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Machine Learning Models for Mechanical and Micro Structural Properties of Recycled Fine Aggregate Concrete Using Different Mixing Approaches

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Abstract

The construction industry is primarily responsible for the depletion of natural resources and the disruption of environmental equilibrium due to unregulated mining activities. In this particular context, the utilization of recycled fine aggregate (RFA) derived from construction and demolition (C&D) waste presents itself as a viable solution. The conventional method of mix proportioning for RFA in concrete is not applicable in this case. The main innovation of our research lies in the fulfilment of one of the principles of circular economy, namely the reduction of carbon emissions, through the recycling of locally collected concrete waste. To tackle this issue, a novel triple mix-proportioning approach has been developed using the concepts of maximum packing density and minimum paste theory. The fresh and hardened properties were evaluated and microstructural characterization was carried out for the newly formulated mixes incorporating RFA with optimized combined aggregates. The compressive strength of concrete with recycled fine aggregate increases by 5.04% for 25% and, 21.69% for 50% replacement, and decreases by 35.44% for 100% replacement as compared to controlled concrete at the age of 28 days using the triple mixing approach. The findings indicate that replacing approximately 50% of sand with RFA is the optimal amount, as further replacement leads to a decrease in compressive strength, particularly at 100% replacement due to the presence of adhered mortar in RFA. In this study, the performance evaluation of RFA concrete has been conducted by comparing six established ML regression models and sensitivity analysis was performed to assess the variable's performance.

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Influence of bagasse ash powder and marble powder on strength and microstructure characteristics of alkali activated slag concrete cured at room temperature for rigid pavement application

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ABSTRACT

In this research, an attempt is made to partially replace ground granulated blast furnace Slag (GGBS) with a binder rich in SiO_2 and CaO in alkali activated slag concrete (AASC) to increase workability and setting time. GGBS is replaced with bagasse ash powder (BAP) in 5%, 10%, and 15% of the binary mix, and subsequently with marble powder (MP) in 5% and 10% of the binary mix. After establishing the best mix for both binder replacements, a ternary mix with 5% BAP and 10% MP is created. The fine aggregates used in the comparison are 100 % river sand and slag sa l. 10 M sodium hydroxide and the alkaline to binder ratio is 0.4, were used. Mechanical properties such as compressive strength, split tensile strength, and flexural strength are performed cured at 1, 3, 7, and 28 days samples. To further understand the intrinsic mechanism of strength development, microstructure, morphology and mineralogy on AASC are investigated. Based on the findings, it can be inferred that AASC mixes have a higher strength than OPC mixes. The mechanical strengths of the AASC binary mix with 10% MP and 5% BAP are higher. The microstructural analysis reveals the mixes developed with BAP and 100 % GGBS, had a denser microstructure than the normal mixes. The mechanical properties obtained for most of the AASC mixes are significantly higher than the IRC SP:62-2014 recommendations for rigid pavements for low volume roads.

Introduction

Large scale urbanization and infrastructure development need valuable natural materials and while producing valuable construction materials leads to the generation of large volumes of industrial waste. Solid waste management is becoming increasingly critical considering the ever-increasing amounts of waste materials created. Thermal power plants produce coal ash, integrated iron and steel mills have blast furnace slag, steel melting slag, and nonferrous industries such as aluminium, zinc, iron, and copper generate various types of mine tailings. Burning of agricultural biomass produces various types of ashes (Siddique, 2014). The increased volume of waste creates an increase in landfill management charges and a shortage of valuable landfill areas. Moreover, the disposal of industrial products becoming a significant problem for many organizations. Recycling or repurposing industrial waste by-products has become more attractive than landfilling as environmental awareness of potentially hazardous impacts has grown (Chandra et al., 2020).

On the other hand, India is a developing country and need large infrastructure such as highway and expressways for transportation. Bituminous pavements have short-life due to rutting and the formation of potholes compared to concrete pavement (rigid pavement). The concrete prepared with Ordinary Portland Cement (OPC) results in serious environmental issues such as reduced raw material availability, increasing CO_2 emissions, and high energy consumption during OPC manufacturing and all these lead to an increase in global warming.

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Comparative Study on Reinforcing Effect of Graphene Oxide in Cement Mortars with River Sand and M-Sand

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Abstract

In the recent era, graphene oxide, a new member of the nanomaterial family, has grown in significance. In this study, River Sand (R-Sand) and Manufactured Sand (M-Sand) are being used as aggregate in cement mortars to assess the reinforcing impact of graphene oxide. The study examines effects of various graphene oxide concentrations on the compressive strength and flexural strength of the cement mortar's mechanical and microstructural features. The study's findings show how graphene oxide can be used as a reinforcing agent in cement-based products and how R-sand and M-sand perform differently when utilized as fine aggregate. The comparison of cement mortar with and without superplasticizer for both R-sand and M-sand is done once the optimal dosage of graphene oxide has been established. The work sheds light on the possibility of using M-sand as a substitution for river sand and the optimization of graphene oxide concentrations for maximal reinforcement in cement mortar. The optimal GO dosage for R-sand and M-sand was found to be 0.2% and 0.6%, respectively and it is validated through SEM tests.

Keywords: *Graphene Oxide, M-Sand, R-Sand, SEM*

1.0 Introduction

The widespread application concrete and mortar, has led to large consumption of naturally available sand around the world due to the booming infrastructure in emerging and developing nations, there is a sizable demand for natural sand. Globally every year, about 32-50 billion tons of sand is utilized in the preparation of concrete[1]. In the banks of Ganges, about 200 adults were assaulted by wild animals due to illegal extraction of river sand[2]. As a result of cumulative extraction of natural sand from the river beds, numerous problems results, including the lowering of the subterranean water table, which results in the defeat of water-retentive sand strata, expanding of river courses, river bank slides, a vegetation loss of along river banks, intake wells exposure for water supply systems, disruptions of water existence, and farming issues. Developing countries like India are facing a shortage of quality natural sand. This is a severe threat to the environment and society in India due to the depletion of natural sand deposits.

In recent years, manufactured sand is well-known as a suitable substitute source for river sand. As the properties of M-Sand and R-Sand are found to be similar, the particle

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Civil Engineering for Multi-Hazard Risk Reduction ›

Conference paper

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Prediction of Unconfined Compressive Strength of Expansive Soil Amended with Bagasse Ash and Lime Using Artificial Neural Network

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Bagasse ash;
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ABSTRACT

Expansive soils (ES) have a long history of being difficult to work with in geotechnical engineering. Numerous studies have examined how bagasse ash (BA) and lime affect the unconfined compressive strength (UCS) of ES. Due to the complexities of this composite material, determining the UCS of stabilized ES using traditional methods such as empirical approaches and experimental methods is challenging. The use of artificial neural networks (ANN) for forecasting the UCS of stabilized soil has, however, been the subject of a few studies. This paper presents the results of using rigorous modelling techniques like ANN and multi-variable regression model (MVR) to examine the UCS of BA and a blend of BA-lime (BA + lime) stabilized ES. Laboratory tests were conducted for all dosages of BA and BA-lime admixed ES. 79 samples of data were gathered with various combinations of the experimental variables prepared and used in the construction of ANN and MVR models. The input variables for two models are seven parameters: BA percentage, lime percentage, liquid limit (LL), plastic limit (PL), shrinkage limit (SL), maximum dry density (MDD), and optimum moisture content (OMC), with the output variable being 28-day UCS. The ANN model prediction performance was compared to that of the MVR model. The models were evaluated and contrasted on the training dataset (70% data) and the testing dataset (30% residual data) using the coefficient of determination (R^2), Mean Absolute Error (MAE), and Root Mean Square Error (RMSE) criteria. The findings indicate that the ANN model can predict the UCS of stabilized ES with high accuracy. The relevance of various input factors was estimated via sensitivity analysis utilizing various methodologies. For both the training and testing data sets, the proposed model has an elevated R^2 of 0.9980. It has a minimal MAE and RMSE value of 0.0042 and 0.0217 for training data and 0.0028 and 0.0104 for testing data. As a result, the generated model excels the MVR model in terms of UCS prediction.

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ENGLISH VERSION

Shrinkage and Strength Characteristics of Expansive Soil Amended with Bagasse Ash and Lime.

Características de contracción y resistencia del suelo expansivo modificado con ceniza de bagazo y cal.

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Abstract

Bagasse ash (BA) is a non-environmental waste product gathered from sugarcane manufacturing industries. As a result of the large accumulation and shortage of disposal yards, handling BA has become an immediate challenge. This paper presents studies on the Atterberg limit, shrinkage index, linear shrinkage after 7 days of curing, compaction, and unconfined compressive strength (UCS) tests (following 7 days of curing) of BA and lime-BA assorted expansive soil (ES) by differing BA content from 0 to 18% at an interval of 3% and adding 4% lime by dry weight of ES. The outcomes disclosed that the inclusion of BA and lime beneficially controls the shrinkage attribute. According to the research, changes in moisture-density correlations resulted in reduced maximum dry densities (MDD) and greater optimal moisture content (OMC). The volume change characteristic of ES can be mitigated by mixing BA and lime. In addition, test findings showed that both BA and lime-BA enhanced axial stress while reducing axial strain. As a result, a substance that was once thought to be a misery to the environment and society has become a benefit to the civil engineering industry.

Keywords: *Expansive soil; Atterberg limit; Shrinkage index; linear shrinkage; MDD & OMC; UCS.*

Resumen

La ceniza de bagazo (BA) es un producto de desecho no ambiental que se recolecta de las industrias manufactureras de caña de azúcar. Como resultado de la gran acumulación y escasez de patios de eliminación, el manejo de BA se ha convertido en un desafío inmediato. Este artículo presenta estudios sobre el límite de Atterberg, índice de contracción, contracción lineal después de 7 días de curado, compactación y pruebas de resistencia a la compresión libre (UCS) (después de 7 días de curado) de suelos expansivos (ES) variados BA y cal-BA diferenciándose el contenido de BA de 0 a 18% en un intervalo de 3% y agregando 4% de cal en peso seco de ES. Los resultados revelaron que la inclusión de BA y cal controla beneficiosamente la característica de contracción. Según la investigación, los cambios en las correlaciones humedad-densidad dieron como resultado una reducción de las densidades secas máximas (MDD) y un mayor contenido de humedad óptimo (OMC). El cambio de volumen característico de ES se puede mitigar mezclando BA y cal. Además, los resultados de las pruebas mostraron que tanto el BA como el BA con cal mejoraron la tensión axial y al mismo tiempo redujeron la tensión axial. Como resultado, una sustancia que alguna vez se pensó que era una miseria para el medio ambiente y la sociedad se ha convertido en un beneficio para la industria de la ingeniería civil.

Palabras clave: Suelo expansivo; Límite de Atterberg; Índice de contracción; contracción lineal; MDD & OMC; UCS.

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RESEARCH

Prognostication of mechanical properties of banana and jute fiber reinforced concrete using ANN

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Abstract
In the present study, using data from experiments, an artificial neural network (ANN) model has been created to predict the strengths of concrete with banana and jute fibers at concrete ages of 7 and 28 days. The parameters considered for the ANN inputs are Grade of Concrete, FA, CA, W/C, Super Plasticizer, length, diameter and Density of fiber, curing in days, NaOH Concentration, Fiber treatment in hours, percentage of fiber added. The results from training and testing models have shown the great potential of ANN in predicting the compressive and flexural strengths of banana and jute fiber reinforced concrete.

Keywords Banana fiber reinforced concrete · Jute fiber reinforced concrete · Artificial neural network (ANN) · Strength Prediction

Introduction

Around the world, concrete is a widely used building material. Over the past forty years, concrete technology has advanced significantly. Nowadays, regular building supplies may be practically used to create application-oriented concrete mixtures.

A workable solution for meeting the requirement for sustainable development on a global scale is the reinforcing of concrete with natural fibers, because they are more sustainable, biodegradable, and favorable to the environment than synthetic fibers. Fiber reinforced-composite is of numerous types and properties with many benefits. The usage of fibers in the concrete improves energy with the benefits preventing formation as well as the extension of cracks within the concrete. This optimizes the concrete's ductility while retaining its outstanding quality during the post-cracking era. The fibers within the concrete bond, the sides of a generating crack collectively at the same interval it reduces the visible injury from becoming apparent.

Fiber reinforced-composite is of numerous types and properties with many benefits. In addition to minimizing the creation and spread of cracks within the concrete, the use of fibers in the concrete enhances energy. The fiber-reinforced composite improves the various properties related to concrete such as compression, tension.

Banana fibers w ich can be obtained naturally which has vital benefits like rigidity, low density, high removability, renewability and provides acceptable mechanical properties. Moreover, banana fibers are biodegradable and recyclable.

Banana fiber, a cellulosic jargon fiber found by the pseudo stem of the banana plant is the finest fiber with relatively good mechanical properties.

Jute fibers are is a golden silky fiber that can be obtained naturally. The natural jute fiber is more effective material which improves concrete strength and various properties of concrete. Along with this jute have become most utilized natural fibers which prohibit the usage of polymer. In the vicinity of Bangladesh, jute is locally accessible so it is less costly. Bengal Delta plain is the best source of jute fibers, which is occupied by Bangladesh and India.

Ordinary concrete mixed with banana and jute fibers also called BFRC and JFRC have been used extensively over the past few decades. Utilizing banana and jute fibers in concrete is an innovative approach that addresses both environmental sustainability and the need for durable construction materials. In the Environmental context the use of natural fibers such as banana and jute stems from the growing concern over environmental sustainability in construction. Traditional concrete production involves significant carbon emissions and relies heavily on non-renewable

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Analysis and design of multistorey commercial building using Etabs

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Abstract— Civil Engineers are facing a great challenge in structural designing. The design must fulfil various parameters which include economical structure, durability and serviceability. But taking these points in mind it becomes very difficult for an Engineer to fulfil all these requirements at a time when a design is performed manually. This dissertation presents research on digital tools used in civil engineering and comparing their results by taking in mind the requirements of the above points. In this research process a building is taken for analysis and design on well-known Software ETABS. Based on the results taken from the Software some comparison is done with manual analysis for commercial building.

Nowadays every designing organisation is using these Software but there is a question mark to which software we must go for designing. The parent organisations which have developed these designing tools promote their Software by showing all the positive points. In addition to this they are trying to fill all the loop holes which they found in their products but it will never happen that another developing company will put the points in light what the negative points are there in existing products. They keep on improving to deliver their best. In this project work I will present the difference for future users to which tool you must go through to acquire your needs. I am not saying that some products are not ok at all. I have designed a residential building with proper loading which is being designed on both ETABS. Manual calculations make it crystal clear the difference between the Software.

Key word: Etabs Software, structural design, commercial building.

1. Introduction

In civil engineering, a structure with several parts, such as a foundation, walls, columns, floors, roofs, doors, windows, ventilators, stairlifts, various types of surface coatings, etc., is referred to as a "building." A structure is created using structural analysis and design such that it can withstand all applied loads without failing for the duration of its planned life. Geotechnical investigation must be used to gather the relevant data regarding the supporting soil before any structure's study and design. The process of gathering data and assessing the site's conditions in order to plan and build a structure's foundation is known as a geotechnical site investigation. In order to ensure that the final design of a building and the building can be used for its intended function over the course of its design life, structural engineers must balance the need for the most accurate, efficient, and inexpensive design. STAADPRO, ETABS, SAP, and other software programmes are now available on the market for nearly all types of structural analysis and design.

AUTOCAD:

A popular commercial drafting and computer-aided design (CAD) programme is AutoCAD. AutoCAD, created and marketed by Autodesk, was first made available as a desktop application for microcomputers with built-in graphics controllers in December 1982. Prior to the release of AutoCAD, the majority of commercial CAD programmes were run on mainframe or minicomputers, with each CAD operator (user) utilising a different graphics terminal. Additionally, there are mobile and online apps for AutoCAD.

ETABS:

Engineering software called ETABS is used to analyse and design multi-story buildings. The grid-like geometry specific to this form of construction is taken into account via modelling tools and templates, code-based load prescriptions, analysis techniques, and solution approaches. ETABS can be used to analyse simple or complex systems under static or dynamic conditions. Modal and direct-integration time-history analyses may be coupled with P-Delta and Large Displacement effects for a sophisticated evaluation of seismic performance. Under monotonic or hysteretic behaviour, nonlinear linkages and concentrated PMM or fibre hinges may capture material nonlinearity. It is possible to develop applications of any complexity thanks to intuitive and integrated features. ETABS is a coordinated and effective solution for designs ranging from straightforward 2D frames to intricate modern high-rises thanks to interoperability with a variety of design and documentation systems.

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A Performances Study on GGBS with Alccofine-Based High Strength Self-Compacting Concrete

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Abstract:- This paper conducts both experimental studies on high-strength concrete (HSC) incorporating the development of SCC mixes using industrial products such as Alccofine as an additive of 10% and GGBS as a partial replacement for cement at 0, 10, 20, 30, 40, 50, 60%, and the second phase covers the study of fresh and hardened properties of developed high strength SCC mixes in the laboratory. The study comprehensively tested properties like Rheological, compressive strength, and split tensile strength at 7, 28, and 91-day curing periods. The results highlighted enhanced workability when GGBS replaced cement, particularly in the 40% is optimum strength is satisfied. However, beyond 10% alccofine additive, adverse effects were observed across all parameters.

Keywords:- *Ground Granulated Blast Furnace Slag (GGBS), Supplementary Cementitious Material (SCM), Compressive Strength (C.S), Split Tensile Strength (S.T.S)*

I. INTRODUCTION

One of the most significant advancements in the construction sector has been the creation of self-compacting concrete (SCC). This tangible idea aims to reduce the risk brought on by the human aspect. SCC is increasingly being used because of its many appealing qualities. SCC differs significantly from traditional slump concrete in terms of its characteristics. SCC is a highly workable concrete that can flow through densely reinforced and complex structural elements under its weight and adequately fill all gaps without segregation, excessive bleeding, excessive air migration, or other material separations, as well as without the need for vibration or other mechanical consolidation. According to Okamura (1997)[21], SCC is highly designed concrete that has a significantly higher fluidity without segregation and can fill every corner of formwork while supporting itself. So, without compromising the engineering qualities of the concrete, SCC does away with the necessity for vibration, either internal or external. SCC is a fluid mixture that can be used in dense reinforcement and challenging situations without vibrating.

This concrete was initially developed in Japan in the late 1980s to combat the decline in concrete quality brought on by a lack of skilled labor, as well as issues with homogeneity and compaction at the corners of cast-in-place concrete, particularly with complex structures, to increase the durability of concrete and structures. Following the creation of SCC in 1988 in Japan, all of Europe began to work on this special noise-free revolution in the building sector. SCC research in Europe has been particularly active over the past five years, from 1991 to 2000. Because of this, Europe published self-compacting concrete requirements and guidelines before the United States (EFNARC 2002) [20]. Currently, there is a lot of research being conducted globally to improve the fluidity of concrete while maintaining its strength and durability attributes without significantly raising the cost. In November 2002, the first North American symposium on the design and application of self-consolidation concrete was held. Due to the advantages of using this concrete, various universities and government R&D firms currently employ a large number of researchers. Very limited work is reported from India, where the future for concrete is very bright due to scarcity of skilled manpower, non-mechanization of the construction industry, and abundant availability of construction materials available at very low cost. Therefore, it can be said that SCC is still quite unknown to many researchers, builders, ready-mix concrete producers, academia, etc. Self-compacting concrete (SCC) is an innovative type of fresh concrete known for its ability to flow and consolidate without the need for external vibration. This technology is particularly useful in construction scenarios where traditional concrete consolidation using vibrators is challenging. SCC is characterized by its exceptional filling and passing ability, as well as its resistance to segregation. It possesses superior flow properties in its fresh state, facilitating self-compaction and material consolidation while eliminating issues related to segregation. Alccofine is an advanced micro-fine mineral admixture derived from slag, designed for use as a supplementary cementitious material (SCM) in concrete and mortar applications. This eco-friendly material is primarily composed of low calcium silicate and boasts high glass content with remarkable reactivity. It is meticulously processed from Ground Granulated Blast Furnace Slag

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EXPLORING STRUCTURAL PERFORMANCE THROUGH SEISMIC & PUSHOVER ANALYSIS OF G+4 STOREY BUILDING

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Abstract: In this study, we utilized ETABS structural analysis software to intricately model 5-storey reinforced concrete frames (G+4) with setbacks in both X and Y directions. The analysis considered medium soil conditions and addressed seismic Zones II, III, IV, and V. We focused on parameters such as storey drift, displacement, stiffness, base shear, and Modal participation factor. Results were systematically tabulated and graphically presented for comprehensive comparative analysis. Additionally, pushover analysis using ETABS provided insights into the structure's capacity to withstand increasing seismic forces until failure or significant deformation, crucial for seismic design and structural evaluation.

Keywords: Linear analysis, base shear, story displacement, story shear, Non-Linear analysis, and Push over analysis.

I. INTRODUCTION

In civil engineering, structures are typically designed according to building codes for normal loads. However, these codes may not fully consider the behavior of structures during severe seismic events. Unlike industries such as automotive and aviation, construction faces limitations in creating large-scale prototypes and conducting extensive testing due to the unique nature of each building. In seismic-prone areas, structural design must meet two critical criteria: withstanding operational loads and ensuring resilience against earthquakes. Engineers employ two main methods for seismic calculations: the Lateral Force Method for simple structures and the Modal Response Spectrum Analysis for structures influenced by higher vibrational modes. ETABS stands out as an innovative software for structural analysis and design of buildings. It offers features like 3D modeling, fast linear and nonlinear analysis, and comprehensive design tools. ETABS facilitates a smooth transition from CAD drawings and accommodates various materials. Renowned for its user-friendly interface, compliance with Indian Standard Codes, versatility, and accuracy, ETABS provides both linear and nonlinear analysis capabilities, including pushover and P-Δ analysis. Linear static analysis assumes a linear relationship between forces and displacements, fitting for structures within the elastic range of materials. Seismic analysis is crucial in earthquake-prone regions, where preventive and mitigation strategies are paramount. Nonlinear analysis, on the other hand, establishes a nonlinear force–displacement relationship, accounting for aspects like large deformations, material behavior, and contact interactions. Pushover analysis, a component of nonlinear analysis, simulates earthquake-induced forces to identify structural weaknesses and assess performance during seismic events. It offers valuable insights into forces, deformations, load paths, and potential damage. While pushover analysis offers advantages, its accuracy hinges on factors such as estimating target displacement, defining lateral load patterns, and identifying failure mechanisms.

The study focuses on evaluating the effects of soft storey positioning in different earthquake zones, highlighting the effectiveness of shear walls in significantly reducing lateral displacement and storey drift by 98.838% and 99.86%, respectively. For regions with low seismic activity, the project recommends implementing steel bracing to improve seismic performance. Using ETABS for load calculations, the project aims to analyze the seismic response of a G+10 building across various Indian seismic zones, while ensuring compliance with IS 1893:2002 standards. Another project examines the seismic and wind analysis of a G+11 building located in Pune's seismic zone II, utilizing ETABS, as conducted by Yashashri Ankalkhope et al. The study investigates critical parameters for rectangular and circular columns, comparing outcomes from Linear Static and Linear Dynamic (Response Spectrum Analysis) methods. Performance-based earthquake engineering, which accounts for uncertainties in seismic demand and capacity, is crucial for assessing seismic design. Specifically, the study explores the impact of cracked inertia on building performance during earthquakes, with a focus on pushover analysis, as conducted by Ashwini L.K. et al.

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Sesmic Performance And Retrofit For Yuvaraja's College: The Case Study

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Abstract: More than 80% of the buildings in India are composed of masonry, 20% of which are significant historical structures. As one of the 90% of historical structures in Mysore, Yuvaraja's College, which is made of masonry and only meant to withstand static stresses, had its performance evaluated. Due to their very complicated behaviour under seismic loads, which is characterised by a combination of enormous shear pressures, diagonal tension, and high bond stresses in the columns, all of which are brittle modes of failure, beam column joints of masonry structures require special consideration. The behaviour of the masonry construction during seismic conditions is known. Sap 2000 has been used to analyse the study on the masonry structure of Yuvaraja's College, which is located in seismic Zone II and has G+ 1 storeys. Pushover analysis contains some approximations and simplifications; therefore, some fluctuation is always anticipated in the pushover analysis' seismic demand estimate. To get around some of the drawbacks of conventional pushover processes, certain enhanced pushover procedures have been put out in literature. With the aid of SAP 2000. This study highlights the main causes of the inadequate seismic performance of stone masonry buildings and offers solutions for improving seismic performance for existing structures. By putting the suggestions provided here into effect, the risk to occupants of no designed stone masonry buildings and their property can, in our opinion, be significantly reduced in the case of a future earthquake. This study will be useful to building specialists who want to understand more about this type of construction, whether for post-earthquake reconstruction or seismic mitigation.

1. Introduction:

Seismology is the study of elastic wave generation, propagation, and recording within the Earth, particularly focusing on natural phenomena such as earthquakes. Earthquakes are abrupt movements or tremors occurring within or beneath the Earth's surface. Roughly 90% of earthquakes result from tectonic activities, mainly associated with movements along geological faults. The remaining 10% can be attributed to factors like volcanic activity, subterranean cavity collapses, or human-made causes.

Pushover analysis, along with assessments of building performance using approaches like the Capacity Spectrum Approach or Displacement Coefficient Method, has gained popularity for this purpose. To achieve uniformity in seismic retrofitting approaches, it is crucial to address key considerations for their incorporation into Indian building codes. This entails a thorough understanding of the principles underlying documents like ATC-40 (ATC, 1996) and FEMA-356 (FEMA, 2000), followed by necessary adaptations to suit Indian conditions. Initiating and concluding discussions on this matter promptly is imperative to achieve desired outcomes.

Pre-disaster preparedness strategies often entail repairing and retrofitting reinforced concrete structures to ensure their satisfactory performance during seismic events. These actions can lead to improvements in structural stiffness, strength, and resistance to deformation. While performance factors have been proposed to quantify the effectiveness of these measures, their applicability may vary depending on specific cases. Large-scale experimental programs conducted at SERC have revealed that if structural weaknesses exist in the original design, achieving desired performance levels through retrofitting may not be feasible. In such instances, the evaluation of performance factors might be contingent on the deformation state considered, potentially lacking uniformity. Addressing these complexities is essential to adequately evaluate the suitability of repair measures.

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Review on Utilization of Recycled Aggregate in Concrete Production

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Abstract : The utilization of recycled aggregate in concrete production offers a sustainable solution to address environmental concerns while meeting construction needs. By repurposing materials from demolition waste, recycled aggregate reduces the strain on natural resources and minimizes waste disposal. Incorporating recycled aggregate into concrete production helps to mitigate the environmental impact associated with traditional concrete manufacturing processes. This approach promotes resource conservation and contributes to the circular economy by giving new life to materials that would otherwise end up in landfills. Additionally, using recycled aggregate in concrete production can enhance the material's performance and durability, making it a promising option for sustainable construction practices.

Keywords - Recycled Aggregates, Concrete production, Sustainability, Environmental concerns, Demolition waste, Circular economy.

I. INTRODUCTION

The utilization of recycled coarse aggregate in the production of concrete represents a pivotal advancement in sustainable construction practices. With escalating environmental concerns and a pressing need for resource conservation, this innovative approach offers a promising solution. By repurposing materials derived from demolition waste, recycled coarse aggregate effectively reduces the strain on natural resources while curbing waste disposal. This not only mitigates environmental impact but also fosters the principles of a circular economy by giving new life to otherwise discarded materials. Moreover, incorporating recycled coarse aggregate into concrete production enhances the material's performance and durability, elevating its suitability for a range of construction applications. This introduction underscores the importance of embracing sustainable alternatives in concrete manufacturing, emphasizing the dual benefits of environmental stewardship and construction efficacy.

II. LITERATURE REVIEW ON RECYCLED AGGREGATE

Limbachiya et al (2000) found that Recycled aggregate concrete had 7 to 9% lower relative density and 2 times higher water absorption than natural aggregate. According to their test results, it shown that there was no effect with the replacement of 30% coarse Recycled aggregate concrete used on the ceiling strength of concrete. It also mentioned that Recycled aggregate concrete could be used in high strength concrete mixes with the Recycled aggregate concrete content in the concrete.

Poon et al (2002) They have carried the Study on the use of Recycled Aggregate in concrete and found that the replacement of coarse and fine natural aggregates by recycled aggregates at the levels of 25 and 50% had little effect on the compressive strength of the brick and block specimens, but higher levels of replacement reduced the

compressive strength. However, the transverse strength of the specimens increased as the percentage of replacement increased. They also found that the replacement of natural aggregates at the level of up to 100%, concrete paving blocks with a 28-day compressive strength of not less than 49 MPa can be

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Experimental Study of Compressive Strength of 8m Geoploymer Mortar for Different Combinations of Eucalyptus-Ash with Ggbs(45µ)

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ABSTRACT

Concrete is the material which is unstintingly used in the construction sector and the product of cement is one among the reason for global warming due to release of carbon dioxide, to minimize its effect on nature we must use artificial by- product as an indispensable material. Among artificial by- product, operation of cover ash is more.

The geopolymer mortar made by the using cover- ash set sluggishly in ambient temperature and needs heat curing. To overcome this limitation, Ground Granulated Blast Furnace Sediment(GGBS) grease paint is used as a cementious material which shows considerable gain in strength. In this paper, we delved the parcels of geopolymeric binder prepared using the Ground "Granulated Blast Furnace Sediment"(GGBS) and eucalyptus ash without using conventional cement. The individual parcels of the GM for 1:3 rate, similar as compressive strength test were determined as per applicable Indian norms. cells of size (70.6x70.6x70.6) mm were casted and cured in ambient condition for molarity 8M with different rates and different temperatures.

After the trials, compressive strength is increased for adding number of days of curing. Also compressive strength dropped for adding Na2SiO3/ NaOH rates and adding roaster curing temperatures.

Keywords: Geoploymermortar, GGBFS, coalash, 8M(Molarity)

1. INTRODUCTION

The development of country is depending upon the infrastructures and in every infrastructure the concrete plays major role, we cannot imagine the world without a concrete. The cement is the main constituent of manufacturing of concrete. Use of concrete is thesecond largest consumption after the water the production of cement increases as per theincrease in demand of concrete. The total consumption of concrete in worldwide is estimated about to the11.5 billion tons of concrete per year and18billion tons of concrete expect in the year of 2050

Construction actions include the production of concrete, mortar, bricks, blocks etc.Major articles include cement, fine aggregates like sand, coarse aggregates, bricks, blocks,steel etc. Among this cement production more than 70% of carbon dioxide and other harmful gases will be generated and enters the atmosphere. This will damage the ozone layer. Hence it is necessary to reduce the production and consumption of cement

As a solution, it is necessary to use alternative building materials which do not create harmful effects for the environment. So many researches have been done on many alternatives for cement, fine aggregates

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Experimental Study of Compressive Strength of 8m Geopolymer Mortar for Different Combinations of C-Ash with Ggbs(45µ)

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ABSTRACT

Concrete is the material which is abundantly used in the construction industry and the production of cement is one among the reason for global warming due to release of carbon dioxide, to minimize its effect on nature we must use industrial by-product as an alternative material.

Among industrial by-product, usage of fly ash is more. The geopolymer mortar made by the using fly-ash set slowly in ambient temperature and needs heat curing. To overcome this limitation, Ground Granulated Blast Furnace Slag (GGBS) powder is used as a cementious material which shows considerable gain in strength. In this paper, we investigated the properties of geopolymeric binder prepared using the Ground "Granulated Blast Furnace Slag" (GGBS) and coal ash without using conventional cement. The individual properties of the GM for 1:3 ratio, such as compressive strength test were determined as per relevant Indian standards. Cubes of size (70.6 x 70.6 x 70.6) mm were casted and cured in ambient condition for molarity 8M with different ratios and different temperatures.

After the experiments, compressive strength is increased for increasing number of days of curing. Also compressive strength decreased for increasing Na_2SiO_3/NaOH ratios and increasing oven curing temperatures.

Keywords: *Geoploymer mortar, GGBS, coal ash, 8M (Molarity)*

1. INTRODUCTION

Cement is a material used in construction industry as a binder from last few decades. Many hazardous gases were released in the manufacturing process of cement such as CO, CO_2, etc., in the atmosphere which are more precarious to the environment. Around 6.99% of greenhouse gas is emitted to the atmosphere in the production of cement. In general, 1 tonne production of cement requires 4.01GJ of energy which produces nearly 1 tonne of carbon dioxide to the atmosphere.

Fly ash (by-product of burning coal) is extensively available in a globe, which is used as an alternative for cement. When it utilized as a complete replacement of cement in the presence of H_2O and in surrounding temperature, fly ash reacts with the slaked lime during the hydration process of cement to form the H_2CaO_4Si gel. The development and usage of large volume fly ash cement, which enabled the complete alternative of cement up to 65% by mass is an eloquent improvement.

Geopolymers is an inorganic polymeric material used as binder, firstly developed by Joseph Davidovits in 1970. Geopolymerisation involves a chemical reaction between solid alumino-silicate oxides and alkali

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