reinforced concrete: an experimental and numerical study

Crack growth in concrete gradually increases with an increase in stress levels, and it is a multi-scale process. Concrete reinforced with mono-fibers is effective in improving mechanical properties up to a certain extent. Hybridization of different types of fiber is an alternative solution for early age shrinkage cracks and concrete brittleness. The present investigation aimed to study the mechanical behavior of concrete (50 MPa) reinforced with hybrid graded fibers under uniaxial stress and flexure. Three types of fibers polypropylene, polyester, and hooked-end steel fibers were used for the hybridization. In this study, fibers of different geometry, young's moduli, and tensile strength are selected to investigate the synergy obtained by blending hybrid graded fibers into the concrete. From the experimental results, it was observed that the hybridization of graded fibers into the concrete had achieved superior performance both in strength and stress–strain behavior. An additional nonlinear numerical model was also developed for hybrid fiber-reinforced concrete (HFRC) specimens using finite element-based software (ATENA-GiD) to compare the experimental results. From the experimental and numerical study results, it can be concluded that the addition of hybrid fibers into the concrete improved both the pre-peak and post-peak behavior of the concrete, thereby exhibiting positive synergy in hybridizing metallic and non-metallic fibers into the concrete. Finally, it is observed that there exists a good agreement of results between both the experimental and the numerical study.

vi) TIME-HISTORY ANALYSIS OF SOIL SLOPE SUBJECTED TO SEISMIC LOADINGS

In the present paper, the seismic response of cohesive-frictional soil slope has been investigated in the time-domain by using the 1995 Kobe earthquake records. A 2-dimensional dynamic finite element model has been developed in the plain-strain condition by considering the elastic perfectly plastic Mohr-Coulomb soil model criterion. The analysis simulates maximum horizontal and vertical seismic accelerations simultaneously at the base of the slope. The seismic response of the slope under combined seismic accelerations has been reported in terms of the displacement induced during the earthquake shaking period. The results show that the induced displacement of slope under combined seismic loadings is greater compared to the case of horizontal loading only. Further, the slope is expected to fail at the toe level first rather than at the crest level.

vii) Simplified computer-Aided Hydraulic design of clariflocculator of water treatment plant

This work presents a very useful software tool to design Clariflocculator, most important secondary unit in both water and wastewater treatment plant WTP. The detailed design steps and calculation for its each component are also presented. Its hydraulic design is complex, tedious and quantitative. An effort is made to simplify the entire manual operations with commonly available MS office tool. This method is being used in WTP in Krishna river bank, Vijayawada, India. This spreadsheet is frugal by design, helps in error- free calculations and can be used any quantity design. The entire manual operations are simplified and made user-friendly for designers.

viii) Evaluation of Seismic Vulnerability and Retrofitting of Existing Steel Buildings

The present study focusses on retrofitting of the seismically deficient gravity designed existing RC buildings. Four RC and three Steel buildings which is existing in India are taken for the analysis. All the structures are subjected to Non-linear Static Pushover and

Dynamic Time History Analysis using SAP 2000 to check the capacity of structures under seismic loads. The plastic hinges are assigned as per the guidelines of FEMA 356 in Pushover analysis. Elcentro Ground motion is used for dynamic analysis. The comparison is made between Pushover and Time History Analysis to check how closely the Pushover analysis estimates the dynamic response of the structure. The analysis showed damages in all the buildings with formation of hinges above Collapse Prevention (CP) level. Also, the interstorey drifts of all the buildings exceeded the drift limit as per IS1893. Hence, each building is retrofitted with different suitable retrofitting techniques. Further, the retrofitted buildings are subjected to the Non-linear Static Pushover and Dynamic Time History Analysis and compared with the unretrofitted buildings to check the resilience of the structure under seismic loads.

ix) Evaluation of Seismic Vulnerability and Retrofitting of Existing Steel Buildings

The present study focusses on retrofitting of the seismically deficient gravity designed existing Steel buildings. Three Steel buildings which is existing in India are taken for the analysis. All the structures are subjected to Non-linear Static Pushover and Dynamic Time History Analysis using SAP 2000 to check the capacity of structures under seismic loads. The plastic hinges are assigned as per the guidelines of FEMA 356 in Pushover analysis. Elcentro Ground motion is used for dynamic analysis. The comparison is made between Pushover and Time History Analysis to check how closely the Pushover analysis estimates the dynamic response of the structure. The analysis showed damages in all the buildings with formation of hinges above Collapse Prevention (CP) level. Also, the interstorey drifts of all the buildings exceeded the drift limit as per IS1893. Hence, each building is retrofitted with different suitable retrofitting techniques. Further, the retrofitted buildings are subjected to the Non-linear Static Pushover and Dynamic Time History Analysis and compared with the unretrofitted buildings to check the resilience of the structure under seismic loads

2. CONFERENCES ATTENDED BY FACULTY

i) 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.

ii) Strengthening Of Flexible Pavement By Adding Recron Fibre

Now-a-days, there is dire necessity for roads which aremore stable and stronger. Due to weathering conditions and heavy traffic, the pavement surfaces are getting deteriorated by rutting, pot holes etc. With the addition of this Recronfiber, there is an improvement in the properties of bitumen like increase in stability value and decrease in the flow value, % of air voids etc. Recron fiber is an artificial material obtained from the polyesterand which is also used as a secondary reinforcement for attainingtensile strength. It helps to resistthe cracks obtained by the improper laying of pavement surface and heavy loaded vehicles. In the present study, various proportions of Recron fiber such as 3%, 6%, 9% and 12%are added to Bitumen to prevent the deterioration of pavement surface andvarious tests areperformed on aggregate and bitumen. From the results, it is found that, the flow value and % of air voids decrease and stability value increases. Hence, it is proved that, it protects the pavement surface from the effect of fatigue, cracking and deformation. The obtained results show that 9% is the optimum percentage of Recron fiber to be added to

the bitumen. For nominal bitumen mix, the maximum stability value is 12.07 kN and for modified bitumen (Recron added) mix the maximum stability value is 16.79 kN.

iii) COMPARATIVE STUDY ON ASPHALT MIXTURE WITH NANO MATERIALS AND POLYMER

Pavement materials are crucial factors affecting pavement durability. Now-a-days, there is dire necessity for roads which are more stable and stronger. Due to weathering conditions and heavy traffic, the pavement surfaces are getting deteriorated by rutting, pot holes etc. Among them asphalt is the most sustainable pavement material for construction pavements and can be used for many applications including highways, airport runways, parking lots and drive ways. In order to provide effective durability than that of asphalt, in its original form it has been modified using Nano-materials known as modified asphalt. In this paper we are gone deal with the advances in Nano-materials in hot mix asphalt and also addition of recronfibre and the comparison was made. With the addition of this Recronfibre, there is an improvement in the properties of bitumen like increase in stability value and decrease in the flow value, % of air voids etc. Recronfibre is an artificial material obtained from the polyester and which is also used as a secondary reinforcement for attaining tensile strength. It helps to resist the cracks obtained by the improper laying of pavement surface and heavy loaded vehicles. But whereas, the clay Nano-particles are the primary materials applying in asphalt construction adding Nano-particles like Nano clay, Nano silica and nanotubes in asphalts normally increase the viscosity of asphalt binders and improves the rutting and fatigue resistance of asphalt mixtures. From this the performance of asphalt when treated with Nano-particles and its sustainability compared to that of other pavement materials is examined and studied.

iv) 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.

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

Current study focuses on mechanical properties of Sugarcane Baggase Ash (ScBA) as a cementetious 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.

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) An experimental study on heave and uplift behaviour of granular pile anchor foundation system

Several innovative ground improvement techniques were presented by various researchers throughout the globe for modification of the existing poor soils. Granular Pile-Anchors (GPA) were found to be more promising in resisting the heave behavior of the expansive soils in recent times. The engineering behavior of the soil can be improved by this technique apart from resting the swell. This technique is a modification on the existing granular pile technique with an anchor plate beneath the granular pile that is connected to the foundation by means of an anchor rod or cable. Numerous scale model tests were discussed in this paper to understand the heave and pull-out behavior of Granular Pile-Anchor Foundation (GPAF) system. The effect of spacing was studied by using two granular piles at varied spacing. It was observed that the swell potential was reduced to about 68.09% for 50mm dia GPA, compared to the virgin expansive soil. The swell potential was found to be further reduced at twice the diameter of the pile spacing. The pull-out capacity was found to be increased by about 393% by providing a 50mm diameter GPA in the expansive soil.

3. PATENTS BY FACULTY

Reinforcement of marine sandy soil using treated giant reed fiber and process thereof

Exemplary embodiments of the present disclosure are directed towards a process for reinforcement of marine sandy soil using treated giant reed fibers comprising: collecting giant reed and preparation of giant reed fibers; preparation of treated giant reed fiber by employing three different types of treatments viz., alkaline treatment, bleaching treatment and silicon oil treatment to the produced fiber to ensure the resistance and make it more sustainable; preparing marine sandy soil specimens by incorporation of treated and untreated giant reed fibers to provide reinforced marine sandy soil incorporated with treated giant reed fibers and reinforced marine sandy soil incorporated with untreated giant reed fibers; and evaluating compaction and California bearing ratio (CBR) parameters of the prepared marine sandy soil specimens to determine the penetration resistance whereby the reinforced marine sandy soil incorporated with treated giant reed fibers revealed an enhancement of penetration resistance.

Claims:

1. A process for reinforcement of marine sandy soil using treated giant reed fibers comprising:

collecting giant reed and preparation of giant reed fibers;

characterized by preparation of treated giant reed fiber by employing three different types of treatments viz., alkaline treatment, bleaching treatment and silicon oil treatment to the produced fiber to ensure the resistance and make it more sustainable;

preparing marine sandy soil specimens by incorporation of treated and untreated giant reed fibers to provide reinforced marine sandy soil incorporated with treated giant reed fibers and reinforced marine sandy soil incorporated with untreated giant reed fibers; and evaluating

compaction and California bearing ratio (CBR) parameters of the prepared marine sandy soil specimens to determine the penetration resistance whereby the reinforced marine sandy soil incorporated with treated giant reed fibers revealed an enhancement of penetration resistance.

2. The process for reinforcement of marine sandy soil using treated giant reed fibers as claimed in claim 1, wherein the preparation of giant reed fibers comprises:

cutting the giant reed stems into 30cm length and soaking the cut giant reed stems in sea water for 48 hours at room temperature;

boiling the soaked and cut giant reed stems at 100 oC to provide boiled and soaked giant reed stems, whereby the boiled and soaked giant reed stems are converted into giant reed fibers by hitting the boiled and soaked giant reed stems with a hammer; and clustering and twisting two sets of 10 such giant reed fiber strands@ 30 turns/m around each other like a human hair braids to provide giant reed fibers.

3. The process for reinforcement of marine sandy soil using treated giant reed fibers as claimed in claim 1, wherein the alkaline treatment of the giant reed fibers comprises addition of 3% NaOH into the giant reed fibers and soaking for 48 hours at room temperature and 1.5 MPa pressure.

4. The process for reinforcement of marine sandy soil using treated giant reed fibers as claimed in claim 1, wherein the bleaching treatment of the giant reed fibers comprises, soaking the giant reed fibers in 10 liter solution of 3% Zonrox - NaClO for 120 minutes at 100oC.

5. The process for reinforcement of marine sandy soil using treated giant reed fibers as claimed in claim 1, wherein the silicon oil treatment of the giant reed fibers comprises soaking the giant reed fibers in 10g of liter solution of silicon oil and left for 24 hours at room temperature.