

# 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 with an annual intake of 18. 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 Thirtyfour, with nineteen doctorates. 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.

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#### **1. PAPER PUBLICATIONS OF THE FACULTY**

#### Effect of Perforation Geometry, Number and Pattern on the Seismic Responses of Steel Plate Shear Walls

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The annualized economic burden to United States in 2016 from wildfire is estimated to be between \$71.1 billion and \$347.8 billion. The cost of wildfire to Indian economy is at least USD148 million (₹1,100 Crores). One of the plants with high associated risk to wildfire is Calotropis Procera (CP). Thus, there is a great opportunity to explore materials which upkeep the good health of forest eco system, stabilize soil slopes in forest areas and serve as an alternative material for construction. Current research focuses towards application of various industrial wastes. There is a lot of scope for exploring the potential of re-using the residue collected from wildfires in the areas surrounding forest. There is an adequate scope to raise an alternative material to cement to reduce carbon emissions and achieve sustainability of resources used in the manufacture of cement. India has 10.6% of the hillslopes covered with laterite soils which are prone to frequent slope failures. In the present study, an innovative combination of materials "1) Ash of Calotropis Procera plant (Highly inflammable) - ACP (Derived from forest fires) and 2) Metakaolin – MET (An alternative cementitious material) were utilised to stabilize lateritic soil-LS. Proctor heavy compaction test was conducted to study the minimum water content required to achieve the highest value of unit weight of the resulting combinations. Various proportions of ACP used were "2%, 4%, 6%, 8% & 10%". Various proportions of MET used were "0.2%, 0.4%, 0.6%, 0.8% & 1.0%". Out of five combinations of Laterite soil(LS), Ash produced by burning Calotropis Procera (ACP), and Metakaolin (MET), the combination-3 i.e., LS+ 6% ACP + 0.6% MET gave rise to the highest value of unit weight in heavy compaction. The optimum moisture content achieved is 12% and the highest value of unit weight achieved is 20.8 kN/m3.

#### Outrigger and Belt Truss Optimal Location Study for High Rise Steel Building

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Because of fast population increase and limited land availability, the construction industry has expanded its wings in the vertical dimension. As high-rise buildings reach for the sky, structural challenges control the selection and design of structural systems. Moment resisting frames, load carrying structural walls, dual systems, tube systems, and moment resisting frames with outriggers are all popular lateral load resisting systems. The goal of this article is to look into the performance of outriggers, placement optimization, and their efficiency when utilized in multiple numbers at different heights (2/3rd, 1/2th, and 1/3rd times the height of the building). Models of 30-story structures with outrigger (O.R) and belt truss (BT) systems are examined for earthquake and wind loads, and lateral drift responses are compared to determine the best position for O.R and BT systems. The O.Rs must be positioned at the top floor and at a height that is 0.5 times the height of the building to achieve the greatest decrease in lateral displacements, which is 50.46%. Storey drift reduction for the same example shows a maximum reduction of 40.21%. When compared to Core only condition, by using Fe 345 grade steel for all columns and Fe 250 Grade steel for other members.

#### Comparative study of with and without stiffeners in perforated steel plate shear walls for high rise steel buildings

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In seismically active places, Steel Plate Shear Walls (SPSW) are an efficient lateral load resisting technology that may be installed for both new construction and retrofitting. The base moment in the core has an impact on the choice and design of the structural system as a high-rise building height increases. owing to its high initial stiffness, substantial ductility, good post-buckling strength, and stability of hysteresis. In order to decrease displacement and boost lateral stiffness in earthquake resistant structure design, the SPSW system is increasingly viewed as a competitive alternative to traditional lateral load resisting systems. Response spectrum analysis is used to calculate the maximum story displacement, maximum story drift, maximum story shear,

maximum story overturning moment, and maximum story stiffness of high-rise steel buildings connected with perforated steel plate shear walls (PSPSWs) system and PSPWS with stiffeners. In this study, a 30 m x 30 m structure using PSPSWs system is explored for 15, 20, and 25 stories with and without stiffeners at particular positions along two rectangle openings. By the investigation and comparison of the two rectangular PSPSWs with and without stiffeners and the various heights are presented, along with responses such as lateral stiffness, lateral displacements, and story drift due to lateral loads caused by the reaction spectrum of earthquake and wind forces. It concludes that by comparing with and without stiffeners of PSPSWs, the "PSPSW with stiffeners system" shows better performance with increase lateral stiffness, base shear and overturning moments. The wind effect on PSPSWs with stiffeners systems shows better performance due to absorption of energy through openings when compared to subjected earthquake loads and good agreement with all stories by without much variation of drifts and maximum displacements.

#### AI Enabled Accident Black Spot Alerting Mobile System to Enhance Road Safety Using GMM-SVM

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Andhra Pradesh consistently ranked in the top 10 Indian states with the highest number of traffic accidents over the past ten years, according to statistics made public by the National Crime Record Bureau. Andhra Pradesh saw a 20 percent rise in road accidents in the year 2021, totaling 21,556 accidents, of which 8,186 resulted in fatalities. Future accidents can be decreased by comprehending the causes affecting road accidents and using the insights gained from them. When analyzing the causes of traffic accidents, driver's behavior is a crucial component to take into account. Inappropriate driving behaviors can lead to abnormal circumstances that may result in traffic accidents. The proposed methodology uses an integration of Gaussian Mixture Modelling and Machine Learning classification algorithms on the data of road crashes in the Vijayawada region to predict accidents in the future and notify drivers of impending danger. The Road Transportation Authority (RTA), Vijayawada, provided data on road accidents, including three accident classifications and variables influencing accidents. Firstly, the data has been preprocessed and then the proposed methodology is applied to classify the black spots. The developed model can potentially classify accidents based on severity into three classes: fatal, severely injured, and generally injured. Then the developed models are integrated with an Android mobile application through the Google Cloud platform. The mobile application keeps a database of all the crucial user information, including the user's age, gender, vehicle type, and age, and it uses GPS to monitor the user's location. The driver inputs his source and destination addresses to check for any susceptible blackspots before beginning the drive. He is also given the option of real-time safety support, which, when activated, warns the user when he is approaching a blackspot that would have serious repercussions.

## Application of the analytic hierarchy process for the selection of recycling rainwater/household grey water to improve SIDS sustainability targets

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Water and wastewater reuse and recycle are key prerequisite practices towards the achievement of sustainability commitments. However sustainable practices in small island developing states (SIDS) on the conservation and management of water resources have been shown to be woefully deficient in the absence of formal policies and systems to encourage the reuse and recycling of stormwater and greywater in households. The aim of this study is to investigate, and baseline, sustainable management practices in SIDS by examining the effects of urbanization, increased rainfall, inadequate infrastructure, and improper drainage on stormwater and greywater management. The analytical hierarchy process (AHP) and multi-criteria analysis (MCA) were employed to provide a systematic decision-making approach to analyze four critical criteria against five alternatives with the objective of evaluating the effectiveness of rainwater harvesting (RWH) and greywater reuse techniques within the context of Trinidad and Tobago. The findings revealed that the most critical criterion for reusing and recycling stormwater and greywater is awareness, while the top performing alternative was Rainwater Harvesting for Agriculture (RHA). The findings also showed a positive relationship between RHA prioritization with the priority score of awareness, lending credence to its feasibility and efficiency for sustainable water management practices in SIDS. The study discussed novel insights and contributed to the body of knowledge in promoting resilience and long-term sustainable development in the often ignored and underdeveloped regions of SIDS in three areas. Firstly, this study addresses the unique challenges faced by SIDS to ensure long-term water resource resilience by prioritizing investments in capacity building, policy support, infrastructure development, and fostering stakeholder collaboration. Secondly, the need to address challenges in legislative policy building and infrastructural development to ensure the successful implementation of these alternatives was justified. Finally, the study advocates continued research and innovation in this field by academia and professionals to inform new policies and improve contemporary practices to achieve both the sustainable development and management of water resources in SIDS.

#### Impact of Climate Change on Water Resource Engineering in Trinidad and Tobago

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3\*Department of Civil Engineering, Dr. S. & S. S. Ghandhy Government Engineering College, Surat, Gujarat, India;

4\*Department of Civil and Environmental Engineering, University of West Indies, Trinidad and Tobago The detection of rainfall trends is vital for water resource development in small island states such as Trinidad and Tobago. This study investigates whether climate change affects rainfall trends and conducts statistical analysis of annual, seasonal, and decadal cumulative rainfall data obtained from two meteorological stations in Trinidad and Tobago for the period 1990-2020. Using XLSTAT, the nonparametric Mann–Kendall's test was conducted at a 5% significance level to detect whether trends in the rainfall data existed, and the nonparametric Sen's slope estimator was used to detect the magnitude of the trends. The results showed no statistically significant trends in Trinidad and Tobago's annual, seasonal, or decadal rainfall over the 30 years considered. This result indicates that Trinidad and Tobago are safe from abrupt changes in rainfall trends due to climate change and highlights the significance of conducting localized climate studies rather than solely depending on the predictions of global climate models.

#### 2. CONFERENCES ATTENDED BY FACULTY

#### Effects of Aquaculture on Water Quality in Gudivada Region

Varsha Gollapalli<sup>1</sup>, Satish Sajja<sup>2\*</sup>, B.V.V.R.L. Alekhya<sup>1</sup>, B. Hemanth Kumar<sup>1</sup> and C. Guru Sai Haneesh

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In the Gudivada region, surface and ground water are important sources for drinking, agriculture, and aquaculture. The environment and human health gets depleted as the water and groundwater become contaminated as a result of man-made activities. The objective of this study is to provide a brief overview of the environmental impact of aquaculture as well as an assessment of ground water quality in the Gudivada Krishna District of Andhra Pradesh. Aquaculture activities have a substantial physical, chemical, and biological influence on water supplies. Physical pressure is exerted on the water; chemically, the water and land are polluted; and biologically, foreign species, infections, and diseases are introduced. For daily change activities, these aquaculture ponds require the mixing of bore-well or creek waters with fresh water; as a result of this practise, the upstream ponds discharging the polluted water into the channels, and the downstream ponds are utilising the same. This is attributed to increase of pollution in the aquatic environment. Over exploitation of water also leads to salt water intrusion, usage of ground water and conversion of land use to aquaculture. Pollution, damage of delicate coastal ecosystems, dangers to aquatic biodiversity, and significant socioeconomic costs are all factors to consider. Change in land distribution data over a period of 2005 to 2021 is collected and water quality parameters are collected and water quality index is assessed at three locations of gudivada region.

### Optimal site selection for establishing solar power plant based on solar radiation using GIS

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Although many nations employ solar energy as a backup energy source, not every site is equally conducive to the production of solar power. This is caused by the unequal dispersion of solar energy as well as a number of environmental conditions. The framework incorporates a number of Geographic Information Systems (GIS) features, including model builder and area classification. The framework used to derive the five sub-criteria weights determines the ideal locations for plant in the area based on the quantum of potential photovoltaic electricity production (PVOUT) that could possibly produce from Slope, exposure to sunlight, near to highways and closeness to a residential area. Finding the best locations for solar plant side identification in the "Anantapur" district using multicriteria decision analysis (MCDA).

#### Watershed Delineation and Morphometric Analysis Using GIS and Remote Sensing

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A watershed is a territory from which many rivers and streams drain into a common reservoir. The first step in reaping the benefits of watersheds is identifying them and determining how much water they supply. Important watershed parameters may be defined and calculated using a Geographic Information System (GIS). The city of Chittoor in the Indian state of Andhra Pradesh is being investigated here. The Google Earth engine is used to create a LULC map (land use land cover), and USGS Earth Explorer is used to gather DEM data to define watersheds to better understand the study area's landscape. Watershed boundaries and morphometric parameters are presented in the current study.

#### Site selection for solid waste management in Krishna district, Andhra Pradesh using GIS

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Solid waste management involves collecting and processing garbage. It also recycles products. Solid waste management helps determine the best ways to use industrialised garbage. Industrialization produces chemicals and other waste products that harm human health. Solid waste management reduces this impact. Waste management has several ways. This study examined Krishna district in Andhra Pradesh. This study collects soil and geological data. This study shows how GIS may be utilised for waste management planning. The result shows the solid waste management area. So, garbage management should be simplified.

Performance Assessment of Recycled Aggregate Concrete Blended with Supplementary Cementitious Materials and Steel Fibers: An Approach Towards Developing Green and Sustainable Concrete

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Though the term "sustainability" was heard frequently, few people understand its significance, which is to ensure human safety on the planet. Sustainability has many short- and long-term benefits and ignoring it will result in depletion of natural resources in the long run. In this context utilisation of by-products as well as waste materials into the concrete and thereby decreasing carbon dioxide emissions and virgin aggregate extraction will be a sustainable way of developing a green concrete. In this manuscript, an attempt has been made to develop green and sustainable concrete by including Recycled aggregate (RA), Fly Ash (FA) & Sugar Cane Bagasse Ash (SCBA) as supplementary cementitious materials (SCMs). Also, an attempt is made to access the effect of steel fibers (SF) on the concrete thus made. The variables of the study include RA content (0, 100%), FA content (0 to 40%) and SCBA content (0 to 15%) and SF dosage (0, 1%). The properties examined in the study include compressive strength, split tensile strength, flexural strength, water absorption (WA), and acid attack. The results of the experimental programme show that the use of SCMs and SF can significantly improve the mechanical strength and durability of Recycled Aggregate Concrete (RAC). The use of SCMs improved the durability of the mix by densification of the matrix whereas incorporating steel fibers improved the tensile characteristics of the mix significantly, which means that use of RA in conjunction with SCMs and SF improves the overall performance of the concrete and might be a green and sustainable alternative to plain concrete.

#### Performance of slag based recycled coarse aggregate concrete with steel fibers

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Designers may lessen the impact of concrete on the environment while yet ensuring enhanced performance and higher durability by using slag cement, which has proven long-term performance advantages. However, in actual practice, concrete constructions use slag to replace OPC up to 30 to 50 percent of the time, depending on the uses. By using M sand in place of river sand, this study shows differences in the strength and durability parameters of concrete manufactured using 100% with slag cement. Mechanical and durability study was made on replacement of natural coarse aggregates (NCA) with 30, 45 and 60% of recycled coarse aggregates (RCA); Based on the study optimum percentage of recycled aggregates for slag based concrete is 45%. Thus to study effect of fiber on concrete 45% of natural aggregates replaced by recycled aggregates with and without Nano silica. reduces the consumption of natural resources and adds some additional benefits from a structural and financial standpoint. Steel fibers are added at a rate of between 0.5, 1 and 1.5 percent by volume of cement to give it strength. In order to obtain the optimum percentage of steel fibres using slag cement, concrete grades M20, M25, M30 and M35 were used. Testing techniques such as the compression test, flexural test, spill tensile test, Rapid Chloride penetration test used to assess properties recycled aggregate concrete and also performed the life cycle assessment. From the experimental study 1% Steel fibers was optimum for both with and without Nano silica.

#### **Estimation of Water Quality Parameters Using Water Indices and GEE**

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One of the biggest issues in the modern world is water pollution. Since the nation is still expanding, several new industries were being built daily. One of the primary causes of water contamination is this. Domestic trash that is deposited into water bodies is another problem. As a result, the pure water that is available to us is becoming significantly more contaminated every day. It takes a lot of time and manpower to measure the levels of water contamination. A developing technique called remote sensing is being utilized to compute many aspects of environmental research. We can calculate some water quality measures including turbidity, total suspended solids (TSS), and chlorophyll-A using remote sensing photos based on their reflectance property. In our study, we used data from remote sensing to construct the Normalized Difference Turbidity Index (NDTI) and the Normalized Difference Chloroform Index (NDCI) to determine the levels of turbidity and chloroform in the water bodies. This uses little labor and produces results in a very short time.

#### An Experimental Investigation on Flexural Behaviour of Functionally Graded Concrete

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In recent days, everyone used superplasticizers to enhance the concrete's tensile strength and workability. In recent days, everyone used superplasticizers to boost the concrete strength and workability. By substituting superplasticizers, we have used a new material called steel fiber increasing the strength, workability, compressive strength and tensile strength of concrete. In this project, we have used a method called Biomimetics. Biomimicry encompasses imitating the form, characteristics, processes, principles, and methods of nature. This essay examines current biomimetic-inspired civil engineering systems and buildings. One of the key components of biomimetics is one of the interesting techniques that have been widely used in various aspects of life due its beautiful structure with strong layers. The material composition of a structural element can be strategically adjusted based on specific performance requirements in different regions. This approach has the potential to greatly decrease the amount of cement needed. The results shows that functionally graded performs well than conventional concrete.

#### Utilization of Treated Wastewater in Concrete

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Water produced by a community is referred to as domestic wastewater. Consequently, it is made up of waste products from human bodies and water used for cleansing. The smell of fresh wastewater is earthy but not unpleasant. It is a grayish, turbid liquid. It also comprises pollutants in real solution together with big floating and suspended particles, smaller suspended solids (such partly digested vegetable peel, paper, and feces), and extremely small materials in colloidal suspension. Because it includes numerous disease-causing (or "pathogenic") organisms, it is offensive in appearance and dangerous in composition. In a sewage treatment facility, the wastewater that is produced will be cleaned up and then dumped into rivers or fields, as appropriate. In this research, an effort has been made to determine the feasibility of reusing domestic wastewater after treatment of Vijayawada city in the casting of concrete. The performance of domestic wastewater performance has been carried out through various tests, such as compressive strength, split tensile strength, and rapid chloride permeability test (RCPT).

#### **Thermal Insulation of Roof using Composite Materials**

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Due to industrialization and urbanization the temperature is constantly rising day by day. Conventional roofs used by low-income community/society like metal, steel, aluminium, copper, etc will absorb heat and increases room temperature which creates discomfort for the people. Use of natural fibre composites as a roof material are said to have benefits for the environment. There is an expansion in the usage of natural composite materials as it helps to decrease the room temperature and provides the comfort for the users. In this research paper, an attempt will be made to develop composite materials for layering of roof using sugarcane bagasse and polymer. The composite formed by using both waste materials like sugarcane bagasse and polymer will be tested in terms of various parameters like thermal conductivity, tensile strength and impact test.

#### Experimental Investigation on Thermal Insulation of Sustainable 3D Printable Concrete by Using Corncob Powder

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The construction industry is witnessing the latest technology advancement in the form of 3D printing, which promises to revolutionize the sector by reducing costs, material wastage, and environmental impact. One significant approach to achieving these goals is through the incorporation of various supplementary cementitious materials. This research work aims to study the utilization of corn cob powder (organic waste from agricultural industries) as a thermal insulation material in conjunction with other cement supplementary materials (fly ash, and silica fume). The study focuses on evaluating the material's rheological properties, such as slump, initial and final setting times, and flowability. Furthermore, the investigation extends to analyzing the hardened properties of the concrete, including compressive strength, split tensile strength, and flexural strength under varying temperature conditions. Results shown that the compressive, split tensile and flexural strength was increased up 5 % to 7% with the inclusion of corn cob powder at 5% and it exhibits good resistance to high temperatures.

#### Flexural Behaviour of Skinned Beams with Different Shapes of Steel Mesh Confinements

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Jacketing is a popular technique in modern civil engineering for strengthening and modifying structures. It is used to increase bearing load capacity or to restore structural design integrity after the structural design has been altered or after a structural member has failed. This method is typically utilized for horizontal surfaces such as the bottom and sides of beams and vertical surfaces such as walls and columns. This study investigates the flexural performance of high-strength concrete beams reinforced with steel wire mesh in various forms, such as hexagonal steel wire mesh, square wire mesh, and diamond wire mesh, using the concept of dual-layer concrete. At First, three sets of 450 x 50 x 50 mm beams were cast, and three different mesh configurations were confined around the beam and filled with concrete to form 500 x100 x 100 mm beams. The flexural behaviour of these beams was carefully examined under load controlling machine (UTM). The study found that adding steel wire meshes to beams as confinement enhances their total flexural strength and the behaviour of the beams failure mechanism when subjected to two-point stress. The Flexural strength has been increased by an amount of 10%, 23% and 35% respectively for hexagonal, square and diamond meshes. However, the specimen restricted with

diamond mesh wrapped around the inner core performs more effectively than the specimen with Square and hexagonal wrapped around the core in terms of Stress-strain curves and Young's Modulus.

## Pedestrian behaviour analysis at intersection in Vijayawada for road user safety and infrastructure design

Thakkellapati Charitha Varsha, Satish Sajja, B Ramya Aruna Siri1, G Hari Prasad, and E Kashyap Tejo Sai

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Pedestrian behaviour analysis is crucial for improving safety, urban planning, public health, and transportation infrastructure planning to establish a pedestrian-friendly zone and enhance people's overall quality of life in urban contexts. Micro-level infrastructure improvements, such as better lighting, crosswalks, and sidewalks, are essential for communities to be sustainable and walkable. Safe and practical infrastructure encourages active mobility and reduces dependency on energy-intensive modes of transportation. Giving pedestrian safety as a priority in urban construction enhances the environmental significance of sustainable cities. Safe pedestrian environments encourage walking and other non-motorized modes of transportation, which lessens the pollution and emissions that come from driving. In the majority of developing countries, such as India, rapid urbanization, an increase in the number of vehicles, and a lack of adherence to traffic regulations by both automobiles and pedestrians contribute to a significant problem at junctions. The objective of this paper is to investigate how pedestrians behave at three junctions in Vijayawada say the Moghalrajpuram intersection, high school road junction, and kanuru junction (Andhra Pradesh, India). Approximately 69% of people in the study area prefer to cross in a perpendicular manner. At Kanuru, oblique crossing speeds range from 1.88 to 3.08 m/sec, whereas perpendicular crossing speeds range from 1.88 to 2.09 m/sec. Oblique crossing speeds at the High School Road intersection range from 3.35 to 3.49 m/sec, and perpendicular crossing speeds range from 2.00 to 2.45 m/sec. Oblique crossing speeds at Moghalrajpuram junction range from 1.05 to 1.61 m/sec, while perpendicular crossing speeds range from 1.76 to 2.50 m/sec for all the genders and age groups. At every intersection, pedestrian flow variables like crossing patterns, crossing speeds in relation to demographics like age and gender, total pedestrian counts, waiting times, and directions are analysed

#### **Experimental Investigation on Performance of Ferrock Concrete**

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Today, the construction of buildings and infrastructure has increased as a part of development, resulting in a significant demand for concrete and cement. The large-scale production of cement and extraction of river sand

can have negative impacts on environment and depletion of natural resources. Due to the production of 1 ton of cement produces 0.9 ton of CO2 emissions. To mitigate this pollution a green substance called as FERROCK (Iron dust 60%, Flyash20%, Metakaolin 10%, Lime powder 8%, Oxalic acid 2%) is used as a partial replacement of cement with selected ratio (10%, 20%, and 30%) by weight of cement. This study includes the complete replacement of river sand with M sand (85%) and glass powder (15%) to reduce the usage of natural sand (river sand) for the selected grades of concrete M40, M60 byperforming mechanical and durability test on the designed concrete grades with selected ferrock ratios, the mechanical and durability properties were enhanced with 20% ferrock replacement by weight of cement in concrete.

#### Study on effects of TiO2 Nano particles on properties of concrete

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Civil Engineering is one of the vast specializations that required an advanced research to utilize the current trend in Nano technology especially utilizing eco-friendly Nano materials for various constructions such as roads, building, soil stabilization and backfill material treatment. Nanomaterials enhance the strength, durability against aggressive chemical compounds and elements that extend the effective service life of the structure. Nanomaterials can also help to reduce the need for raw materials for upkeep and repair. In particular for heavyduty applications, Nano materials are crucial in the development of high-strength and low-energy buildings. The outcomes of laboratory and field experiments on the effects of Nano materials on the environment are also thoroughly analyzed. There are many different types of Nano particles accessible nowadays, but TiO2 was chosen for this investigation. There are several civil engineering applications for this, to investigate how mechanical properties (compressive strength and flexure strength) are affected by TiO2 Nano particles (NT). In this investigation, M30grade concrete with TiO2 at 0.2, 0.4, 0.6, and 0.8 percent by adding to the weight of cement was used.

#### Study on Mechanical Properties of Alkali-Activated Concrete Developed using Bio Cementation Process

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The second-most-used material worldwide is concrete. The production of cement is responsible for 8% of the world's carbon emissions. For every kilogram of cement produced, 0.9 kilograms of carbon dioxide are released. OPC use is growing, which has negative repercussions like global warming that have an impact on the environment. We require an ecobinder that can replace OPC in concrete either completely or partially in order

to considerably reduce CO2 emissions from the cement industry. An environmentally sustainable approach to reducing carbon emissions from the construction industry is alkali-activated materials. It involves the reaction of industrial wastes like fly ash and GGBS, which are rich in aluminosilicates, with alkali activators like NaOH and Na2SiO3, forming a binding material called alkali-activated concrete. There is a wealth of information on the effectiveness of alkali activated concrete. The behaviour of such alkali-activated concrete made by biocementation is the topic of the current investigation. The process involves the specific action of ureaseproducing bacteria, which results in calcium carbonate buildup and enhances the mechanical characteristics of GGBS and fly ashbased alkali-activated concretes using the activators NaOH and Na2SiO3 made with the bio-cementation technique.

#### Structural Behavior Comparison on Earthquake Resistance of High-Rise Mall Building (Framed Structure,Flat Slab and PT Flat slab)

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The rate of urban population growth and the amount of available space had a significant impact on the construction of high-rise mall buildings in developing countries like the USA, UK, Australia, and Hong Kong. These high-rise mall constructions may be constructed using a variety of structural techniques. Today, RC Frame structures are often employed in constructing. Usually, these structures are employed to counteract the sizeable moments brought on by applied stresses. On the other hand, flat slab structural systems, in which the slab is directly supported by columns, have lately been adopted in many buildings because they have the advantage of greater clear floor-to-floor heights to satisfy the economical, easier form-work, quicker construction duration, and architectural needs. On the other hand, with a post-tensioned slab, the PT flat slab Structural System uses high-strength tensioned steel strands to compress the slab, maintaining the bulk of the concrete in compression. When compared to RC framed structural system, this results in a very efficient construction that minimizes partial consumption and reduces the economic span range. Three cellar+Ground+9 higher floors structural models of a high rise mall building with RC framed structure, flat slab, and PT flat slab structural system arrangement are taken into consideration in the current study. The study is completed by taking into account seismic zone II and type I soil condition, and it takes into consideration the susceptibility of purely RC framed structures, solely flat slab, and completely PT flat slab systems. The structural behavior of an RC-framed structure, a flat slab, and a PT flat slab are being compared for earthquake loads. The response spectrum approach is used to do the analysis. With the use of analytical tools, parameters such as storey displacement, storey drift, hase shear and storey shear are calculated. The findings are then compared between three structural system.

#### 3. Patents granted



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बकाब, बाद्धिक संपदा दप्तर, भारत सरकार, (वाफ्निक) गैद्धिइसंपद्यनुंडायांलय, ભारतसरहार, का <b>पेटेंट</b> -कार्याल	तय, भारत सरकार The Patent Of	fice, Government Of India
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गौद्धिक सम्पत्ति कार्यालय, भारत सरकार, २२२ (पेटेंट निर <sup>ह</sup> ेगक्षफ्त <i>े</i> ष्ट४ ग्रांट इष्टक्रॉझ, बुद्दिगोनां नबां विसंधान	यमावली का नियम 74) (Rule 74 of The Pater	nts Rules) මුදාාම්ලකා, 8 Jf @ ෆාළාඹන් ඔස් හිදිසිං Intellectual Property Office, Government of India,
বাঁদ্ধিক সম্পত্তিৰ কাৰ্যালয়, ভাৰত চৰকাৰ, ৰাঁব্ৰিক ম গঁহিক संपत्ती কাৰ্যালয় খাবন মৰকাৰ আঁতিধ্বখণ্ডালয়	संपदा दफ्तर, भारत सरकार, (वौम्निक अम्लम कार्यालश र्थिय (भारतसरहार, कालाव्यीक million) कार्यालश	,ভারত সরকার, ফ্রীটুর্চ শুগ্রু রঞ্চঁৎট, ফ্রার্টর মন্চার্চে, ১৯ জ্বারুজ আর্টকরার্ট রাইকে র্যার কার্যালয় সারে
सकार पेटेंट सं. / Patent No. मनवान. 05967 G2	ene bain a 477549n e. comano rasbas	. बौद्धिक संपदा चा कार्यालय, भारत सरकार, ब्लेबिस घु१९०
आवेदन सं. / Application No.	202341002650	బ్రోటింగింది. జ్రోగ్రామిటి జాగ్రిశా, కెకి రెడింది శిగ్రియిగికి మిగ్, మేధో సంపత్తి కార్యాలయము, భారత ప్రభుత్వము,
फाटल करने की तारीख / Date of Filing	डवापर, बुद्धिगाना नवा विसंधान , भारत सरकार, बाद्धि धीलध, ७:वज ७ <mark>.12/01/2023</mark> संपदा दफ्तर, भारत सन	দ सपदा कायालय, भारत सरकार, Intellectual Property कार, বৌদ্ধিক সম্পদ কার্যালয়,ভারত সরকার, গ্রুণ্ট্রিষ্ট
के संवरण प्रति भारत सरकार, वीपन मंधनी स्वतन	गरत सरकार, औरिइसपरानुडायांवय, भारतसरहार, लाग इ. नचड प्रत्याच १ PALIT, Achuir 2, IANCA	ാദ്ധിക സ്വത്ത് കാര്യാലയം, ഭാരത സർക്കാർ. പെറ്റം ഉംതുള്ള ഗ്രീമുക്കും മീद्धिक संपदा चा कार्यालय.
TRA RECT / Patentee endrined, ener opene.	. I.RAUT, ASHWITZ.JANGA, S	அறிவுசார் சொத்து அலுவலகம். இந்திய
ార్యాలయము, భారత ప్రభుత్వము, 8 <sup>7</sup> JTIT రాగుగేకే	र्णमप्रतः मन्तर्मः 'ए४ र्षट इएसप्रि, बुद्रिगे-	ा नबा बिसंधान , भारत सरकार, बौद्धिक संपदा कार्यालय,
प्रमाणित किया जाता है कि पेटेंटी को, THERMALLY INSULATED GEO आज तारीख जनवरी 2023 के बारहवें दि	उपरोक्त आवंदन में यथाप्रकोटेत A RUBE POLYMER नामक आविष्कार के लिए, पेटेंट न से बीस वर्ष की अवधि के लिए पेटेंट अनुदत्त	BERIZED STEEL SLAG BASED अधिनियम, 1970 के उपबंधों के अनुसार 1 किया गया है।
It is hereby certified that a patent h	as been granted to the patentee for an ir	vention entitled A RUBBERIZED
STEEL SLAG BASED THERMAN	LLY INSULATED GEOPOLYMER as	disclosed in the above mentioned
application for the term of 20 years	from the 12 <sup>th</sup> day of January 2023 in ac	cordance with the provisions of the
רמניתוג אכנ, 1970. המינה ספפה פכפה לאנש ב לשאטשרש כ. ספ	७३೫० ४७३८७३, बोद्धिक संपदा चा कार्यालय, भारत स	
ال حكومت بالتلق متلامة بالتط بتدمة بتدمال من المراجع بالتليم التركيم بالتط بين المراجع بالتط بتدمة بتدمين من المتلاق بالتلكيم بالتلك من مع محومت والتلكيم بالتلكيم بو دودين فيريكيم ويلكيم بالله بالتلكيم بود ولكيم بالله بالتلكيم بالله بالتلكيم بالله بالتلكيم بود ودين ملكيما مع ولاياري بالتلكيم بالله بالتلكيم بود ودين ملكيم بود ودين مالكيم باللله بالله بالتلكيم بود ودين ماليكين بالتلكيم بالله بالله بالتلكيم بود ودين ماليكيم بالله بالتلكيم بالتلكيم بالله بالله بالله بالله بالله بالتلكيم بالله بالتلكيم بالل بالتلكي بالله بالتلكيم بالله بالله بالله بالله بالله بالله بالتلكيم بود ودين بالله باله با	السري البراير السري السري السري المري المري السري السري المري المري السري السري المري المري المري السري المرم المرم المرم المرم المرم المرم المرم المرم المرم المرم المرم المرم المرم المرم المرم ال	ము, భారత ప్రభుత్వము, 8 जाш लामसाक Шवा स्टे Intellectual Property Office, Government of India, (खावल সরকার, धोवित खुरे खेरे, इंडीले, कार्वेड तंकवन्द, एक, काठलक लाखेकठाठे, बोद्धिक संपदा कार्यातन, भारत , बोद्धिक संपदा चा कार्यालय, भारत सरकार, दिशेषिक वश्व शुधाकफर्का, இந்திய அगरत, सरकार, दिशेषिक वश्व शुधाकफर्का, இந்திய आरत, सरकार, and a strain , क्रेंचेद कंप्रदेश कार्यालय, जारत सरकार, दिशेषिक वश्व शुधाकफर्का, तिद्धिक मण्डल जतकात, ढोविह्न प्रतार, तोद्धिक जन्म्यम कार्यालय, काठलक लाखेकठाठे, श्रि. क. क्रिक जन्म्यम कार्यालय, काठलक लाखेकठाठे, श्रि. क. क्रिक जन्म्यम कार्यालय, खाठल जतकात, ढोविह्न प्रतार, तोद्धिक जन्म्यम कार्यालय, काठलक लाखेकठाठे, श्रि. क. क्रिक जन्म्यम कार्यालय, खाठलक लाखेकठाठे, श्रि. क. क्रिक जन्म्यम कार्यालय, कार्यात्व, क्रिक्रीय प्रतार, कार्यात्व, क्रिक्री, आध्रिक संपदा चार्वालय, काल, बोद्धिक संपदा दास्तर, भारत सरकार, तोद्धिक जन्म्यम द्विइशेपदानुंडार्यात्वय, भारत सरकार, तोद्विक न्म्यन द्विइशेपदानुंडार्यात्वय, भारत सरकार, तोद्विक न्म्यन द्विइशेपदानुंडार्यात्वय, भारत सरकार, क्राठ्विक ल्यालाक्य, ह मतवन्य, ७४२६८ ८२८४४ २४४४.३ ठाक्रभ्र. क्रिक्र
सितन के तरिष : $06/12/2023$ सिपमी - इस पेटेंट के नवीकरण के लिए फीस, यदि इस Note The fees for renewal of this patent, day in every year thereafter	a सरका के कि का कि	प्रत्यात प्रत्येक वर्ष मे उसी दिन देव होगी। 12 <sup>th</sup> day of January 2025 and on the same
ति स सेकेट का साम के कि प्राप्त के कि	स्त सरकार, हॉने के	प्रेट निवक के प्रथात प्रयोक वर्ष में उसी दिन देय होगी। 12 <sup>th</sup> day of January 2025 and on the same

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