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Seismic Evaluation of RCC Buildings by Using Tuned Mass Damper System with Graphical User Interface in Matlab

A.Vinod Kumar[1*], Syed Afzal Basha[2], C G Mohan Babu[3]

Assistant Professor[1, 2, 3]

Department of Civil Engineering

G Pullaiah College of Engineering & Technology, Kurnool, A.P

Corresponding Author's email id: *kumarvinodkrishna@gmail.com[1*], syedafzal74@gmail.com[2]*

Abstract

Earthquakes takes place at any instant and takes lives of the people. Many earthquake engineers and scientists are trying to deal with earthquake resistant structures. The conventional earthquake resistant structures are designed with suitable ductility, but these structures yields more displacements thereby story drifts. So that both structural and non-structural elements gets damaged. So in order to decrease the damage to high rise buildings or discomfort of inhabitants, tuned mass dampers (TMD) are to be installed at the top floor of the building. Therefore reduce the story drifts to certain limit. These tuned mass dampers make the structure free from excessive displacements of the storey levels of the building. The aim of the thesis is to develop a linear time history analysis (LTHA) code by using Newmarks -β method in MATLAB (R2014a) with Graphical User Interface (GUI) and apply it for three storey RCC building.

Keywords*: - Tuned Mass Dampers (TMD), Linear Time History Analysis (LTHA), MATLAB.*

INTRODUCTION

Earthquake is the natural phenomenon of sliding of tectonic plates. In world many earthquakes takes place daily but most of the earthquakes are of minor range, these minor range earthquakes is not much important, because these earthquakes don't create catastrophic consequences. But the earthquakes with higher magnitude greater than 6 we have to cautious more. In Indian

Decrease of Seismic Response in RCC Building by using Non Linear Viscous Dampers in Open Sees Tool

A Vinod Kumar[1], Syed Afzal Basha[2], S Akhil Tej[3]*
Assistant Professor[1, 2, 3]
Department of Civil Engineering
G Pullaiah College of Engineering & Technology, Kurnool, A.P
Corresponding Author's email id: *kumarvinodkrishna@gmail.com[1*], syedafzal74@gmail.com[2]*

Abstract

Buildings should be designed and constructed in such a manner that they will withstand the earthquakes. Many energy dissipating devices like base isolation, tuned mass dampers, viscous dampers are effective in controlling the seismic response of the buildings. The viscous dampers are highly useful in decreasing the storey drifts of the building. In this paper two dimensional RCC building model having 3 bays of equal length and four storey is created using OPENSEES tool which had written in TCL (Tool Command Language) and Non-Linear Time History analysis (NTHA) is carried out to study response of the building frame in terms of displacement and drifts of the building storey with bare frame, with single viscous dampers and with cross viscous dampers installed at first bay and third bay throughout the height of the building. The seismic responses in terms of storey displacements, storey drifts, and top storey displacements time history are compared among three different conditions which are mentioned as above.

Keywords: *- Viscous damper, Non-Linear Time History analysis (NTHA), OPENSEES, drifts, Tool Command Language (TCL).*

INTRODUCTION

With increase of population in urban areas it is necessary to construct high rise buildings due to less availability of land mass to accommodate the population. In India around 40% of the people live in urban areas. Around 52 % of the Indian sub-continent is situated in earthquake

GENERALIZED SHEAR FORCE AND BENDING DIAGRAMS VIA SINGULARITY FUNCTIONS BY USING MATLAB AND GNU OCTAVE

By

A. VINOD KUMAR * SIVANANDA REDDY Y. **

*,** Department of Civil Engineering, G. Pullaiah College of Engineering and Technology, Pudur, Andhra Pradesh, India

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ABSTRACT

In 21st century, computers have been playing vital role in engineering and science. Many engineers and scientists utilize computers to solve the complex engineering problems through programming languages, such as C, C++, Java, Fortran, Python, Scilab, MATLAB, etc. Even though these languages are easy to implement in civil engineering discipline such as finite element analysis, structural dynamics, complex soil mechanics problems, design of reinforced concrete structures, steel structures etc., the students are not comfortable with these languages. Generally in Civil Engineering, analysis, interpretation of analysis and design are very important. To solve these problems best suitable languages are MATLAB, Scilab, Python, GNU OCTAVE and FORTRAN. Therefore it is necessary to introduce the programming languages in civil engineering discipline to aid students to solve complex problems by their tutors. In this paper by using singularity functions, the generalized shear force and bending moment diagrams of the beams with different loading conditions via medium MATLAB and GNU OCTAVE have been drawn.

Keywords: MATLAB, Singularity Functions and GNU OCTAVE.

INTRODUCTION

Civil engineering is one of the oldest branches in engineering. At early days there were not many disciplines in civil engineering. With development in mathematics, civil engineering evolved into many disciplines such as finite element analysis, structural dynamics, non-linear analysis of structural elements. Without mathematics civil engineering is incomplete because every simple problem to complex problem involves numerical analysis. Therefore, it is the time to link the civil engineering with programming languages via mathematics in a soothing manner. The best programming language is MATLAB and it clones like Scilab, GNUOCTAVE for students, academicians and practicing civil engineers alike (Honson, 2011). Therefore everyone can enjoy the concepts in a better way.

We can also develop applications by using the above mentioned programming languages, thereby saving the time and also resources. At present, there are many software available to solve complex problems to trivial problems and 90% of these software are not open source.

Shear force and bending moment diagram plays an important role in design of building components like beam column, etc. Though important, most students felt it difficult to draw shear force and bending moment diagram. Therefore, recent studies (Suh, 2014) show that by developing an educational software for beam loading analysis using pen-based user interference created an interest to link the civil engineering problems with programming language, such that faculty can create interest in students to solve complex engineering problems. Using of Python programming language is popular among student as well as teaching community. Faculty can develop codes for learning beam bending which could aid the students a lot. Many authors had developed the code to draw the shear force and bending moment diagrams but have not developed generalized application for shear force and bending moment (Bhogade & Bolli, 2015; Sobaszek, 2013). This paper will fulfill this requirement by developing a generalized application to draw shear force diagram and bending moment diagram. Some

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MAPPING AND PREDICTING URBAN SPRAWL AND IMPERVIOUSNESS USING REMOTE SENSING DATA

NG. Kalyani, Dr. Dinesh Singh[1], and Dr. Satish Jayanthi [2]
Department of civil engineering, KLU Green fields, Vaddeswaram, Andhra Pradesh
Professor of civil engineer Green fields, Vaddeswaram, Andhra Pradesh
Scientist G, Department of urban, NRSC, Hyderabad

Abstract

The pace of urbanization is rapidly growing and considered as overall global phenomenon. However, it is liable for urban natural issues such as urban heat island impacts, diminished air quality, expanded spillover and urban flooding, disintegration of water quality. Urban growth mainly influenced by two factor, population growth and transportation network. Due to increasing population there is conversion of pervious surface areas into impervious surface such as RCC house construction, road construction etc. impervious surface of earth not permitting water to penetrate into ground. Thus, imperviousness surface dynamics affects both human and environment in near future. In this paper, we focus to extracts urban impenetrable and spread surfaces as well as Urban sprawl using remote sensing images. However, scene changes between multi-sensor remote sensing images in different timings resulted in misclassification and misregistration in remote sensing images. So, checking impervious surface dynamics and urban sprawl in different times in efficient manner is essential requirement. Thus, imperviousness of urban area extracted using indices method and urban sprawl determined using classification based on visualization. Also, predicted future scenario using Markov chain analysis using Landsat remote sensing image. An overall accuracy of 0.96 obtained for urban sprawl and 0.9 for imperviousness.

Keywords: *Urbanization, Classification, Indices method, Future scenario, Markov chain analysis, Impervious surface dynamics, misclassification, misregistration.*

Highlights

1.Urban sprawl using visualization method gave good results.
2.Imperviousness using indices, surface temperature, and albedo computed.
3.Future prediction using markov chain analysis where to acquire accuracy regression change prediction, road pixel, and transition sub models are considered to get correct average value.

1. INTRODUCTION

Urbanisation where people from cities move to rural creating suburban areas, population will get increased both inward and outwards [11]. Demographic pressure due to living standards, size of population, industrial revolution lead to unplanned spatial developments [18]. People to meet their requirements they are changing landscape. Because of this there is increase in pollution.[4] Natural communities are decreasing day by day consequently effecting biophysical assets including soil, vegetation, water. urban sprawl lead to increment in imperviousness causing natural and ecological issues [17].

Impenetrable is characterized as land where water is invading into soil, like streets, garages, walkways, parking lots, housetops in urban areas [22]. Impenetrable is a key ecological marker for evaluating numerous effects caused by condition impenetrable surfaces affect numerous parts of the earth. Major cause of imperviousness is urbanization increasing its surface temperature and effects climate. Balancing is required between human and environment for sustained growth [9]. Jangaon in Warangal developed because of the highway passing through that area even it is highly uneven and with black

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STUDY ON UTILIZATION OF ZEOLITE AND STONE DUST IN CONCRETE

U Leela Prasanth[1], H Karan Kumar[2], Syed Afzal Basha[3]

[1]UG Student, Dept of Civil Engineering, G Pullaiah College of Engineering & Technology, Kurnool
[2]UG Student, Dept of Civil Engineering, G Pullaiah College of Engineering & Technology, Kurnool
[3]Associate Professor, Dept of Civil Engineering, G Pullaiah College of Engineering & Technology, Kurnool

[1]leelaprasanth27@gmail.com
[2]karanking087@gmail.com
[3]syedafzal74@gmail.com

Abstract-- **Concrete is a compound material composed of fine aggregates and coarse aggregate bonded together with fluid cement that hardens over time.The deficit of natural sand arises the need of alternative materials for replacement of natural sand. The squashed stone residue which is locally accessible modern strong waste material is ordinarily utilized as a fine aggregate in concrete. In the current examination, an exploratory program was carried out to consider the compressive and split tensile quality of concrete made utilizing stone residue as halfway substitution of fine aggregate at an increment of 10%. Zeolite is a pozzolanic material and its pozzolanic action improves the compressivestrength of concrete. Natural zeolites are supplementary cementitious materials. By adding zeolite, the investigation on the experiments will be carried out to determine the compressive strength and split tensile strength of concrete made using zeolite as partial replacement of cement up to 20 percent at an interval of 5 percent just as the way Stone dust is being replaced to achieve the objective of the project, M30 grade of concrete is prepared. The cube and cylindrical samples shall be tested after a curing period of 7 & 28 days.**

Key words— **Concrete, zeolite, stone dust, compressive strength, split tensile strength**

I. INTRODUCTION

The concrete is a composite material which is overwhelmingly utilized everywhere throughout the world. It is a composite material which is comprised of cement, sand, aggregate and water. The life of the concrete is extremely high so it tends to be utilized as adaptable material.The strength characteristics of concrete depend upon the properties of constituent material and their combined action. In the concrete the cement is used as the binder material which has the binding tendency. Fine aggregate is one of the important constituent materials as far as strength characteristics of concrete are concerned. Because of increase in activities for different regions and utilities scaring of the naturally available resources is being constrained due to it's over abuse. This may cause threat to the environment. Hence conservation of the naturally available material is great challenge for the civil engineers.

The concrete industry is one of the two biggest makers of carbon dioxide (CO2), making up to 8% of overall man-made discharges of this gas, on the off chance that we can somewhat supplant the cement with the material with alluring properties then we can spare common material and decrease outflow of CO2 in to the climate. Characteristic zeolite rocks are referred to have the option to go about as Supplementary Cementitious Materials (SCM) in Portland cement based concrete. By and large, SCMs are responding with portlandite and giving restricting hydration items similarly as Portland cement does. Along these lines a SCM can substitute certain amount of Portland cement in concrete and in this way decrease the related vitality utilization and CO2 emission.

Increment sought after and decline in common wellsprings of fine aggregate for the creation of concrete has brought about the need to recognize wellsprings of fine aggregate. Waterway sand which is most generally utilized as fine aggregate in the creation of concrete and mortar represents the issue of intense lack in numerous territories. The Stone residue created from stone squashing zones shows up as an issue for powerful removal.The disposal of this dust is serious environmental problem. Which is used here as partially replacement of fine aggregate. By incomplete substitution of characteristic stream sand then this won't just spare the expense of development and yet will take care of the issue of removal of this residue. Concrete made with this substitution can achieve the equivalent compressive quality practically identical tensile strength and modulus of rupture.

This project describes the feasibility of using the zeolite and Stone dust in concrete as partial replacement of cement and fine aggregate.

II. LITERATURE REVIEW

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IMPACT OF USING STONE POWDER AND MINERAL ADMIXTURES IN HIGH STRENGTH CONCRETE

Syed Afzal Basha[1], Dr. B. Jayarami Reddy[2], Dr. C. Sashidhar[3]

[1]Research Scholar, JNT University, Anantapur, A.P.[syedafzal74@gmail.com]

[2]Professor & HOD, YSR Engineering College of YVU, Prodattur. [bjreddyyvuce@gmail.com]

[3]Director of Evaluation, JNT University, Anantapur, A.P.[sashigunt@gmail.com]

Abstract: In present era, high-strength concrete is progressively utilized in modern concrete technology and particularly in the construction of elevated structures. This examination has been directed to explore the properties of high-strength concrete that was delivered by using stone powder (SP) as an option of extent on sand after being processed. The aim of the research is to study the effect of replacement of sand with stone powder and substitution of cement with mineral admixtures (GGBS & Zeolite) on the mechanical properties of high strength concrete. The test results showed clear improvement in compression and split tensile nature of concrete by using stone powder and mineral admixtures together in concrete. The increment in the magnitude of compressive strength and split tensile strength are comparable with conventional concrete.

Key Words*: Stone Powder, Mineral Admixtures, High strength concrete, Mechanical properties*

I. INTRODUCTION

Considering the volume, concrete is the first mostly used building material in the world. The definition of high strength changes over the years as concrete strength used in the field increases. High strength concrete is a kind of superior performance concrete by and large with a predetermined compressive quality of 40 MPa or more. Over the most recent couple of decades, extensive exploration exertion has been spent on the use of industrial by product (fly ash, blast furnace slag, silica fume, etc.) and characteristic assets (lime stone, pozzolans, etc.) as substitution of Portland cement. Supplementary cementitious materials can be utilized for improved concrete performance in its fresh and hardened state. They are basically used for improved workability, durability and strength. These materials permit the concrete producer to design and modify the concrete mixture to suit the ideal application [1]. Many researches examine the possibility of using stone powder, limestone powder as partial replacement of sand and partial replacement of cement. The test outcomes demonstrate that granite powder of marginal amount as fractional sand substitution has advantageous impact on the mechanical properties such as compressive strength, split tensile strength, modulus of elasticity [2]. The point of this examination is to contemplate the impact of stone powder utilized as mostly substitution of sand on significant mechanical properties of hardened concrete. The goal of this paper is to provide insight into the challenges of utilizing SCMs in order to better predict their performance. The development of alternative SCMs for concrete will help ensure availability of high-quality concrete with minimized environmental impact into the future.

II. SUPPLEMENTARY CEMENTITIOUS MATERIALS

Supplementary cementing materials (SCMs) add to the properties of hardened concrete through water driven or pozzolanic activity. Commonplace models are fly ash, ground granulated blast-furnace slag, rice husk ash and silica-fume. There are various advantages of incorporating supplementary cementitious materials into blend structure. Not only will SCMs allow cement contents to be reduced, they will also improve both the fresh and hydrated properties and performance of concrete.

REPROCESSING OF GLASS MATERIAL IN ENHANCING CEMENT MORTAR WITH COARSE AGGREGATES

By

KONDURU ANAND *

SYED AFZAL BASHA **

S. VINAY BABU ***

SIVANANDA REDDY Y. ****

* **** Department of Civil Engineering, G. Pullaiah College of Engineering and Technology (Autonomous), Kurnool, Andhra Pradesh, India.

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ABSTRACT

The possibility of recycling mixed colour waste glass for manufacturing decorative architectural mortars, has been investigated. In mortars, the 0–33–66–100% of calcareous gravel volume has been replaced with recycled glass cullets, with no other inorganic addition. To mitigate the possible alkali–silica reaction, mixes with a hydrophobic admixture were also compared. The obtained results show that the replacement of calcareous gravel with glass cullets of similar grain size distribution permits to reduce the dosage of the superplasticizer admixture to obtain the same workability of fresh mortar; it does not affect significantly the mechanical performances, the water vapour permeability and the capillary water absorption but it reduces significantly the drying shrinkage deformation. The used recycled glass is classified as no reactive in terms of alkali–silica reaction neither in water nor in NaOH solution following the parameters of the current normative, even in the absence of the hydrophobic admixture. The hydrophobic admixture further delays the expansion trigger but not the speed of its propagation.

Keywords: Glass Waste, Construction Mortar, Alkali - Silica Reaction, Compressive Strength.

INTRODUCTION

Glass is a transparent material produced by melting a mixture of materials such as silica, soda ash, and CaCO3 at high temperature followed by cooling during which solidification occurs without crystallization. Glass is widely used in our lives through manufactured products such as sheet glass, bottles, glassware, and vacuum tubing. Glass is an ideal material for recycling. The use of recycled glass helps save energy. The increasing awareness of glass recycling speeds up inspections on the use of waste glass with different forms in various fields. One of its significant contributions is to the construction field where the waste glass has been reused for concrete production.

1. Waste Glass

Glass is an important component of Indian economy, generating more than 21 million metric tons of consumer products each year. Glass production is energy intensive and accounts for 12% of the total cost of sales. As per the reports, India's Rs.60,000-crore packaging industry is growing at around 15%. The glass segment accounts for around 10% of the total packaging

industry.

1.1 Reputation of Recycling in Glass Industry

- *Environmental Aids:* Recycling glass makes production efficient and provides significant environmental benefits.
- *Saves Raw Materials:* Over a ton of natural resources are conserved for every ton of glass recycled, including 1,300 pounds of sand, 410 pounds of soda ash, 380 pounds of limestone and 160 pounds of feldspar.
- *Lessens Demands of Energy:* For each 10 percent cullet used in the industrial phase, energy costs drop around 2-3 percent. (The glass recycling process produces a crushed glass product called cullet. Cullet is frequently mixed with virgin glass materials to

Influence of Metakaolin on Stone Waste Aggregate Concrete

Sakevalla Vinay Babu[1(✉)], U. Raghu Babu[2], N. Venkata Ramana[3], and P. Pavithra[1]

[1] Department of Civil Engineering, G. Pullaiah College of Engineering and Technology, Kurnool 518002, Andhra Pradesh, India
vinaysake@gmail.com, pavithral37.civil@gmail.com
[2] Applied Mechanics Department, Sardar Vallabhbhai National Institute of Technology, Surat 395007, Gujarat, India
ammaraghubabu@gmail.com
[3] Construction Technology Department, Center of PG Studies, Visveswaraya Technological University, Kalaburagi 585105, Karnataka, India
rccramana@gmail.com

Abstract. The present paper reports the utilization of industrial stone waste in construction works as coarse aggregate. The black stone waste (BSW) aggregates collected from the stone industry was used as coarse aggregate by replacing the natural aggregate with different replacement levels of 0%, 25%, 50% and 75%. In addition, this work also investigates the influence of Metakaolin (MK) on the compressive strength and splitting tensile strength of concretes made with BSW aggregates. BSW aggregate concrete mixtures were prepared the replacement of cement with MK in the replacement levels of 0%, 5%, 10% and 15%. Results have shown that, the addition of MK involve to increase the mechanical properties of black stone aggregate concrete. The optimum strength results were obtained at 10% MK replacement level. Beyond the replacement level of 50% of natural aggregate with BSW aggregate MK blended concretes the strength results were lessened as compared to that of the concrete made with natural coarse aggregate (i.e. 0% BSW aggregate).

Keywords: Metakaolin · Stone waste · Concrete · Compressive strength · Splitting tensile strength

1 Introduction

Now a days, metakaolin (MK) has attracted significant attention of researchers due to its high pozzolanic property. MK is produced by the kaolin clay calcination at high temperature ranges 500 °C to 800 °C. The percentage of MK addition has significant influence of porosity of the cement matrix. Bredy et al. [1] stated that the incorporation of MK below 10% decreases the porosity and the dosage level of more than 30% MK increases the porosity. The addition of MK enhances the compressive strength of concretes [2]. Li and Ding [3] were observed supreme compressive strength at 10% addition of MK to the concrete.

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Effect of Pond Ash on Black Stone Waste Aggregate Concrete

U. Raghu Babu, N. Venkata Ramana, Sakevalla Vinay Babu and Piantee Pavithra

Abstract During the energy generated from the thermal power plants, the waste generated in large quantities is a serious environmental concern due to its disposal. Many researchers have well documented the utilization of fly ash as a mineral admixture among the different wastes generated from the thermal power plant. However, limited studies have investigated the effect of the other wastes, including pond ash on the mechanical properties of concrete. In this context, the investigation on the effect of pond ash in the construction industry is required. In addition, this paper also investigates the utilization of black waste stone as coarse aggregate in concrete, which helps to reduce the consumption of natural resources. An attempt has been made to investigate the compressive strength and splitting tensile strength, and the performance of concretes made with partial replacement of cement with pond ash and coarse aggregate with black stone aggregate. For this, concrete specimens were prepared with two different w/cm (water to cementitious) material ratios, four different replacement ratios (0, 5, 15, and 25%) of cement, and four different replacement levels of coarse aggregate (0, 25, 50, and 75%). The experimental results concluded that the potential applicability of pond ash and waste stone aggregate in concrete leads to the active utilization of waste products from both thermal power plants and

U. Raghu Babu (✉)
Applied Mechanics Department, Sardar Vallabhbhai National Institute of Technology, Surat, Gujarat 395007, India
e-mail: amnraghubabu@gmail.com

N. Venkata Ramana
Construction Technology Department, Visvesvaraya Technological University, Center of PG Studies, Kalaburagi, Karnataka 585105, India
e-mail: rccramana@gmail.com

S. Vinay Babu · P. Pavithra
Department of Civil Engineering, G. Pullaiah College of Engineering and Technology, Kurnool, Andhra Pradesh 518002, India
e-mail: vinaysake@gmail.com

P. Pavithra
e-mail: pavithra137.civil@gmail.com

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Study of Geo Polymer concrete using Fly ash and GGBS

S Vinay Babu [1], K Anand[2]

[1]Professor, Department of Civil Engineering, G Pullaiah College of Engineering, Andhra Pradesh, India

[2]Assistant Professor, Department of Civil Engineering, G Pullaiah College of Engineering, Andhra Pradesh, India

ABSTRACT

Construction industry is one of the contributing fator to the environmental crisis; the use of waste materials or industrial by-products from different industries as an alternative to conventional concrete materials would reduce this issue. The use of this material will contribute to sustainability in the building industry and protect natural resources. It can replace traditional concrete materials and use it. This study aims primarily to examine sand replacement to optimize the benefit of industrial by-products and other waste materials. Day by day, demand for sand is growing. Sand mining increases gradually as needed, with the impact from the mining of the river, water quality, and ecological effect generally affected. Therefore, it is very important to consider Sand Alternative in view of the need for sand in the future. Lack of sand affects construction work directly. The alternate material such as quarry dust and saw dust may be used in concrete to meet the need of fine aggregates. Quarry dust comes from the crushing of rocks, while sawdust refers to the fine size, powdery waste formed by sawing of wood. In this study, traditional mix 1:2.32:2.82 (M25) with water to binder ratio is maintained as 0.49 was used in this present study. Here the natural sand is replaced partly here by quarry dust (QD) and sawdust (SD) with different percentages i.e. is 50% of natural sand as constant and remaining 50% as the different proportions of Quarry dust and Saw dust. respectively by weight and effects of replacement on concrete is observed. The concrete was cast and their compressive, tensile strength and durability measured at 7, 14 and 28 days, respectively; the cubes of 150 x 150 x 150 mm, and the cylinders of 15 cm of diameter and of 30 cm of height were cast. The incorporation of 0.5 percent glass fibers into concrete as a mixture will increase the compressive and the tensile strength of the concrete dramatically.

Key words: Quarry Dust (QD), Saw Dust (SD), Slump cone test, Compaction Factor test (CFT), Compressive Strength, tensile strength and Durability test.

1. INTRODUCTION

In construction sectors, cement, sand and aggregate are essential needs. Natural sand deposits like India are being exploited and serious threats to the environment and society are caused by developing countries like India (the Authors native country) that facing a lack of sufficient natural sand content [1]. The rapid sand extraction from the beds of the rivers causes problems because the river beds are deeper, vegetation is lost on the banks of river, the aquatic life is disturbed as well as agriculture also due the water table in the well has been lowered etc. Building industries in developing countries are therefore emphasizing the need for alternative materials to offset the natural sand market [2].

We can overcome this problem by using two methods (a) concrete is replaced by another material which is very difficult or impossible at present, in terms of workability, durability and strength (b) partly or entirely substituting specific raw materials. It is possible to have second alternative option. Now a day's lot of invention in the area of concrete technology are being carried out by different researchers [3]. We are attempting to solve this problem by substituting various residues for which we have published numerous papers suggesting various materials that can be used as a component substitute for raw materials such as cement, fine and coarse aggregates.

Sand is an important material used to prepare mortar and concrete and plays a major role in the construction of concrete mixes. The primary use of cement and mortar is generally high in use of natural sand [4]. Hence in developing countries, the demand for natural sand has been very high to meet rapid infrastructure growth. Fine aggregate physical and chemical properties influence the durability, workability and also strength of concrete, because fine aggregates are the key components of concrete and cement mortar. Fine and gross aggregates together make up 75-80 percent of all concrete volume [5], so it is very important that the correct form of concrete and a good quality aggregate should be select from

Admixtures Influence on Concrete

Vinay Babu S[1], Akhil Tej S[2]

[1] *Assistant Professor, Dept. of Civil Engg,GPCET,KURNOOL.*
[2] *Assistant Professor, Dept. of Civil Engg,GPCET, KURNOOL*

Abstract- Materials scientists, chemists, engineers, and manufacturers' technical representatives have helped the concrete industry to improve our ability to control work times, workability, strength, and durability of Portland cement concrete by adding some supplementary substances named admixtures. The function of each admixture focuses on a specific need, and each has been developed independently of the others. Some admixtures already have chemistry that affects more than one property of concrete, and some have simply been combined for ease of addition during the batching process. To better understand recommended usage for various application of these chemicals admixture in concrete, the present study is planned to be obtained more specific information in this direction. In this investigation on performance of concrete with GGBS and different PCE based water reducing admixture the tests on compressive strength and Workability of the concrete with Ordinary Portland cement and Portland pozzolana cement with GGBS and admixture are carried out at different curing periods for M45 grade of concrete to conclude its behavior.

Index Terms- ***Concrete, Admixture, Workability, GGBS, Compressive Strength***

1. INTODUCTION

1.1. *General*

Concrete is a composite construction material, composed of cement (commonly Portland cement) and other cementitious materials such as fly ash and slag cement, aggregate (generally a coarse aggregate made of gravels or crushed rocks such as limestone, or granite, plus a fine aggregate such as sand), water, and admixtures. Materials scientists, chemists, engineers, and manufacturers' technical representatives have helped the concrete industry to improve our ability to control work times, workability, strength, and durability of Portland cement concrete by adding some supplementary substances named admixtures. The function of each admixture focuses on a specific need, and each has been developed independently of the others. Some admixtures already have chemistry that affects more than one property of concrete, and some have simply been combined for ease of addition during the batching process.

Admixture is an essential component of any modern concrete mix, providing a compromise for the conflict between water and workability and performance of hardened concrete. The advancement in admixture technology has played a significant role in the development of concrete technologies. The advanced PCE based admixtures have demonstrated various performance benefits and technical advantages over conventional superplasticizers in meeting the diversified challenging technical requirements of various high performance concrete technologies for construction.

In this investigation on performance of concrete with GGBS and different PCE based water reducing admixture the tests on compressive strength and Workability of the concrete with Ordinary Portland cement and Portland pozzolana cement with GGBS and admixture are carried out at different curing periods for M45 grade of concrete to conclude its behavior.

1.2. *Admixtures:*

General:

ACI 116R-00 defines the term admixture as "a material other than water, aggregates, hydraulic cement, and fiber reinforcement, used as an ingredient of a cementitious mixture to modify its freshly mixed, setting, or hardened properties and that is added to the batch before or during its mixing." In ACI 212.3R it is stated that "chemical admixtures are used to enhance the properties of concrete and mortar in the plastic and hardened state. Admixtures have long been recognized as important components of concrete used to improve its performance.

Function:

In ACI 212-3R, the reasons for the use of admixtures is outlined by the following functions that they perform:

- Increase workability without increasing water content or decrease the water content at the same workability;
- Retard or accelerate time of initial setting;
- Modify the rate or capacity for bleeding;
- Reduce segregation;

STUDY ON MORPHOLOGIES OF CEMENT HYDRATION

S Vinay Babu[1], A Vinod kumar[2], SAkhil Tej[3],

[1,2,3]Assistant Professor, Dept of Civil Engineering, GPCET, Kurnool

Abstract

The current state of knowledge of cement hydration mechanisms is reviewed, including the origin of the period of slow reaction in alite and cement, the nature of the acceleration period, the role of calcium sulfate in modifying the reaction rate of tricalcium aluminate, the interactions of silicates and aluminates, and the kinetics of the deceleration period. In addition, several remaining controversies or gaps in understanding are identified, such as the nature and influence on kinetics of an early surface hydrate, the mechanistic origin of the beginning of the acceleration period, the manner in which microscopic growth processes lead to the characteristic morphologies of hydration products at larger length scales, and the role played by diffusion in the deceleration period. The review concludes with some perspectives on research needs for the future.

1. Introduction

Understanding the kinetic mechanisms of cement hydration intersects both academic and practical interests. From an academic standpoint, the chemical and microstructural phenomena that characterize cement hydration are quite complex and interdependent, making it difficult to resolve the individual mechanisms or the parameters that determine their rates. Fundamental study of hydration therefore offers significant scientific challenges in experimental techniques and multi-scale theoretical modeling methods. From a more practical standpoint, the drive to produce more sustainable concrete materials is leading to more complex mix designs that include increased amounts of secondary mineral additions, often originating as by-products of other industrial processes, and a wide variety of chemical admixtures that can enhance concrete performance. More complete knowledge of basic kinetic mechanisms of hydration is needed to provide a rational basis for mixture proportioning as well as the design and selection of chemical admixtures.

Several detailed reviews have been written about the mechanisms that are thought to govern the kinetics of hydration [1–4]. At the time they were published, several important issues – the mechanistic origin of the induction period, the rate-controlling mechanisms during the acceleration period, the most important factors responsible for the subsequent deceleration of hydration, etc. – were addressed but left unresolved due to either lack of data or seemingly equivocal evidence for different viewpoints. But significant strides have been made both in experimental techniques and in theoretical models in the intervening years. Our intention is to focus on these more recent developments, thereby providing an updated picture of the current state of knowledge and identifying the remaining controversies or gaps in understanding.

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PERFORMANCE OF COMPRESSIVE STRENGTH OF LIMESTONE AGGREGATE CONCRETE WITH PLASTIC FIBRE

S Vinay Babu, C.G Mohan Babu

Abstract—Not for a long time, there is growing interest in a new generation of concrete to make huge development in construction. A relatively new sophisticated construction material of cementations complex, ultra-high performance concrete (UHPC). The UHPC refers to a mighty generation of concrete whose compressive strength more than 150MPa, tensile strength greater than 5MPa. The benefits of UHPC is perceived as a revolutionary material that has high compressive strength, self-compacting, and ductile behavior. However, the UHPC is still limited to a few structural applications due to high cost, limited design codes, and the high factors of safety adopted in design. This paper describes the mixing design and procedures for UHPC and obtained experimental results that proposed an increase in information of slab-column connections against punching shear failure. The punching shear test of flat plate slab depends mainly on the tensile strength, fabrication method, and local synthesis. The experimental method was examined a punching shear strength of UHPC flat plates having dimensions 1350*1350*80mm. The test is performed under vertical loading, using various parameters on the punching shear strength. These parameters include concrete strength, column shape, column aspect ratio, and reinforcement ratio. The experimental setup is hydraulic press allows investigating the concrete shear strength under quasi-static loading regime.

Index Terms— Cracking pattern, Deflection, Flat plates, Experimental study, Interior column, Punching shear, Steel fibers, Ultra-High Performance Concrete (UHPC).

1 INTRODUCTION

Reinforcement concrete flat plate structure is widely used nowadays due to the vast advantages such as formwork is simplified, decrease floor heights in buildings, and its pleasant appearance. The slabs without column capitals or drop panels appeared in the 1950s[1].

However, the critical problem of this system is the failure region of column-slab connections known as punching shear failure. A punching shear failure means the column is essentially pushed through the slab due to the high stresses region of column-slab connections. The engineering designer must consider punching shear failure in a flat plate system which can become an increasingly critical section in the whole system that occurs suddenly without any warning. The failure of one joint in the system may lead to loss of structural solidity.

Recently, Designers are looking forward to increasing concrete compressive strength in a structure because it is one of the most effective methods to avoid punching shear failure. Besides, the increasing concrete compressive strength in a structure minimizes the deflections under load particularly with long spans, improves long-term properties, decrease the cross-section of the member with the same strength capacity and decrease the total weight of the structure that helps in earthquake resistance especially in a tall building that located in earthquakes zones.

This study was applied UHPC to increase concrete compressive strength. The UHPC has been demonstrated to have compressive strengths more than seven times and tensile strengths greater than three times that of conventional concrete[2].

Interesting is, that UHPC exhibits nearly linear behavior up to 90% of its compressive strength before diverging 5 % from linear elastic behavior (this value is 45 % for NSC)[3].

Investigated was punched four interior column slab connections are made of UHPC. The column aspect ratio, column shape, and flexural reinforcement ratio in slabs are chosen as test parametric. In the Concrete Research laboratory - Faculty of Engineering, Ain Shams University - Cairo - Egypt were made the experimental test.

2 UHPC SPECIMENS AND SET UP

The immense mechanical and durability properties of UHPC make all the world interesting and researching merely with different names. Various brand names are used to refer to cementitious composite materials with ultra-high compressive strength and improvement durability around the world like [4, 5] Ductal® is a common name in the USA, Ultra-High Performance Concrete(UHPC) prevalent in Europe, while Reactive Powder Concrete(RPC) rife in Asia. Also, there are common names around the world as Compact Reinforced Composite (CRC), Densified Small-Particle(DSP) concrete, Fiber-Reinforced High-Performance Concrete (FRHPC), Macro Defect-Free(MDF) concrete, Multi-Scale Fiber-Reinforced Concrete (MSFRC), Steel Fibrous Cement-Based Composite(SFCBC).

2.1 UHPC Material

Ultra-high performance concrete (UHPC) is a new generation of concrete imperturbable of very fine powder as portland

• S Vinay Babu
Faculty of Civil Engineering Department, GPCET, Kurnool,AP

C.g Mohan Babu ,Faculty of Civil Engineering Department, gPCET, Kurnool,AP

Global Journal of Trends in Engineering

Assessment of Compressive and Split Tensile Strength of Silica Fume Cement Concrete

Syed Afzal Basha[1], P.Pavithra[2], J Ushasree[3]

[1,2,3] Dept of Civil Engineering, G Pullaiah College of Engineering and Technology, Kurnool, A P, India

ABSTRACT: Cementations materials have been used by mankind for construction from time immemorial. The every rising functional requirement of the structures and the capacity to resist aggressive elements has necessitated developing new cementations materials and concrete composites to meet the higher performance and durability criteria. The environmental factors and pressure of utilizing waste materials from industry have also been the major contributory factors in new developments in the field of concrete technology. Concrete is an artificial material in which the aggregates both fine and coarse are bonded together by the cement when mixed with water. The concrete has become so popular and indispensable because of its inherent in concrete brought a revolution in applications of concrete. Concrete has unlimited opportunities for innovative applications, design and construction techniques. Its great versatility and relative economy in filling wide range of needs has made it very competitive building material. With the advancement of technology and increased field of applications of concrete and mortars, the strength workability, durability and other characters of the ordinary concrete need modifications to make it more suitable for a by situations. Added to this is the necessity to combat the increasing cost and scarcity of cement. Under these circumstances the use of admixtures is found to be an important alternative solution. Hence an attempt has been made in the present investigation to evaluate the workability, compressive strength, split tensile strength is evaluated with replacement of cement and micro silica fume (0 – 25%).

Keywords: Cement aggregate, compression, split and flexural strengths

I.INTRODUCTION

India is the second largest producer of cement on the globe after China. In total, India manufactures 251.2 Million Tons of cement per year. The cement industry in India has received a great impetus from a number of infrastructure projects taken up by the Government of India like road networks and housing facilities. While the Indian cement industry enjoys a phenomenal phase of growth, experts reveal that it is poised towards a highly prosperous future over the very recent years. The annual demand for cement in India is consistently growing at 8-10%. NCAER has estimated after an extensive study that the demand for cement in the country is expected to increase to 244.82 million tons by 2012. At the same time, the demand will be at 311.37 million tones if the projections of the road and housing segments are met in reality The word 'pozzolana' was derived from pozzolana, a town in Italy, a few miles from Naples and mount vacuous. The materials are of volcanic region containing various fragments of pumice, obsidian, feldspars, and quartz etc. the name 'Pozzolana' was first applied exclusively to this material. But the term has been extended later to diatomaceous earth, highly siliceous rocks and other artificial products. Thus, the pozzolanic materials are natural or artificial having nearly the same composition as that of volcanic tuffs or ash found at pozzolanas. Silica fume (SF) known as micro-silica is a by-product of the reduction of high-purity quartz with coal in electric furnaces in the production of silicon and ferrosilicon alloys. Because of its extreme fineness and high silica content, silica fume is a highly effective pozzolanic material. Silica fume is used in concrete to improve its properties like compressive strength, bond strength, and abrasion resistance; it reduces permeability and therefore helps in protecting the reinforcing steel from corrosion.

Silica fume has been used as a high pozzolanic reactive cementitious material to make high-performance concrete in the severe conditions. This mineral admixture has highly been used in severe environmental conditions despite its several mixing and curing problems because of its acceptable early-age strength development The hydration mechanism and properties of secondary C-S-H made by pozzolanic reaction have been studied by many investigators However, CSH formed by silica fume-calcium hydroxide reaction might be different with respect to the amount of molecular water, C/S ratio, and density Moreover, because of its rather different characteristics, pozzolanic gel has a high potential to contribute in reactions with other internal or external ions such as Al, Cl, and alkalis On the other hand, the search for a new environmentally friendly construction material that will match the durability of ancient concrete has provoked interest into the study of alkali-activated cementitious systems over the past decades. Alkali-activated cements refer to any system that uses an alkali activator to initiate a reaction or a series of reactions that will produce a material that possesses cementitious property Alkali-activated cement, alkali-activated slag and fly ash, and geopolymers are all considered to be alkali-activated cementitious systems; however, it is expected that the structures of these materials are vastly different and result from different chemical mechanistic paths. It is commonly acknowledged that calcium silicate hydrate (CSH) is the major binding phase in Portland cement and alkali-activated slag's, however, the binding property of geopolymers is generally assumed to be the result of the formation of a three-dimensional amorphous aluminosilicate network

Performance of Concrete under Sulphate Curing

J.Ushasree
Assistant Professor, Department of Civil Engineering
G.Pullaiah College of Engineering & Technology, Kurnool

Dr.N.Venkataramana
Associate Professor, Department of Civil Engineering
UBDT College of Engineering, Davanagere

Syed Afzal Bash
Sr.Assistant Professor, Department of Civil Engineering
G.Pullaiah College of Engineering & Technology, Kurnool

Abstract - Sulphate permeability of concrete is the relative ease with which sulphate ion can penetrate in to the pores of concrete. The study of sulphate permeability in concrete is of importance when concrete is subjected to sulphuric atmosphere such as saline nature, sulphuric manufacturing plants etc. The penetration of sulphate ions into concrete may lead to the corrosion of reinforcement and hence weaken the structures and also adversely affect durability of concrete. Therefore a detailed study has been required to find the sulphate permeability of concrete. The aim of our study is to get acquainted with these Supplementary Cementitious Materials (SCM's) and to examine some features. The most interesting feature is to increase chemical resistance of concrete. The present work studied the performance of Bethamcherla stone powder on sulphate attack.

Supplementary cementitious materials can be used for improved concrete performance in its fresh and hardened state. They are primarily used for improved workability, durability and strength. These materials allow the concrete producer to design and modify the concrete mixture to suit the desired application. Concrete mixtures with high Portland cement contents are susceptible to cracking and increased heat generation. These effects can be controlled to a certain degree by using supplementary cementitious materials. Supplementary cementitious materials such as red mud, Bethamcherla stone powder, slag and silica fume enable the concrete industry to use hundreds of millions of tons of by product materials that would otherwise be land filled as waste. Furthermore, their use reduces the consumption of Portland cement per unit volume of concrete. Portland cement has high energy consumption and emissions associated with its manufacture, which is conserved or reduced when the amount used in concrete is reduced. One main objective of this work is to study the experimental investigation on performance of blended concrete of M_{30} grade. The Bethamcherla stone powder percentage for replacement of cement is varied as 0%, 10%, 20%, 30%, and 40%.

Keywords – Bethamcherla stone powder, Supplementary Cementitious Materials, Sulphate curing.

I. INTRODUCTION

1. General

Concrete technologists throughout the world are making constant efforts to find innovative materials which can partially or fully replace the ever demand and expensive building material, cement. Use of industrial wastes like silica fume, ground granulated blast furnace slag, metakaolin, rice husk ash, which possess pozzolanic property are tried to replace cement partially. Substitution of waste materials will conserve dwindling resources and will avoid the environmental and ecological damages caused by quarrying and exploitation of the raw materials for making cement. The output of these waste materials suitable as cement replacement such as slag, fly ash, silica fume, rice husk ash etc is more than double that of cement production. Use of industrial waste products is not only a partial solution to environmental and ecological problems, it significantly improves the microstructure and consequently the durability properties of concrete, which are difficult to achieve by the use of pure Portland cement alone. The aim is not only to make the cements and concrete less expensive, but to provide a blend of tailored properties of waste materials and Portland cements suitable for specified purpose. The combination of different pozzolanic materials to produce cheaper and more durable building materials will solve to some extent the ecological and environmental problems.Pozzolanas or supplementary cementitious materials improve the consistency and

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Assessment Of Cement Plant Variability

S Akhil Tej [1], A Vinod kumar[2], K Anand[3]

[1,2,3]Assistant Professor, Dept of Civil Engineering, G Pullaiah College of Engineering & Technology, Kurnool

ABSTRACT

This study evaluates the environmental impact of the cement production and its variations between different cement plants, using Life Cycle Impact Assessment. For that purpose, details of the cement production processes are investigated in order to show the respective part of raw materials preparation and clinker production using environmental impacts calculated with CML01 indicators. For the kiln emission data, a European pollutant emission register for French intensive industries is used to quantify the variability of indicators between cement plants. For the CML01 indicators that are controlled by kiln emissions, some of them (i.e. global warming, photochemical oxidation) show variations between cement plants between 20 and 30%, as for other (i.e. acidification, eutrophication, terrestrial ecotoxicity) variations are greater than 40% due to the lack of accurate measurements on both pollutant content and annual flow. Finally, a normalisation, using Western Europe yearly emissions is performed and permits to highlight among all the CML01 indicators which ones are the main impacts for the cement production. Abiotic depletion, global warming, acidification and marine ecotoxicity are the four identified impacts.

1. Introduction

The Portland cement manufacturing industry is under close scrutiny these days because of the large volumes of CO_2 emitted. Actually this industrial sector is thought to represent 5–7% of the total CO_2 anthropogenic emissions (Hendricks et al., 1998; Humphreys and Mahasenan, 2002). Therefore numerous studies have been done to evaluate CO_2 emissions and energy consumption (Capros et al., 2001; CIF, 2003; Gartner, 2004). Other cement emissions such as SO_2 emissions have also been analysed (Josa et al., 2004, 2007) using Life Cycle Assessment (LCA) method. This method refers to international standard (International Standardisation Organisation (ISO), 2006) and has been applied to the building sector since 1990 (Fava, 2006). It is now a widely used methodology (Asif et al., 2005; Ortiz et al., 2009; Blengini, 2009). The inclusion of every stage of the process or product's life cycle is fundamental to this analysis. In some cases, however, a full life cycle (cradle to grave) analysis is not pertinent and the analysis must end at an intermediate stage (cradle to gate). This is the case, when one analyses cement production, which has multiple specific applications in civil engineering (beams, pillars, pavements, bridges, etc.)

and therefore disallows a unique life cycle to be defined. However, any partial analysis is useful for the further construction of complete life cycles for specific cement end-products (beams, columns, pavements, etc). Reliable results on cement production impacts are therefore needed for studies on a larger scale, dealing with concrete (material scale) (Flower and Sanjayan, 2007) up to structure

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Influence of Quartzite Waste on Mechanical Properties of Concrete

[1]C G Mohan Babu ,S Akhil Tej
[1]Assistant Professor; Assistant Professor,
[1,2]Department of Civil Engineering, Faculty of Engineering & Technology, GPCET,KURNOOL, India

Abstract— Disposal of solid waste materials is a great concern in cities all around the world. Some of these waste materials are not biodegradable, which often leads to disposal crisis and environmental pollution. Many efforts are being made for the recycling of different types of solid wastes with a view to utilize them in the production of various construction materials. The granite stone industries produces vast amount of by-product rock waste and as a result, many residential and agricultural areas are settled over the landfills which are basically composed of these waste materials. Rajasthan in India alone produces 900 million tons of sandstone waste thus leading to a large dumping of these materials without any essential utilization. The increasing annual production and those already accumulated is one of the major sources of environmental pollution. This study focuses on the effective utilization of these wastes as aggregate in cement concrete which leads to an overall sustainable development in the field of concrete research. This paper reveals the use of polished granite waste from discarded tiles waste as a partial replacement of coarse aggregate and quartz sandstone powder waste as a partial replacement for fine aggregates in cement concrete. It was observed that the incorporation of polished granite tile and quartz sandstone powder waste in concrete decreases the Compressive and Flexural tensile strength. The concrete containing polished granite waste substituted 20% of natural coarse aggregate and quartz sandstone powder waste, substituted up to 30% of natural fine aggregate could be recommended for all applications.

Keywords—*Polished Granite Tile Waste(PGTW), Quartz Sandstone Powder Waste(QSPW), Compressive Strenth , Flexural Strength.*

I. INTRODUCTION

Concrete is considered as the second most consumed material after water. It was estimated that the world consumes twenty five billion tonnes of concrete every year, while 450 million cubic metre of concrete are consumed by the Indian construction industry every year. Concrete is the mixture of cement, coarse aggregate and fine aggregate and water in which the aggregates constitute (65–80) % of the total volume. Typically, a concrete mix is about 10% to 15% cement, 25% to 30% sand, 40% to 45% percent aggregate and 15% to 20% water. Entrained air (5% to 7%) is also added to concrete to improve durability. Concrete should have enough compressive strength, tensile strength and flexural strength to support applied loads. At the same time to increase its design life and reduce maintenance cost it should have good durability.

In India, during industrial, mining, municipal, agricultural and other process about 960 million tonnes of solid waste is being generated annually as by-products. Out of this, 350 million tonnes are organic waste from agricultural sources, 290 million tonnes are inorganic waste of industrial and mining sectors and 4.5 million tonnes are hazardous in nature.

Waste utilization is an attractive alternative to disposal in that disposal cost and potential pollution problems are reduced or even eliminated along with the achievement of resource conservation. Nevertheless, to use available materials most efficiently, the utilization strategy must be coupled with environmental and energy considerations.

One of the development goals of India "Pradhan Mantri Awas Yojana (PMAY)" - For all the people who belong to lower income group, economically weaker section and middle income group in India Launched in 2015, it is a housing development that will deliver 2 Cr permanent houses in urban as well as rural areas by the year 2022. This may be accomplished by provision of quality alternative building materials such as waste tile and stone powder aggregates. Thus from economical point of view, a research on the production of cost effective concrete to meet demand is the most important step in the right direction in concrete technology.

This research will focused on granite tiles wastes obtained from the industry in India and quartz sandstone powder obtained from mines as a waste produced during stone crushing.

According to **Narendra Kumar Sharma et al.(2017)** the concrete containing polished granite waste, substituted up to 20% of natural coarse aggregate could be recommended for all applications and the substitution from 20% to 40% could be recommended for non-structural applications, pavement etc. So by following above investigation for this study, 20% polished granite tile waste is used as partial coarse aggregates replacement to natural coarse aggregates and quartz sandstone is used in various percentage (0,10, 20, 30%) as partial replacement of fine aggregate. In this study physical characteristic of material and mechanical strength of concrete is to be investigated in accordance with the Indian standard for M-30 grade concrete.

II. EXPERIMENTAL WORK

Materials:

Cement- Cement is a well known building material and has occupied an indispensable place in the construction work. Cement Bond is a fine, dim powder. It is blended with water and materials, for example, sand, rock, and squashed stone to make concrete. Ordinary Portland cement, 43 grade was used.

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Concrete's Reaction to Controlled Permeable Formwork

K Anand, K Mallikarjuna Reddy, C G Mohan Babu
Assistant Professor, G Pullaiah College of Engineering & Technology, Kurnool

Abstract - *In recent years the number of reinforced concrete structures experiencing premature deterioration has grown considerably. It is worth noting that in many cases the structures in question were constructed less than 20 years ago. However, most were designed with an anticipated design life of approximately 100 years. This has forced governments to make provisions in routine maintenance budgets for structural rehabilitation, a process that is both expensive and also disruptive to the travelling public. This paper shall compare concrete cast against conventional Impermeable Formwork (IMF) and demonstrate how a Controlled Permeability Formwork (CPF) liner can reduce initial construction costs, whilst at the same time achieving durability, through the natural enhancement of the near surface cover. The quality of the surface zone of concrete is a crucial factor for durable concrete structures, as it is the first line of resistance to penetration of aggressive agencies. Use of controlled permeable formwork (CPF) liner is one of the techniques employed to improve the quality of the surface zone of concrete. CPF line drains mix water and entrapped air from the near surface of concrete while retaining cement and other fine particles. This helps to reduce water-cement ratio, increase cement content and decrease surface pores in the surface zone of concrete. It is postulated that CPF drains air and water, which migrate towards the formwork due to vibration caused while compacting concrete and hydrostatic pressure.*

Key Words: Concrete, Controlled permeable formwork, Structure, Properties

1. INTRODUCTION

Permeable formwork is a special class of lined formwork intended to produce improvements in the strength and durability of the surface of concrete. The bracing and the liner in the formwork are engineered to resist the pressure of plastic (or fresh) concrete, but to allow trapped air and excess water to pass through and be removed during concrete placement and consolidation. The objective in using permeable formwork is to eliminate voids (bug holes) on the surface of the concrete and to increase the strength and durability of the concrete surface immediately behind the formwork.

The quality of the surface zone of concrete is important for reinforced concrete elements, as all the aggressive agents penetrate through the surface zone of concrete to initiate damage. Durability of concrete structure is primarily dependent on the characteristics of surface zone of concrete. To facilitate the process of placing and compaction of fresh concrete, it is necessary to increase the volume of free water slightly above that actually required for complete hydration of cement. It had been postulated that the mix water and the entrapped air would migrate towards the formed surface due to compaction and hydrostatic pressure of concrete. As the formed surface is impermeable the water and air are retained at the interface. This causes an increase in water-cement (w/c) ratio at the surface level of concrete and visually the most obvious sign of presence of blowholes, pinholes and surface blemishes following removal of the formwork. The net result of this process would modify the surface zone of concrete with higher w/c ratio and lower cement content than that had originally been contemplated. In other words, the surface zone of concrete would be of poorer quality compared to the bulk concrete On the contrary, a well compacted dense concrete surface zone is invariably preferred to enhance the durability of RC structures.

2. LITERATURE REVIEW

Philip G. Malone [1] Absorptive or permeable formwork behaves as a filter that allows air and water to escape from the concrete that is directly behind the formwork. The concrete is retained by the filter medium (often a woven or nonwoven fabric); however, air, water, and materials dissolved in the water and very fine suspended solids can escape from the concrete adjacent to the formwork. The water draining through the liner contains a variety of dissolved and fine suspended materials. The liquid extracted from cement paste typically is a saturated calcium hydroxide solution with a pH in the range of 12.5 to 13.5. The fine suspended material can include cement particles, with an average size of 10 μm, and fine mineral admixtures, such as silica fume with an average size 0.1 μm.

Cuicui Chena [2] The concrete surfaces resulting from CPF were blow-hole free with no blemishes but the control one, corresponding to the inner sides of the conventional steel mould walls, presented many blow-holes. Strength from rebound method of concrete from CPF was improved more than 10% than control one. Water sorption and chloride ion penetration of concrete could be restrained if the concrete was casted using CPF due to the denser surface. Pore structure of concrete surface from CPF was modified remarkably, compared with the control one. The porosity of 0-3mm slice was reduced from 10.48% of the Control sample

Seismic Evaluation of RCC Buildings

A.Vinod Kumar[1*], Syed Afzal Basha[2], C G Mohan Babu[3]

Assistant Professor[1, 2, 3]

Department of Civil Engineering

G Pullaiah College of Engineering & Technology, Kurnool, A.P

Corresponding Author's email id: *kumarvinodkrishna@gmail.com[1*], syedafzal74@gmail.com[2]*

Abstract

Earthquakes can happen at any time and kill people. Many earthquake engineers and scientists are attempting to cope with earthquake resistant constructions. The traditional earthquake resistant constructions are constructed with enough ductility, yet these structures produce higher displacements and so story drifts. As a result, both structural and non-structural elements are affected. Tuned mass dampers (TMD) will be put on the top level of the building to reduce damage to high-rise structures and discomfort to residents. As a result, keep tale wanders to a minimum. These calibrated mass dampers prevent excessive displacements of the building's story levels. The goal of this thesis is to create a linear time history analysis (LTHA) code.

Keywords: - *Tuned Mass Dampers (TMD), Linear Time History Analysis (LTHA), MATLAB.*

INTRODUCTION

Earthquake is the natural phenomenon of sliding of tectonic plates. In world many earthquakes takes place daily but most of the earthquakes are of minor range, these minor range earthquakes is not much important, because these earthquakes don't create catastrophic consequences. But the earthquakes with higher magnitude greater than 6 we have to cautious more. In Indian

Global Journal of Trends in Engineering

Microbiologically-induced calcium carbonate precipitation improves concrete.

Syed Afzal Basha , J Ushasree , A vinod kumar
[1,2,3]Dept. Of Civil Engineering, G Pullaiah College of Engineering and Technology, Kurnool, A P, India

ABSTRACT: Natural processes, such as weathering, faults, land subsidence, earthquakes, and human activities create fractures and fissures in concrete structures which can reduce the service life of the structures. Although concrete technology has greatly developed in the past decades, fissures, cracks, and steel corrosion remain the Achilles heel of any concrete structure. Biologically modified construction materials become more popular for higher strength and long-term sustainability. One way to circumvent costly manual maintenance and repair is to incorporate an autonomous self - healing mechanism in concrete. One such an alternative repair mechanism is currently being studied, i.e. a novel technique based on the application of bio-mineralization of bacteria in concrete. The applicability of specifically calcite mineral precipitating bacteria for concrete repair and plugging of pores and cracks in concrete has been recently investigated and studies on the possibility of using specific bacteria as a sustainable and concrete-embedded self-healing agent was studied and results from ongoing studies are discussed. In the present study we have discussed how to enhance durability of building structures by microbiologically induced calcium carbonate precipitation (MICCP), use of bacterial protein powder in commercial fly ash pozzolana cements for high performance construction materials ,effect of different concentrations of bacteria on the serviceability of concrete and the efficiency of bacteria when suspended in different medium (water, phosphate- buffer and urea-CaCl2) on the serviceability of concrete.

Keywords: Microbiologically induced calcium carbonate precipitation, bacterial concrete, chemical process, construction

I.INTRODUCTION

Humans have the ability to precipitate minerals in the form of bones and teeth continuously. This ability is not only confined to human beings; even Bacillus Pasteruii, a common soil bacterium, can continuously precipitate calcite (Stocks-Fischer et al [1]). This phenomenon is called microbiologically induced calcite precipitation. Under favorable conditions Bacillus Pasteruii when used in concrete can continuously precipitate a new highly impermeable calcite layer over the surface of the already existing concrete layer. Calcite has a coarse crystalline structure that readily adheres to surfaces in the form of scales. In addition to the ability to continuously grow upon itself it is highly insoluble in water. Due to its inherent ability to precipitate calcite continuously bacterial concrete can be called as a "Smart Bio Material".

It is generally accepted that the durability of concrete is related to the characteristics of its pore structure. Degradation mechanisms of concrete often depend on the way potentially aggressive substances can penetrate into the concrete, possibly causing damage. The permeability of the concrete is depending on the porosity and on the connectivity of the pores. The more open the pore structure of the concrete, the more vulnerable the material is to degradation mechanisms caused by penetrating substances. The deterioration of concrete structures usually involves movement of aggressive gases and/or liquids from the surrounding environment into the concrete followed by physical and/or chemical reactions within its internal structure, possibly leading to irreversible damage [Claisse et al. 1997]. Therefore, transport properties and mechanical properties (compressive strength) are the important factors for concrete serviceability. The present study furnishes a performance analysis of the bacterium BKH1 and one of its secretary proteins (bioremediase) regarding compressive strength enhancement, tensile strength and self-healing attributes of Portland Pozzolana cement based specimens. Comprising with the observations of Ordinary Portland cement based specimens obtained earlier; we are trying to affirm the practical applicability of the bio-remediate protein in fly ash/slag based pozzolana cements as alternative approach to construction technology. Earlier it was reported that sand consolidation by B. pasteurii reduced porosity by up to 50% and permeability by up to 90% in the areas where the cementation took place (Kantzas et al [5], and Gollapudi et al [6]). Microbial calcite plugging was selective and its efficiency was affected by the porosity of the medium, the number of cells present and the total volume of nutrient added. The sand column loaded with bacteria was so tightly plugged that the column was fractured with a mechanical knife for examining. In a study conducted by Zhong and Islam [7], an average crack width of 2.7 mm and a mixture of silica fume (10%) and sand (90%) showed the highest compressive strength in the microbial remediation of granite. Concrete crack remediation by microorganisms was significantly different from that of granite remediation, mainly due to the fact that concrete maintained high levels of pHs An extreme alkaline environment of pH around 12 is the major hindering factor for growth of B. pasteurii, whose optimum pH for growth is around 9. However, B. pasteurii has the ability to produce end spores to endure an extreme environment (Ramakrishnan et al [8, 9]).